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Brittle

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(54) **BASE FOR A MODULAR EXERCISE SYSTEM**

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(30) **Foreign Application Priority Data**

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A63B 21/00 (2006.01)
A63B 24/00 (2006.01)

(52) **U.S. Cl.**
CPC ***A63B 21/4033*** (2015.10); ***A63B 21/00058*** (2013.01); ***A63B 24/0062*** (2013.01); *A63B 2220/833* (2013.01); *A63B 2225/093* (2013.01)

(58) **Field of Classification Search**
CPC A63B 21/4033; A63B 21/00058; A63B 24/0062; A63B 2220/833; A63B 2225/093; A63B 2024/0093; A63B 2071/065; A63B 21/005; A63B 71/0622; A63B 69/14; A63B 2069/165; A63B 2071/025; A63B 2071/026; A63B 2071/0683; A63B 2209/08; A63B 2210/50; A63B 24/0087; A63B 2220/51; A63B 2220/62; A63B 2225/15; A63B 2225/50; A63B 2225/685; A63B 2230/755; A63B 22/0046; A63B 22/06
See application file for complete search history.

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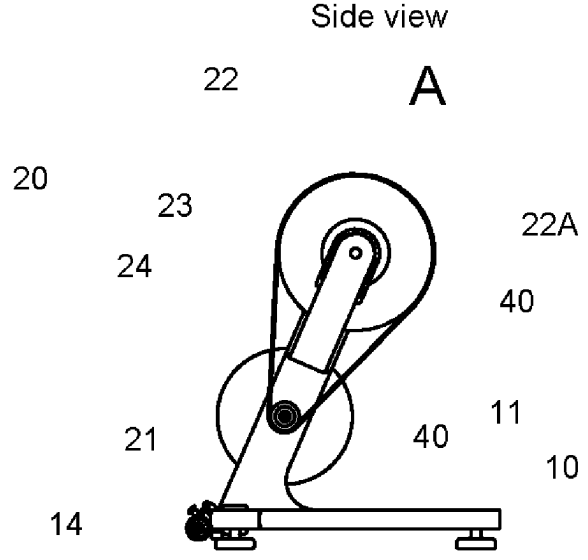
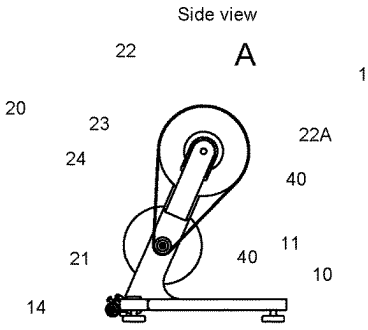
Primary Examiner — Sundhara M Ganesan
(74) *Attorney, Agent, or Firm* — William H. Bollman

(57) **ABSTRACT**

The present invention relates to a base for a modular exercise system comprising: a ground element for locating the base on a surface; a resistance apparatus mounted on the ground element; an attachment means for receiving and connecting an interchangeable exercise device to the base; and at least one first sensor which is operative to detect and identify the interchangeable exercise device when connected to the base and to communicate with a processor when the resistance apparatus is engaged with a drive mechanism on the interchangeable exercise device.

21 Claims, 10 Drawing Sheets





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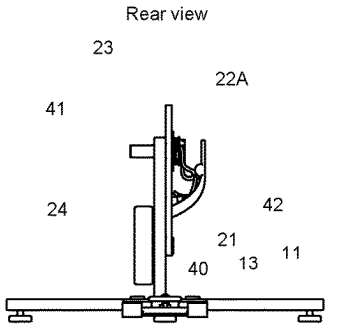
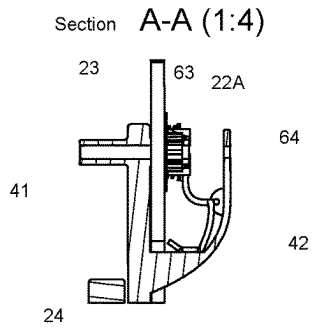


Fig. 1B



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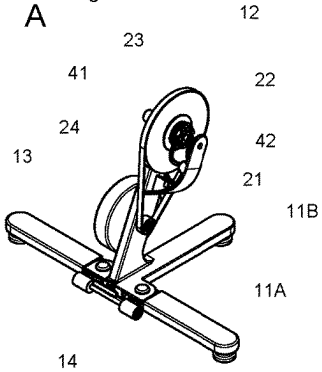

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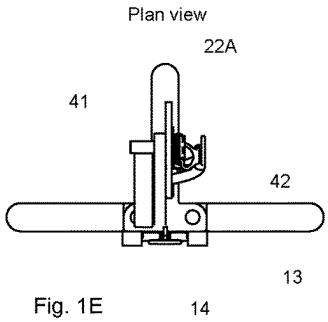

Fig. 1E

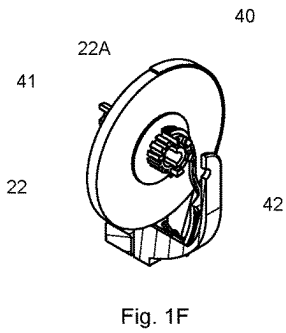

Fig. 1F

Side view

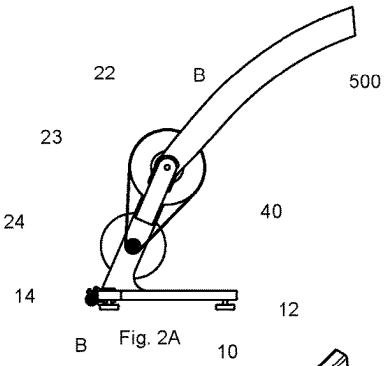

Fig. 2A

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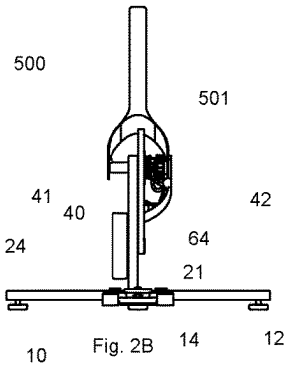
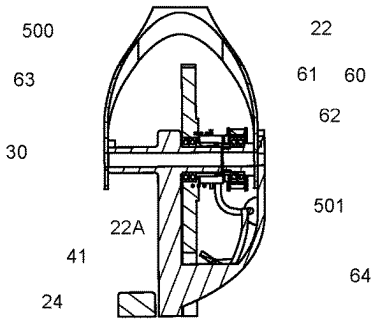


Fig. 2B

Section B-B (1:4)



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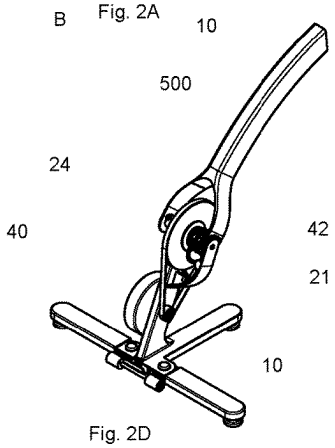
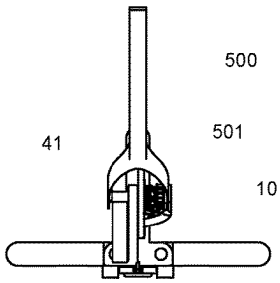


Fig. 2D

Plan view



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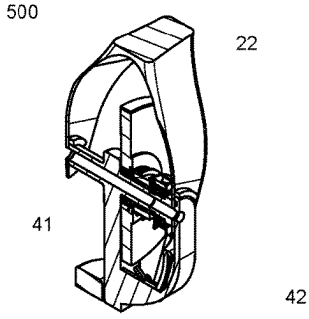

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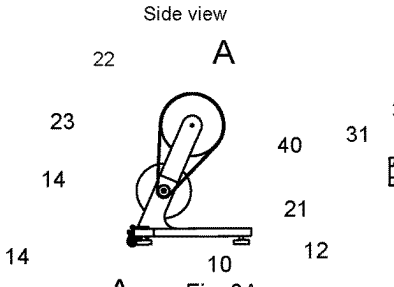

