MODULAR ISOMETRIC AND SPEED TRAINING DEVICE

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ABSTRACT
A modular exercise device that provides isometric and speed training in a plurality of embodiments by providing a single sensing core that can be encased in multiple housings. A force measurement smart core is an electronic piece although a pressure indicator or physical force gauge could be used also. A feedback interface providing visual/auditory/tactile interaction could be visual using an LCD or LEDs, audible, or tactile (vibration feedback). Means to setup the device include buttons or dials to set the goal force or change the exercise program. A memory allows the device to be programmed to walk the user through a routine or to allow the user to see previous workouts. A connection means to connect to a computer, the network or other electronic device using standard known architecture would be utilized. This could be wireless, wired or through memory cards.
Core Components - Force and Time Measurement

- Force and Time Measurement
- Power: battery, mains, solar etc.
- Memory

Core Components

- Visual/Auditory Tactile Interaction Component
- Connection: USB, wireless or wired

User Applied Force

Fig. 1
Fig. 5
Speed is shown by the gradient of the curve. A steeper gradient shows a faster muscle reaction. Different neural reaction times.

Fig. 6
Fig. 9

Smart Phone provides interface for dumb force measurement
Fig. 13
MODULAR ISOMETRIC AND SPEED TRAINING DEVICE

FEDERALLY SPONSORED RESEARCH

[0001] Not Applicable

SEQUENCE LISTING OR PROGRAM

[0002] Not Applicable

CROSS REFERENCE TO RELATED APPLICATIONS

[0003] Not Applicable

TECHNICAL FIELD OF THE INVENTION

[0004] The present invention relates generally to an exercise device. More specifically, the present invention relates to a modular exercise device that provides isometric and speed training in a plurality of embodiments by providing a single sensing core that can be encased in multiple housings.

BACKGROUND OF THE INVENTION

[0005] Isometric exercise is a type of strength training where the practitioner's joint angle and muscle length do not change during the muscle contraction. Isometric exercises are performed in a static position with no movement involved. A classic example of an isometric exercise is to hold your hands together with the palms touching and press them together as hard as you can for ten seconds. The joint and muscle are worked against themselves with no movement. Isometric exercising has a long history and elements appear in yoga and martial arts.

[0006] Isometrics has a number of benefits: it is a very safe form of exercising, as it is difficult to inadvertently overload your muscles. Isometrics are frequently used for physical therapy treatment, and it increases maximum strength beyond that achievable while using straight strength training. Isometrics strength training helps build fast twitch muscle fibers, the key component for speed, which is important in many sports. Traditional strength training does not. No heavy equipment or weights are required.

[0007] Given the known benefits of isometrics it is very noticeable that isometric exercising is little practiced compared to other forms of strength training and physical exercises. One of the main reasons for this is that there is little or no feedback when doing isometric exercises. It is impossible to know from one exercise to the next whether you are using a similar effort level. During a prolonged exercise regime over a couple of weeks or months there is no way to track improvement except through other forms of exercise. Therefore average exercisers have not adopted isometrics even though the benefits of isometrics have been documented in numerous studies.

[0008] The other major advantage of isometrics is they have shown to increase the ratio of fast twitch muscle to slow twitch muscle fiber of a practitioner. Speed is one of the most difficult things to train for; therefore being able to use isometrics is an important aspect of any serious speed training.

SUMMARY OF THE INVENTION

[0009] A modular exercise device that provides isometric and speed training in a plurality of embodiments by providing a single sensing core that can be encased in multiple housings.

The device is modular and consists of a smart core that can be used with a number of physical extensions that expand and build on the device and allow it to be used in a huge variety of ways to exercise different muscles for different sports. The major components of the system are: a smart core which is comprised of a memory, force and time measurement core, power means, visual/auditory tactile interaction component, and a housing or frame.

[0010] A force measurement smart core is an electronic piece although a pressure indicator or physical force gauge could be used also. A feedback interface providing visual/auditory tactile interaction could be visual using an LCD or OLED or any other type of visual display or LEDs, audible, or tactile (vibration feedback). In an alternative embodiment, tactile feedback is measured in a similar fashion to that of a torque wrench. When using a torque wrench, a user is not watching the wrench; they are watching the workpiece. When the user reaches the proper torque, there is an audible click and a slight motion of the handle to let them know they are there. The present invention, in some embodiments may use a combination of audio and slight motion to provide visual/auditory tactile interaction and feedback.

[0011] The present invention also teaches means to setup the device, which include buttons or dials to set the goal force or change the exercise program. Memory allows the device to be programmed to walk the user through a routine or to allow the user to see previous workouts. A connection means to connect to a computer, the network or other electronic device using standard known architecture would be utilized. This could be wireless, wired or through memory cards.

[0012] One interesting use for the device of the present invention is that because there is little or no muscle movement it is possible to be doing other things while exercising. Imagine a force gauge that attached to a steering wheel, allowing you to flex your muscle and receive feedback while stuck in traffic. Or more likely one could use this device while watching television.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The accompanying drawings, which are incorporated herein and form a part of the specification, illustrate the present invention and, together with the description, further serve to explain the principles of the invention and to enable a person skilled in the pertinent art to make and use the invention.