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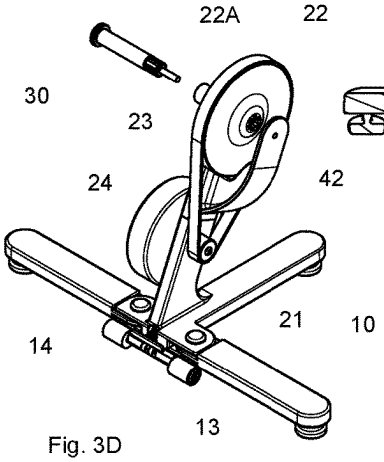

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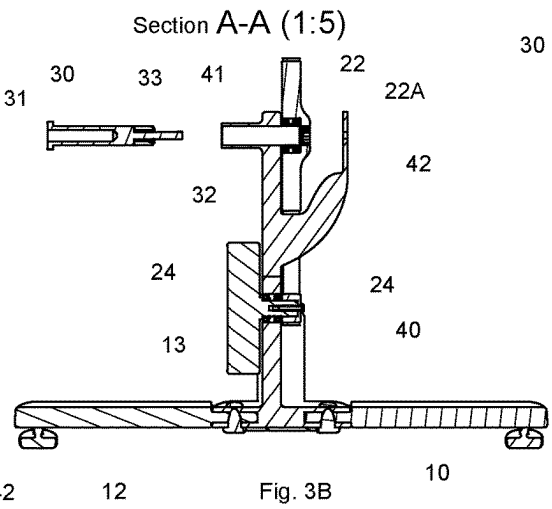

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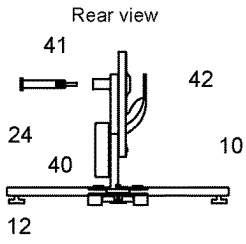

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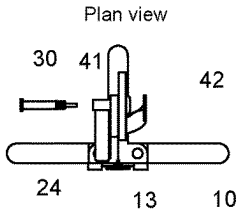

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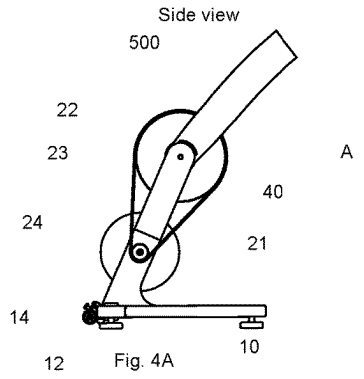

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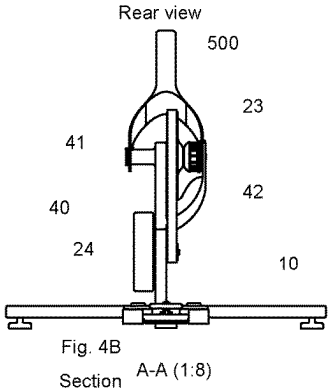

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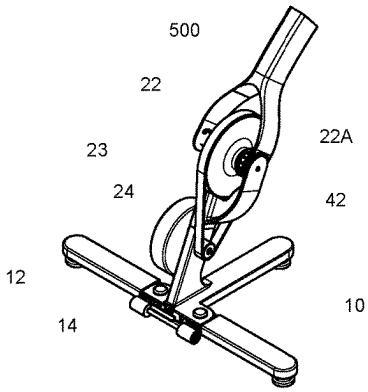

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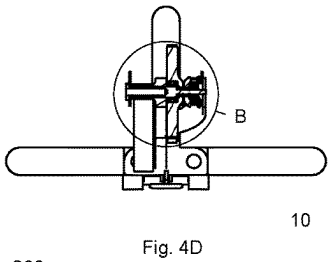

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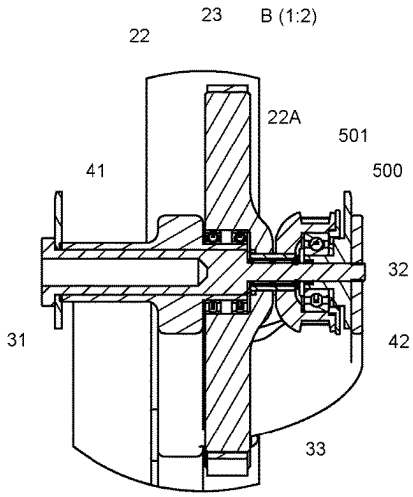

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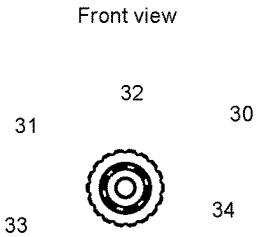

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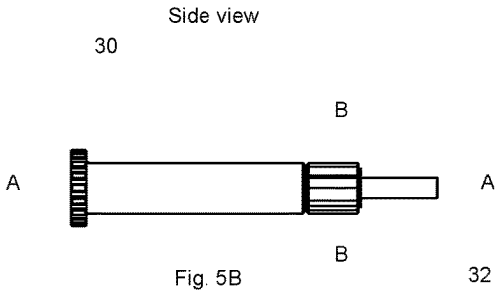

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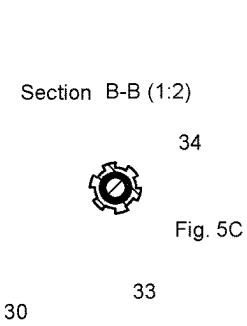

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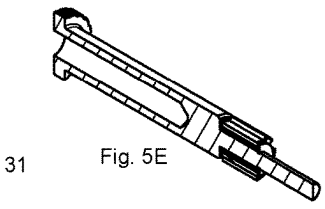

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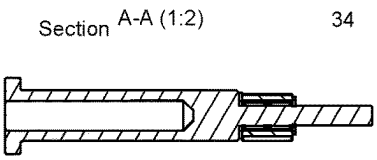

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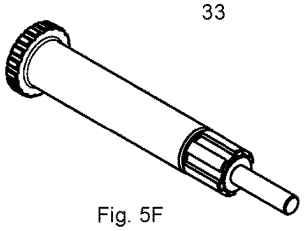

Fig. 5F

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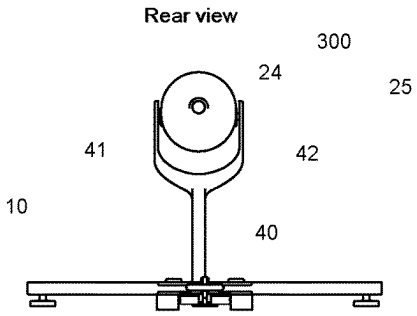
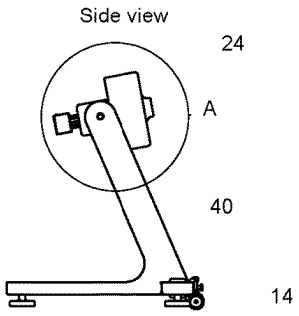


Fig. 6A



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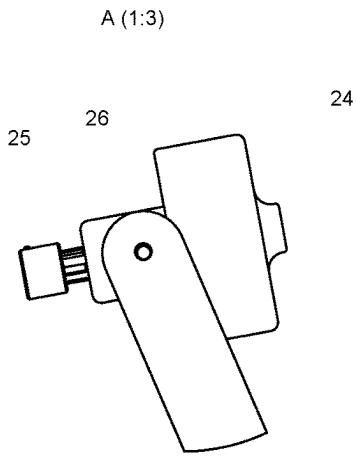

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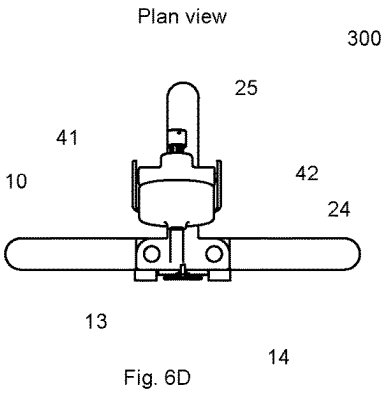

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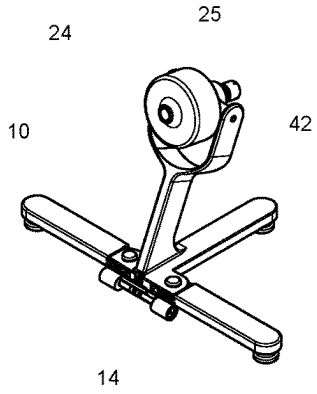

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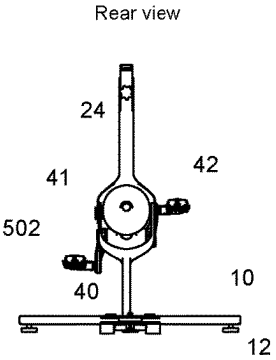

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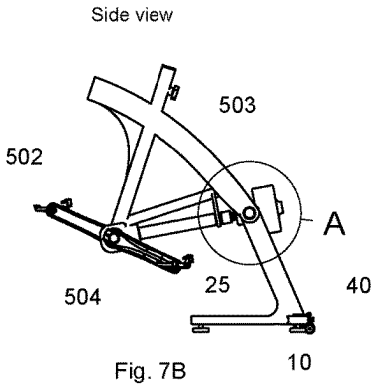

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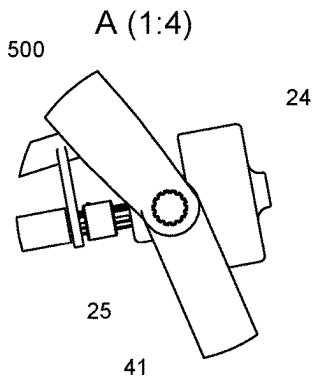

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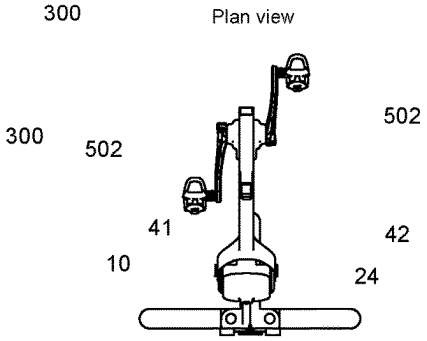

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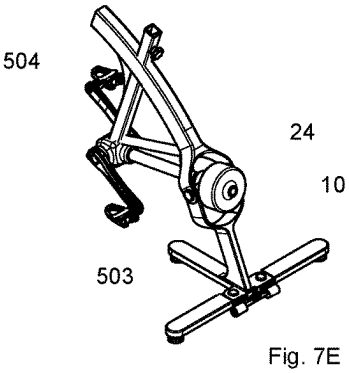

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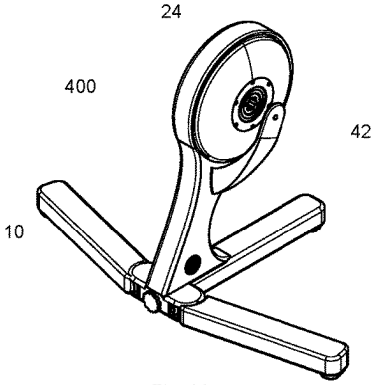
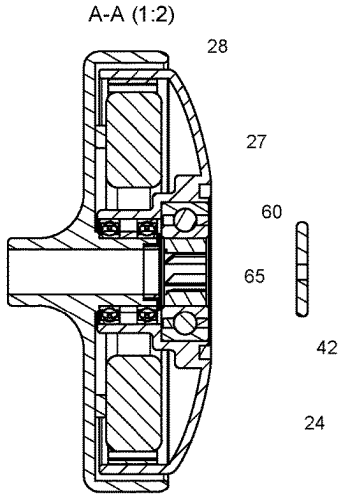


Fig. 8A



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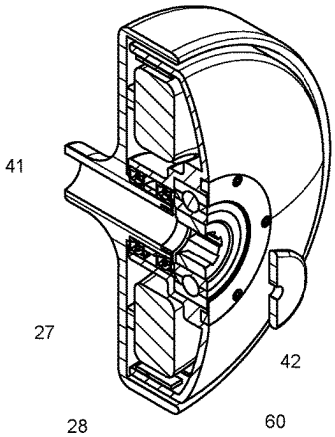

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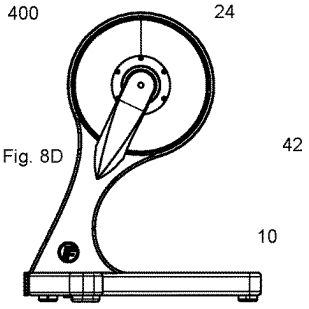

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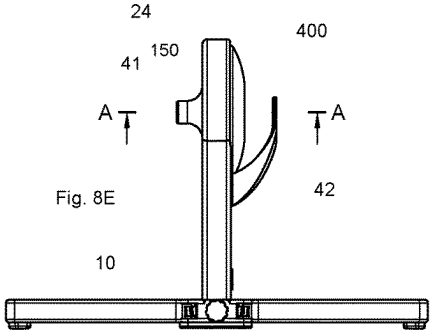

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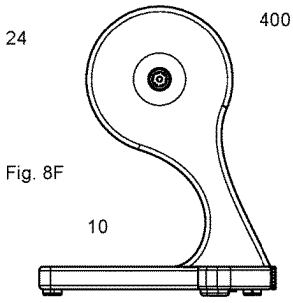

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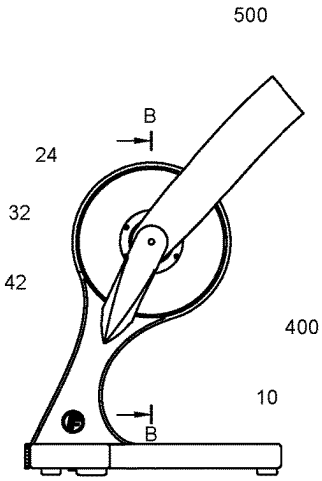
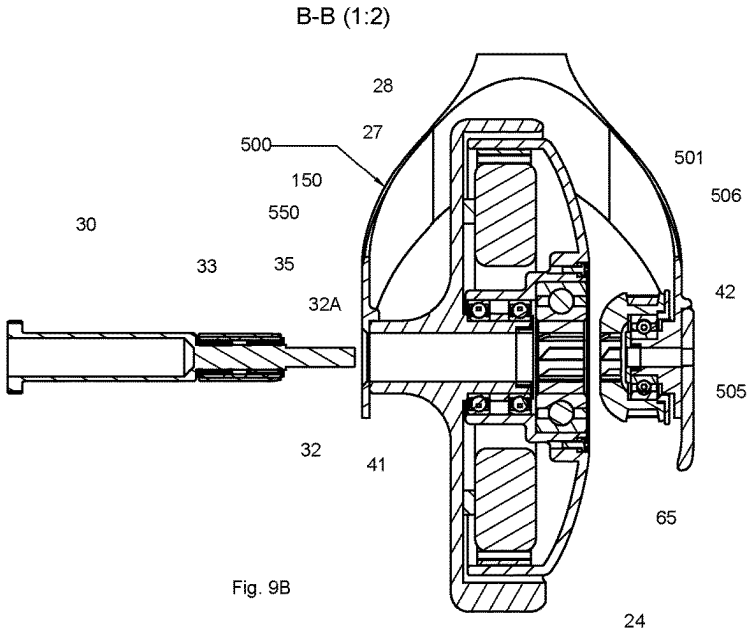


Fig. 9A



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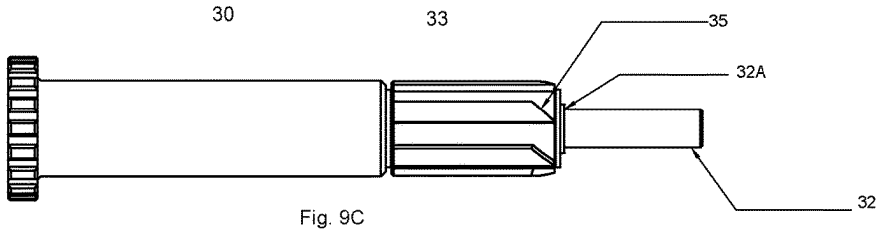

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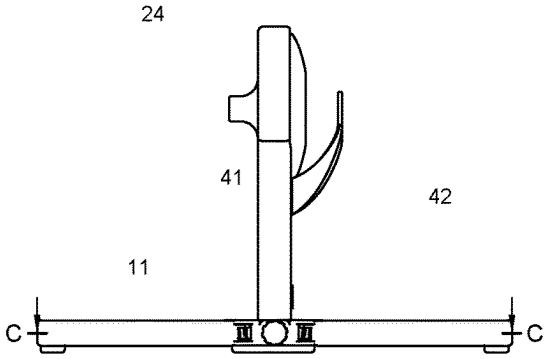

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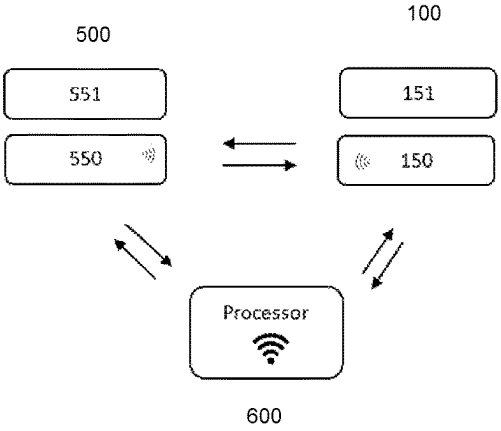

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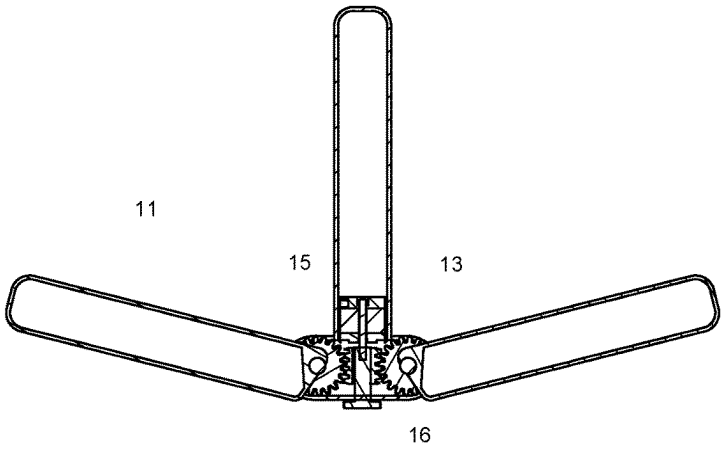

Fig. 10B

BASE FOR A MODULAR EXERCISE SYSTEM

FIELD OF THE INVENTION

The present invention relates to a base for a modular exercise system, in particular a base with a resistance apparatus that can receive different types of exercise devices that each engage with the resistance apparatus when connected.

BACKGROUND

When training for a particular sport or activity it is often necessary to perform exercises that targets different muscle groups. Typically this may involve use of multiple exercise devices which take up considerable space and therefore it may not be easy or possible to train and store the equipment at home and instead equipment may be provided at a gym or training centre.

Additionally, when training on different equipment it is often necessary to change the parameters measured or the training goals to be achieved on a particular device so that training data can be analysed, or training zones set. Usually a user will manually select training settings from a menu for each device they use to reflect the training device. This can take time which reduces training time and may make it harder to compare activities.

The present invention overcomes these problems.

PRIOR ART

Smart turbo trainers provide a base with a resistance means that is adapted to receive a bicycle and simulate cycling in an indoors environment. The smart turbo trainer can link with software on an electronic device.

SUMMARY OF THE INVENTION

According to a first aspect of the present invention there is provided a base for a modular exercise system comprising: a ground element for locating the base on a surface; a resistance apparatus mounted on the base; an attachment means for receiving and connecting interchangeable exercise devices to the base; and at least one sensor which is operative to detect and identify the interchangeable exercise device, when connected to the base, and is operative to communicate with a processor when the resistance apparatus is engaged with a drive mechanism on the interchangeable exercise device.

In this way the same base can be used with a number of different exercise devices to perform different exercises without the requirement for multiple different standalone exercise devices; and without the requirement to manually configure resistance settings for different devices, since the type of exercise device attached is identified and settings can be automatically activated for the particular exercise device. Advantageous training can commence immediately once the exercise device is connected with the corresponding resistance profile automatically selected.

Engagement between the resistance apparatus and the drive mechanism includes the physical engagement created by connection of the exercise device to the base which may trigger communication with the processor. For example once the exercise device is connected and has been identified by means of the sensor a signal may be transmitted to the processor from the sensor to confirm engagement.

Engagement between the resistance apparatus and the drive mechanism may also include the act of driving the drive mechanism by the user, the act of which may trigger communication with the processor, by means of transmission of a signal from the sensor to the processor to confirm active use, and/or receipt of a signal to the sensor from the processor. For example the sensor on the base, or a second sensor may detect force applied to through the resistance apparatus and transmit a signal to the processor when force is applied.

The base has at least one sensor which is operative to detect and identify the selected interchangeable exercise device when connected to the base. The at least one sensor may be mounted on or within the base. Therefore in some embodiments the one or more sensor is not visible.

For example each exercise device may include a microchip with identification details so that the sensor on the base detects the microchip and obtains data pertaining to the identification of the exercise device. For example the base may include a sensor in the form of a Radio Frequency Identification (RFID) reader that communicates with a passive RFID tag (microchip) on the exercise device.

Data obtained from at least one sensor is relayed to the processor. The processor provides a central hub with a receiver for receiving data that is analysed by the processor and a transmitter to send command signals, for example to the resistance apparatus to change resistance.

The processor may be mounted on the base, or may be provided on the exercise device, or may be remote. Typically the processor is part of an electronic device that includes a display screen for displaying information relating to the signals received form the at least one sensor.

An electronic device has a power source such as a battery or receives a power source, such as from a power supply.

In a preferred embodiment the processor is provided as part of an electronic device with a screen (display) that is arranged on the exercise device where it can be viewed by a user during exercise. The electronic device may be integrated with the exercise device or may be a separate module that can be moved from one exercise device to another.

In another embodiment the processor may be provided on the base and may transmit signals to an electronic device with a display screen that can be viewed by a user whilst exercising. In this example the processor may communicate with the electronic device wirelessly or by a wired connection.

In a preferred embodiment the processor is associated with a control means that enables a user to manually select resistance settings (increasing or decreasing resistance on the resistance apparatus). For example the processor and control means may be combined on an electronic device that is integrated with the exercise device, or remote electronic devices such as a smart phone or tablet. In this way the electronic device can both analyse sensor signals by means of the processor and be used to control the resistance apparatus.

It is appreciated that in some embodiments the processor and control means may be provided as separate elements that communicate.

Ideally the control means is arranged at a location close to a user's hands when exercising so that they can easily select the chosen resistance.

The at least one sensor is also adapted to communicate with the processor, or a second sensor is provided to communicate with the processor, when the resistance apparatus is engaged with a drive mechanism on the interchange-

able exercise device. This enables resistance data to be obtained by the one or more sensor when the exercise device is being driven by a user.

Preferably the at least one sensor or a second sensor is operative to transmit a signal to a receiver in communication with the processor confirming when the resistance apparatus is being driven by the drive mechanism on the interchangeable exercise device.

In this way when the exercise device is in use and being driven and the resistance apparatus is engaged, or when the exercise device is not in use, this is automatically detected by at least one sensor and a signal is transmitted to the processor so that status is determined. For example the transmitted signal may indicate when the exercise device is active (driven), inactive (not driven), active under load (driven with resistance over a certain level). This enables periods of activity to be accurately measured.

It is appreciated that an array of sensors may be provided on the base and on each exercise device that all feed sensor data to the processor to assist in providing information relating to resistance settings on the resistance apparatus (such as level of resistance) and data related to the drive mechanism, such as revolutions of a pedal. The sensor data obtained from the array of sensors can be combined to determine user output information. Additional data from a user may also be transmitted to the processor, such as heartrate readings from a heartrate monitor to further assist with exercise analysis.

The processor receives signals detected by one or more sensor by means of at least one receiver that is operatively connected to the processor. In this way the processor receives signals to identify connection of an interchangeable exercise device; identify the type of exercise device; detect when the drive mechanism on the exercise device is in use or not in use. In this way the type of exercise to be carried out is known once assembly on the exercise device on the base is complete so that resistance settings suitable for the type of exercise device are automatically provided, or automatically pre-selected so that no manual input is required to change resistance setting range.

Furthermore, as soon as an exercise device is mounted on the base, suitable training programs may be made available and data collected during exercise can be analysed under parameters set for the specific exercise device so that related data metrics can be collected, recorded and/or displayed without requirement for manual input.

Additionally, if a user is following a particular program that requires certain parameters to be met, such as to maintain a certain number of revolutions per minute, or maintain a perceived effort based on force applied through the drive mechanism, the resistance apparatus may automatically adjust upon receipt of a command signal from the processor under certain conditions to help a user to achieve this.

Preferably the processor may be a microprocessor. The term processor is considered to cover any type of processor suitable for use as part of the system.

Preferably at least one sensor is provided on the base to sense a force applied by the interchangeable exercise device, in particular by the drive mechanism, and the processor derives a signal indicative of an amount of work done.

Preferably at least one force sensor is provided on the resistance apparatus. Advantageously this removes the requirement for separate force sensors on each exercise device, making the exercise system more affordable as the sensors are provided on the base that can be used for all interchangeable exercise devices.

In preferred embodiments at least one transmitter is provided on the base which is operative to transmit a signal from one or more sensor, or each sensor has a transmitter operative to transmit a signal from the sensor to a receiver indicative of at least one of: a force (power) applied by the user; a level of resistance provided by the resistance device; an exercise start time; an exercise end time and total energy expended (kJ or kcal). Measuring these parameters enables exercise exertion feedback to be provided to the user. In some embodiments a sensor may include a transmitter.

In a preferred embodiment the processor is in communication with a display screen so that data collected by the sensors that is transmitted to the processor can be observed whilst using the base and exercise device. For example an electronic device may incorporate the processor, receiver, transmitter, control means and a display screen. The electronic device may be integrated with the exercise device, or the exercise device may include a holder for receiving a displaceable electronic device such as a tablet or smart phone.

It is appreciated that an app maybe provided on an electronic device that is able to receive data and enable display of data and also may be in communication with the resistance apparatus to enable operation of the control means through the app, so that command signals can be sent from the electronic device to the resistance apparatus, for example to alter resistance.

In preferred embodiments, both the base and the interchangeable exercise device may be adapted to be arranged in a first configuration for use, and in a second compact configuration, for stowage to minimise the amount of space required for storage. One way to achieve this is that both the base and interchangeable exercise device preferably have folding parts which may be lockable when deployed.

The ground element is for locating the base on a surface. In preferred embodiments the ground element includes at least three legs to provide a stable ground element that takes up minimal space.

Preferably the legs are foldable so that they can be splayed in use and stowed when not in use to enable easy storage of the base when it is not in use.

In some embodiments the ground element includes feet to enhance grip of the ground element against the surface and to minimise any movement during use. The feet may be formed from or coated in a resiliently deformable material, such as rubber or silicone.

In some embodiments the ground element is adjustable to enable adjustment of height and/or orientation. For example the feet may also be adjustable, or feet may be attached to adjustable legs so that the ground element can be stabilised on an uneven surface.

In some embodiments the feet and/or legs include one or more worm gear to extend and retract, for example by folding the foot and/or leg. In some embodiments the worm gear(s) may be electronically driven, having a motor to drive the gear(s) of the legs/feet may be manually adjustable, such as by a threaded post that engages with the gear(s). In these ways the ground element can be easily setup for use and compacted for storage.

In some embodiments the base may include a level guide, such as a bubble level, or sensors to assist with levelling the base. For example, one or more sensors may be provided to determine when the base is level and the level status may be indicated by one or more visual indicator, such as a light to show when the base is level and unlevel.

The ground element may be weighted so assist with maintaining position of the base during use.

The resistance apparatus is mounted on the ground element. The resistance apparatus is connected to the drive mechanism in use, so that variation of resistance apparatus changes the amount of input force required by the user. The resistance apparatus ideally has an adjustment means for selectively varying its resistance so that a user can make changes during use.

The resistance apparatus preferably has at least one rotating component wherein rotational resistance of at least one component can be altered. For example, the resistance apparatus may include a drive train with at least two drive wheels connected by a belt and a resistance unit, wherein at least one of the drive wheels is connected to the resistance unit so that resistance applied to the drive wheel is adjustable. Advantageously the use of a configuration including drive wheels and a belt provides a quiet, clean, and low maintenance mechanism.

In another embodiment the resistance apparatus may comprise a rotating resistance unit that is adapted to receive a shaft that connects to the drive means and the resistance unit can be adjusted to change ease of rotation.

In preferred embodiments the resistance unit has means to provide magnetic resistance to provide a reliable way to accurately and quickly adjust resistance by altering the strength or orientation of a magnetic field.

Preferably the resistance unit may include electromagnets enabling adjustment using the control means such as a control panel to transmit electronic signals, rather than using a manual dial that may delay changes or limit transitions to the time it takes a user to manually alter the dial. For example the resistance unit may have a resistance coil and magnets to adjust resistance.

In preferred embodiments the control means are provided in use on the interchangeable exercise devices so that a user can adjust resistance easily whilst using the device. The resistance unit is adapted to receive signals and adjust resistance in response to the signals. The control means is in communication with the resistance unit, for example to adjust the electromagnetic resistance. Preferably signals are transmitted wirelessly from the control means to the resistance unit.

The control means enable a user to increase or decrease resistance generated by the resistance apparatus. The control means may have controls such as a selection of buttons, a touch pad, display screen or rocker switch to enable a user to easily toggle between selecting increasing or decreasing resistance. Ideally the control means are ergonomically positioned on the exercise device to optimise the workout by causing minimal effort and change of position to perform adjustment using the control means.

As mentioned above, the control means may part of an electronic device that may be a removeable electronic device, such as a smartphone or tablet.

In a preferred embodiment the control means may comprise or be connected to an electronic device and system (such as an integrated electronic device or an app on a smartphone) that also incorporates the processor to permit a user to adjust resistance, as well as having functions to record and analyse data and to display data so that a user can monitor their progress.

In a preferred embodiment the control means is in communication with, or integrated with a display screen, that may be mounted on the exercise apparatus which can display resistance data. Furthermore as the control means may also be able to receive data by means of at least one receiver, the control means may receive data from other input sources, such as a heartrate monitor so that resistance data can be analysed against user data to provide useful metrics to measure exercise related output.

In some preferred embodiments the resistance unit includes a speedup gearbox that is connected to the resistance unit to increase the rotational speed of the rotating element of the resistance unit.

In some embodiments the base may be adapted to provide user feedback when resistance is changed, or under certain conditions. For example the resistance unit may drop resistance just before a change of resistance is made so that a user receives feedback that a selected change has been initiated. In another embodiment a vibrating module may be provided to provide haptic feedback when a change of resistance is selected or when a preset condition is detected, for example heartrate moves from one training zone to another.

The attachment means is for receiving and connecting an interchangeable exercise device to the base so that different exercise devices can be easily connected and disconnected to the base.

Connection of the exercise device to the base is detected by one or more sensors. Typically this is achieved by an RFID tag on the exercise device being detected by an RFID reader on the base. The RFID reader may only detect an RFID tag within close proximity to establish that it is the exercise device in use and not another exercise device nearby.

In some embodiments the base, or specifically the attachment means, may include a contact sensor to detect presence of the exercise device.

The attachment means extends from the ground element. In some embodiments the attachment means may be combined with parts of the resistance apparatus.

In preferred embodiments an arm extends from the ground element and the arm has at least one figure for receiving the exercise device. For example a pair of fingers may provide a bracket that receives the exercise device.

In a preferred embodiment the attachment means includes a bracket with a means for receiving a pin to enable coaxial connection with the hub of the resistance apparatus (first hub) and a hub on the exercise device (second hub). In this way attachment of the exercise device can simultaneously engage the resistance apparatus and thereby the drive mechanism.

In a preferred embodiment the pin includes at least one spline or ridge that acts to engage both the resistance apparatus and exercise device to that the hub one each rotates in unison by a user driving the drive mechanism.

For example, a toothed pin (pin with splines) may be received through the hub and through a toothed coaxial drive wheel on the resistance apparatus to engage the toothed pin with drive wheel. An inner face of at least part of the hub has a toothed surface and an inner face of at least part of the drive wheel has a toothed surface so that the hub and drive wheel are locked together by the toothed pin and will rotate in unison.

In preferred embodiments distal ends of the splines on the pin may taper to a point to correspond with angled teeth on the first and/or second hubs to enable smooth engagement when inserting the pin. Advantageously this configuration enables insertion of the pin even when the engaging parts are not exactly aligned.

In a preferred embodiment once the pin is in place to connect the base to the exercise device a dog clutch is provided for engaging the hub on the exercise device (second hub) with the resistance apparatus so that when the exercise device is mounted on the base and secured by the

attachment means, the hub of the exercise device is selectively engaged with the resistance apparatus when ready for use.

In another preferred embodiment the clutch is a one-way freewheel clutch such as a sprag clutch, preferably a silent sprag clutch. In this way the sprag clutch enables one-way rotation and has a freewheel to permit free rotation when there is no drive generated by a user.

In another embodiment the resistance apparatus has a connector for receiving a driveshaft that is connected to the drive mechanism of the interchangeable exercise device. For example the exercise device may include a bevel box connected to the drive mechanism to enable the driveshaft rotation to be transferred from a first plane to a second plane. In this way the drive mechanism is rotated in a first plane by the user driving the bevel box which causes rotation of the drive shaft in a second plane. Advantageously the use of a bevel box enables power to be distributed through a defined angle, such as 90 degrees which can assist with making the base and exercise device more compact and therefore more easily stored. Furthermore the use of a driveshaft connected to the resistance means provides a quiet, clean, and low maintenance mechanism.

One of the interchangeable exercise devices may be a cycling exercise device with pedals driving a hub that is connected to the resistance apparatus, a seat, and a handlebar in order to simulate a cycling exercise. In this embodiment the control means is located on the handlebar region of the cycling exercise device for ease of use and to reflect where controls are positioned on a bicycle.

Another one of the interchangeable exercise devices may be a grinding exercise device with pedestal handles driving a hub that is connected to the resistance apparatus in order to simulate grinding exercise. For this device the control means may be located on a handle grip region of the grinding exercise device for ease of use during exercise.

Another one of the interchangeable exercise devices may be a rowing exercise device with a retractable handle attached to a line that drives a hub that is connected to resistance apparatus when pulled to simulate rowing. Typically the rowing device also has a sliding seat. The handle may include control means to enable adjustment whilst rowing.

The interchangeable exercise devices may include sensors in communication with the processor or to another remote device that communicates with the processor to provide additional user feedback. For example an exercise device may include accelerometers, gyroscopes and/or laser displacement sensors to provide positional information about the user and/or parts of the devices, for example position of the rowing handle un use, or posture during cycling. This feedback may help to guide a user to enhance their technique, for example by using rower handle position to simulate optimal oar position relative to water.

The exercise devices may also include vibration modules or similar to generate haptic feedback under certain conditions, such as when resistance changes.

Yet further interchangeable exercise devices may include resistance units for weight training.

Preferred embodiments of the invention will now be described, by way of example and with reference to the Figures in which:

BRIEF DESCRIPTION OF FIGURES

FIG. **1**A shows a side view of a first embodiment of the base;

FIG. **1**B shows a rear view of the first embodiment of the base;

FIG. **1**C shows a cross section of the first embodiment of the base;

FIG. **1**D shows an isometric view of the first embodiment of the base;

FIG. **1**E shows a plan view of the first embodiment of the base;

FIG. **1**F shows a close up view of the second drive wheel;

FIG. **2**A shows a side view of the first embodiment of the base connected to part of an exercise device;

FIG. **2**B a rear view of the first embodiment of the base connected to part of an exercise device;

FIG. **2**C shows a cross section of part of the first embodiment of the base connected to part of an exercise device;

FIG. **2**D shows an isometric view of the first embodiment of the base connected to part of an exercise device;

FIG. **2**E shows a plan view of the first embodiment of the base connected to part of an exercise device;

FIG. **2**F shows an isometric cross section of part of the first embodiment of the base connected to part of the exercise device;

FIG. **3**A shows a side view of a second embodiment of the base;

FIG. **3**B shows a cross section A-A of the second embodiment of the base;

FIG. **3**C shows a rear view of a second embodiment of the base;

FIG. **3**D shows a rear isometric view of the second embodiment of the base;

FIG. **3**E shows a plan view of the second embodiment of the base;

FIG. **4**A shows a side view of a second embodiment of the base connected to part of an exercise device;

FIG. **4**B shows a rear view of a second embodiment of the base connected to part of an exercise device;

FIG. **4**C shows a rear isometric view of the second embodiment of the base connected to a part of an exercise device;

FIG. **4**D shows a cross section A-A of the second embodiment of the base;

FIG. **4**E shows a close up of part of the cross section shown in FIG. **4**D;

FIG. **5**A shows an end view of a pin for use with the second embodiment of the base;

FIG. **5**B shows a side view of the pin;

FIG. **5**C shows the spline of the pin;

FIG. **5**D shows a cross section A-A of the pin;

FIG. **5**E shows an isometric view of a cross section A-A of the pin;

FIG. **5**F shows an isometric view of the pin;

FIG. **6**A shows a rear view of a third embodiment of the base;

FIG. **6**B shows a side view of a third embodiment of the base;

FIG. **6**C shows a close up of the resistance unit of a third embodiment of the base;

FIG. **6**D shows a plan view of a third embodiment of the base;

FIG. **6**E shows an isometric view of a third embodiment of the base;

FIG. **7**A shows a rear view of a third embodiment of the base connected to part of an exercise device;

FIG. **7**B shows a side view of a third embodiment of the base connected to part of an exercise device;

FIG. 7C shows a close up of the resistance unit of a third embodiment of the base connected to part of an exercise device;

FIG. 7D shows a plan view of a third embodiment of the base connected to part of an exercise device;

FIG. 7E shows an isometric view of a third embodiment of the base connected to part of an exercise device;

FIG. 8A shows a perspective view of a fourth embodiment of the base;

FIGS. 8B and 8C show a cross section of the resistance unit of the fourth embodiment of the base;

FIG. 8D shows a right side view of the fourth embodiment of the base;

FIG. 8E shows a rear view of the fourth embodiment of the base;

FIG. 8F shows a left side view of the fourth embodiment of the base;

FIG. 9A shows a side view of the fourth embodiment of the base connected to an exercise device that is only part shown;

FIG. 9B shows a cross section of FIG. 9A along line B-B;

FIG. 9C shows the pin with angled teeth;

FIGS. 10A and 10B show an example of a folding base; and

FIG. 11 shows a diagrammatic view of communication between sensors and the processor of the system.

DETAILED DESCRIPTION OF FIGURES

FIGS. 1A to 1F and 2A to 2F show a first embodiment **100** of the invention with a ground element **10** with three legs **11**. Each leg **11** having a foot **12** that spaces the leg from the surface.

The ground element **10** is formed from metal, such as steel, and the feet **11** are adjustable elements to enable the feet **12** to be adjusted to compensate for an uneven surface.

Two of the legs **11**A are hinged at pivots **13** to enable the legs **11**A to be splayed as shown in the FIGS. **1**A, **1**B, **1**D and **1**E or stowed (not shown) wherein the two legs **11**A are arranged to fold inwards to be parallel to the third leg **11**B.

The ground element **10** has a pair of wheels **14** mounted on an edge to enable the base **100** to be wheeled to assist with movement from one location to another.

The resistance apparatus **20** comprises first and second drive wheels **21**, **22** connected by a belt **23** and the first drive wheel **21** is connected to a resistance unit **24**. The first drive wheel **21** has adjustable resistance as it is connected to the resistance unit **24**. The second drive wheel **22** has a hub **22**A through which a pin **30** is received.

The resistance apparatus **20** which is made up of two drive wheels **21**, **22**, the belt **23** and the resistance unit **24**, is arranged on an arm **40** that extends from the ground element **10**. The arm **40** provides location points for both drive wheels **21**, **22** and for the resistance unit **24**.

The first drive wheel **21** and resistance unit **24** are arranged coaxially on a shaft (not visible).

The second drive wheel **22** is arranged on a finger **41** extending from the arm **40** and the second drive wheel **22** is further secured and engaged by inserting of a pin **30** that passes through the first finger **41** engages with a second finger **42** that extends from the arm **40**.

The first finger **41** is a tube that is arranged perpendicular to the plane of the arm **40**.

The resistance unit **24** includes electromagnetic resistance means to enable electronic adjustment of resistance to alter ease of rotation of the first drive wheel **21** and thereby the second drive wheel **22** that is connected to the drive mechanism on the exercise device **500**.

Resistance applied to the first drive wheel **21** can be adjusted by changing the magnetic field created by the electromagnets in the resistance unit **24**.

The pin **30** is received through the first finger **41** and a distal end **31** of the pin **30** is connected to the second finger **42** by a screw thread connection (not shown).

The attachment means **50** is provided by the pin **30** and the fingers **41**, **42**. The first finger **41** is a tubular extension through which the pin **30** is received. The second finger **42** provides a distal end for receiving the exercise device.

The pin **30** enables the exercise device **500** to be connected to the resistance apparatus **20** and the fingers **41**, **42** provide a support bracket for receiving and supporting the exercise device during use. In this way the exercise device **500** can be easily arranged on the base **100** and securely connected to the base **100**.

When the exercise device **500** is mounted on the base **100** a dog clutch **60** enables engagement of the hub **22**A of the second drive wheel **22** with the drive mechanism (not shown in FIGS. **1** and **2**) of the exercise device **500**.

The dog clutch **60** has two engagement surfaces **61**, **62**. The first engagement surface is mounted on a spring **63** so that when the spring **63** is released the first engagement surface **61** connects with the second corresponding engagement surface **62** on the exercise device so that the dog clutch **60** is engaged. When the dog clutch **60** is engaged the connected parts on the base and exercise device rotate in unison.

A switch **64** is provided to lock and release the first and second engagement surface **61**, **62**. When the spring **63** is compressed the first and second engagement surfaces **61**, **62** are separated (see FIG. **2**C). When the spring **63** is released the first and second engagement surfaces are engaged. The switch **64** is provided on the second finger **42**.

The hub **22**A of the second drive wheel **22** is coaxial with a hub **501** provided on the exercise device **500**, so that both hubs **22**A, **501** rotate about the pin **30** and the dog clutch **60** enables engagement surfaces **61**, **62** to be engaged so that both parts (drive wheels of resistance apparatus and hub of exercise device that is connected to the drive mechanism) rotate in unison when driven by a user activating the drive mechanism.

FIGS. **3**A to **3**E and **4**A to **4**E show a second embodiment of the base **200**. In FIGS. **4**A to **4**E part of an exercise device **500** is shown. Like parts have like references.

The second embodiment **200** has the same arm **40** and fingers **41**, **42** configuration, but the exercise device **500** is engaged in a different way.

In the second embodiment **200** the pin **30** is adapted to engage the hub **501** of an exercise device **500** with the second drive wheel **22** of the resistance apparatus **20**.

The pin **30** has a distal end **32** that connects to the second finger **42**. The pin **30** also has a spline **33** that when inserted through the first tubular finger **41** and located on the second finger **42** positions the spline **33** so that it engages with inner surfaces of the second drive wheel hub **22**A and the hub **501** of the exercise device **500** (see FIG. **4**E). In this way when the spline **33** is inserted and engaged with both hubs **22**A, **501** they rotate in unison so that input from a user through the drive mechanism of the exercise device **500** is in communication with the resistance apparatus **20**.

In the pictured embodiments shown in FIGS. **3**B to **3**E the second drive wheel **22** includes magnets (not shown) to locate the spline **33** into the hub **22**A of the second drive wheel **22**.

The pin **30** also provides a quick and easy means for connecting the exercise device **500** to the base **200** by forming part of the attachment means **50** that is a combination of the pin **30** and the fingers **41**, **42**.

FIGS. **5**A to **5**F show an example of the pin for the second embodiment of the base **200** that enables quick connection.

The pin **30** has a spline **33** that rotates freely on needle bearings **34** about the pin **30** so that the main body of the pin does not rotate in use, only the spline **33** (see FIG. **5**D). The spline **33** has a toothed outer surface that engages with toothed inner faces of the hub of the second drive wheel **22**A and the hub **501** of the exercised device **500**. In this way both hubs **22**A and **501** rotate in unison and are connected to the resistance apparatus **20** and to the drive mechanism (not shown) of the exercise device.

FIGS. **6**A to **6**E and **7**A to **7**E show a third embodiment of the base **300**. Like parts have like references. In the pictured embodiment the arm **40** projects from the ground element **10** with a two fingers **41**, **42** that both extend upwards in the same configuration. The fingers **41**, **42** support a resistance unit **24** that has a connector **25** for receiving a drive shaft **503** provided on the exercise device **500**. The exercise device **500** has a bevel box **504** that enables rotary motion generated through the drive mechanism (pedals **502**) to be changed through 90 degrees to rotate the drive shaft **503** that is connected to the resistance unit **24**.

The fingers **41**, **42** also act as a bracket for receiving and supporting the exercise device **500**.

The connector **25** is adapted to receive an end of a drive shaft **503** that extends from the drive mechanism **502** of exercise device **500** (see FIGS. **7**A, **7**B, **7**D, **7**E). As a user (not shown) drives the drive mechanism **502**, by pedalling on the exercise device **500**, rotary motion is transmitted by 90 degrees though the bevel box **504** on the exercise device **500** to the driveshaft **503** rotates which enables rotary motion to be transmitted coaxially along the driveshaft by means of the resistance unit **24**.

The resistance unit **24** also includes a speed up gearbox **26** that increases rotational speed of the rotating element (not shown) of the resistance unit **24**.

The resistance unit **24** has an electromagnetic resistance means to enable a user to quickly and easily adjust resistance.

FIGS. **8** to **9** show a fourth embodiment of the base **400**. Like parts have like references.

The fourth embodiment **400** of the base has a one way clutch **60** with angled teeth **65** that receive a pin **30** with corresponding distal ends **35** of the splines **33** of the pin **30** and an exercise device **500** with corresponding angled teeth **505** on the hub **501**.

The advantage of the angled teeth **505**, **65** that engage with the distal ends **35** of splines **33** is to aid with smooth engagement between the parts even when the teeth may not be directly aligned. The angling of the teeth when used with a one way clutch also means that the coupling between the clutch and pin, the coupling between the clutch and exercise device, are uni-directional and will disengage when rotation is reversed.

On the pin **30** shown in FIGS. **9**B and **9**C the distal end **32** of the pin **30** has a step **32**A. The step **32**A engages with the receiving part of the exercise device **500** to correctly secure the base **100**, **200**, **400** with the exercise device **500**. In use the step **32**A is pressed against the frame **506** of the exercise device **500** by the engagement of the distal end **32** into the second finger **42**. The hub **501** is arranged on the frame **506** so as to rotate in use.

In FIGS. **8**E and **9**B the position of a sensor **150** on the resistance apparatus **24** is indicated. In FIG. **9**B the position of a sensor **550** on the exercise apparatus **500** is shown. The positions shown are only an example of where the sensors may be positioned and the sensors may be located at any suitable position.

FIG. **8**E therefore shows an embodiment **400** with all the preferred features of the invention comprising: a ground element **10** for locating the base **400** on a surface; a resistance apparatus **24** mounted on the ground element **10**; an attachment means **42** for receiving and connecting an interchangeable exercise device (not shown, refer to FIG. **9**B) to the base **400**; and a sensor **150** which is operative to detect and identify the interchangeable exercise device when connected to the base **400** and that is also operative to communicate with a processor when the resistance apparatus is engaged with a drive mechanism on the interchangeable exercise device.

Sensor **150** includes an RFID reader arranged on a wall of the resistance apparatus **24**. The RFID reader **150** receives signals from an RFID tag **550** provided on each exercise device **500**. When the exercise device **500** is mounted on the base (not fully shown in FIG. **9**B) a signal transmitted from the RFID tag **550** is detected by the RFID reader **150**. Upon identification of the exercise device **500** a resistance profile can be selected for the user.

Sensor **150** is also operative to communicate with the processor when the resistance apparatus is engaged with a drive mechanism on the interchangeable exercise device. Sensor **150** therefore includes means to detect when the resistance apparatus and drive mechanism are engaged which may be achieved for example by detecting resistance created by the resistance apparatus by a force sensor and/or detecting movement when the drive mechanism by a movement sensor. It is therefore appreciated that sensor **150** may combine a plurality of sensing means to detect different parameters.

In FIGS. **8**B and **8**C there is shown the resistance unit **24** which includes a resistance coil **27** and magnets **28** for generating resistance during rotation. In this embodiment there is no requirement for two drive wheels connected by a belt, instead resistance is generated by the resistance unit **24** that has a hub that receives the pin **30** and has a clutch **60**. The base **400** has a first finger **41** and a second finger **42** that provided insertion points for the pin **30**. The pin **30** passes through the first tubular finger **41** and the threaded distal end **32** of the pin **30** is connected to a threaded aperture in the second finger **42**.

In FIGS. **10**A, **10**B a mechanism for deploying the legs **11** of the ground element **10** is shown. The legs **11** are pivotable by a pivot formed from worm gears **13**. The worm gears **13** are driven by a motor **15** or can be driven manually by a turning a threaded post **16** that is in communication with the worm gears **13**. In this way the legs **11** can be folded together for stowage and adjusted to accommodate an uneven surface during use.

In all embodiments **100**, **200**, **300**, **400** at least one sensor **150** (see FIG. **9**B that includes an example location) is provided. The at least one sensor may be externally mounted or may be internally mounted, for example inside the arm **40**.

FIG. **11** shows a diagrammatic example of a preferred example of the system having a base **100**, an exercise device **500** and an electronic device **600** that includes the processor. The base **100** has a sensor **150** and the exercise device **500**

has a sensor **550**. Both sensors **150**, **550** communicate to detect if the exercise device **500** is connected to the base **100**.

Sensor **150** is configured to detect presence of the exercise device **500** and determine the type of exercise device upon receipt of one or more signals from the exercise device sensor **550**. In this example the exercise device sensor **550** transmits a signal to the base sensor **150** that confirms presence and type of exercise device. In this example one sensor transmits a signal and the other sensor receives the signal and therefore both sensors do not transmit and receive. It is appreciated that a signal to identify the exercise device may also confirm receipt of the exercise device onto the base. For example the base sensor **150** may receive a signal from the exercise device sensor **550** that confirms presence and data, such as a code, relating to the type of exercise device. A signal is then transmitted from the base sensor **150** to the processor on the electronic device **600** where the signal can be analysed and corresponding events may occur, such as provision of a resistance force map training program.

At least one of sensor **150** or **151** operative to communicate with the processor when the resistance apparatus is engaged with a drive mechanism on the interchangeable exercise device.

For example when presence of the exercise device and type of exercise device is detected by sensor **150** a signal may be transmitted to the processor.

It is appreciated that the base **100** may have one sensor **150** that has multiple sensing means so that one sensor could be capable of detect presence of an exercise device, identifying the exercise device and sense data relating to resistance applied by the resistance apparatus.

For the purposes of the example shown in FIG. **11**, sensor **151** is arranged on the resistance apparatus (not shown in FIG. **11**) of the base **100** to communicate with the processor when the resistance apparatus is engaged with the drive mechanism on the exercise device. Sensor **151** senses data relating to resistance.

Sensor **551** is in communication with the drive apparatus (not shown) on the exercise device **500** and detects parameters relating to drive, such as revolutions per minute/force applied. Sensor **551** is an example of an additional sensor that may communicate with the processor to provide further information that can be used to provide more exercise related data for a user and may also assist with recorded hours of use of the exercise device that may be useful when considering maintenance of the exercise device.

The processor is able to receive and transmit signals, indicated by arrows showing two way communication with the sensors **150**, **151**, **550**, **551**.

It is appreciated that a sensor may only transmit a signal, may only receive a signal, or may both transmit and receive a signal.

Signals transmitted from a sensor to the processor are analysed and under certain conditions the processor will generate command signals to be sent from the processor to the resistance apparatus to alter resistance. Signals transmitted from a sensor to the processor are also analysed to provide information for a user relating to exercised perform and this information may be stored and/or displayed on the electronic device.

A preferred embodiment of the system comprises any one of the pictured or described bases **100**, **200**, **300**, **400**, with at least one sensor as described above, an exercise device **500** mounted thereupon with at least one sensor as described above and an electronic device **600** that houses a processor, a transmitter, a receiver and the control means.

The invention has been described by way of examples only and it will be appreciated that variation may be made to the above-mentioned embodiments without departing from the scope of invention as defined by the claims.

The invention claimed is:

1. A base for a modular exercise system comprises: a ground element for locating the base on a surface; a resistance apparatus mounted on the ground element; an attachment means for receiving and connecting an interchangeable exercise device to the base; and at least one sensor which is operative to detect and identify the interchangeable exercise device when connected to the base and is operative to communicate with a processor when the resistance apparatus is engaged with a drive mechanism on the interchangeable exercise device.

2. A base according to claim **1** wherein the at least one sensor or a second sensor is operative to transmit a signal to a receiver in communication with the processor confirming when the resistance apparatus is being driven by the drive mechanism on the interchangeable exercise device.

3. A base according to claim **1** wherein the processor is provided as part of an electronic device that has a transmitter, a receiver and a display.

4. A base according to claim **1** wherein the interchangeable exercise device includes a control means which communicates with the resistance apparatus and enables a user to vary a force applied by the resistance apparatus.

5. A base according to claim **4** wherein the processor is operatively connected with the control means.

6. A base according to claim **1** includes at least one second sensor which senses a force applied through the drive mechanism; and the processor derives a signal indicative of an amount of work done by a user.

7. A base according to claim **1** wherein a transmitter is provided on the base which is operative to transmit a signal to a receiver in communication with the processor indicative of at least one of: a force applied by a user; a level of resistance provided by the resistance device; an exercise start time; an exercise end time and total energy expended (kJ or kcal).

8. A base according to claim **1** wherein the resistance apparatus has an adjustment means for varying its resistance.

9. A base according to claim **1** wherein the attachment means includes a bracket for receiving the interchangeable exercise device.

10. A base according to claim **9** wherein the bracket includes a first finger with a tube that receives a pin and a second finger for receiving the exercise device and a distal end of the pin.

11. A base according to claim **10** wherein the first finger is adapted to support a first hub of the resistance apparatus.

12. A base according to claim **11** including a dog clutch for engaging a first engagement surface on the first hub of the resistance apparatus, with a second engagement surface on a second hub on the interchangeable exercise device.

13. A base according to claim **12** including a switch to engage and disengage the first and second engagement surfaces of the dog clutch.

14. A base according to claim **11** including a one-way freewheel clutch for engaging the first hub of the resistance apparatus with the second hub of the interchangeable exercise device.

15. A base according to claim **11** including a pin with at least one spline that engages with the first hub of the

resistance apparatus and a second hub on the exercise device by means of at least part of inner faces of the first and second hubs which each have a toothed profiles so that the first and second hubs rotate in unison when engaged with the spline of the pin.

16. A base according to claim **15** wherein a distal end of each spline on the pin is angled for engagement with the first and second hubs.

17. A base according to claim **1** wherein the attachment means is connected to the resistance apparatus.

18. A base according to claim **1** wherein the resistance apparatus has a connector for receiving a driveshaft that is connected to the drive mechanism of the interchangeable exercise device.

19. A base according to claim **1** wherein the ground element is adjustable in height/orientation.

20. A system comprising the base according to claim **1**, an exercise device mounted thereupon with at least one sensor, and an electronic device that houses a processor, a transmitter, a receiver and a control means.

21. An interchangeable exercise device for use with the base according to claim **1**.

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