[0014] FIG. 1 illustrates the architecture of the present invention;

[0015] FIG. 2 illustrates the smart core with accessory interfaces taught by the present invention;

[0016] FIG. 3 illustrates the smart core in an alternative configuration taught by the present invention;

[0017] FIG. 4 illustrates an alternative configuration taught by the present invention;

[0018] FIG. 5 illustrates the device in use in one upper body workout embodiment;

[0019] FIG. 6 shows how force is plotted against time for the user for three different measurements;

[0020] FIGS. 7 and 8 show how the force is plotted against time for the user during an exercise routine;

[0021] FIG. 9 illustrates the architecture where the basic device of the present invention is reconfigured to simply be the force and time measurement core and an interface to an existing computer, or smart phone;
FIGS. 10-12 illustrate an alternative embodiment providing a device that consists of two separate sensors that would both measure the force that is being applied to them;

FIG. 13 illustrates an alternative embodiment of the present invention comprising a stepper motor in addition to the force measurement device’s handles that provides means for allowing very slow movement during the exercise; and

FIGS. 14-16 illustrate the device in use in one lower body workout embodiment.

DETAILED DESCRIPTION OF THE INVENTION

In the following detailed description of the invention of exemplary embodiments of the invention, reference is made to the accompanying drawings (where like numbers represent like elements), which form a part hereof, and in which is shown by way of illustration specific exemplary embodiments in which the invention may be practiced. These embodiments are described in sufficient detail to enable those skilled in the art to practice the invention, but other embodiments may be utilized and logical, mechanical, electrical, and other changes may be made without departing from the scope of the present invention. The following detailed description is, therefore, not to be taken in a limiting sense, and the scope of the present invention is defined only by the appended claims.

In the following description, numerous specific details are set forth to provide a thorough understanding of the invention. However, it is understood that the invention may be practiced without these specific details. In other instances, well-known structures and techniques known to one of ordinary skill in the art have not been shown in detail in order not to obscure the invention.

Referring to the figures, it is possible to see the various major elements constituting the apparatus of the present invention. The present invention is a modular isometric and speed-training device. The core of the device 100 is where the majority of the cost exists; once that has been purchased the device can be reconfigured with many different inexpensive physical extensions 202, 203, 204, 205, 206. The extensions 202, 203, 204, 205, 206 allow the user to easily alter the device to exercise specific muscle groups or add sport specific extensions 202, 203, 204, 205, 206 that target strength routines that benefit the desired attributes for that sport. No device of this small and portable size can measure muscle speed and reaction time simultaneously and track progress towards a goal. This device is one of the only exercise devices that can help train speed one of the main attributes of an athlete’s training regime. The device is modular and consists of a smart core 100 that can be used with a number of physical extensions 202, 203, 204, 205, 206 that expand and build on the device and allow it to be used in a huge variety of ways to exercise different muscles for different sports. In the figures, the physical extensions 202, 203, 204, 205, 206 shown are all for use with upper body exercises although it would be obvious to one of ordinary skill in the art to replace or include lower body attachments 1400 as shown in FIGS. 14-16 for lower body core training as taught by many other exercise machines in the prior art as lower body and core training is a big component of speed in sports. The major components of the system are: a smart core 100 which is comprised of a memory 101, connection means 102, force and time measurement core 103, power means 104, visual/auditory tactile interaction component 105, and a housing or frame 106. A force measurement smart core 103 is an electronic piece although a pressure indicator or physical force gauge could be used also. A feedback interface providing visual/auditory tactile interaction 105 could be visual using an LCD or LEDs, audible, or tactile (vibration feedback).

Means to setup the device include buttons or dials to set the goal force or change the exercise program. A memory 102 allows the device to be programmed to walk the user through a routine or to allow the user to see previous workouts. A connection means 102 to connect to a computer, the network or other electronic device using standard known architecture would be utilized. This could be wireless, wired or through memory cards.

Different shapes and devices to allow a variety of exercises to be performed through connection to a central housing or frame 106 are taught by the present invention. Now referring to FIG. 2, several embodiments of the present invention are shown. The central house 106 contains the smart core 100. The smart core 100 can then be attached to any number of physical extensions 202, 203, 204, 205, 206 that expand and build on the device and allow it to be used in a huge variety of ways to exercise different muscles for different sports. For example, fixed handgrips 202, T-handle grips 203, cord pulls 204, a medicine ball 207 or moveable handle bars 205 can be attached as alternative housings to the smart core 100 to create several exercise embodiments of the present invention.

FIG. 3 illustrates one embodiment of the present invention where the smart core 100 is secured in a housing affixed with two receiving arms 301 and 302 for attachably receiving numerous grips. The grips can come in many shapes such as the short handle 303, balled handle 304, and extended handle 305 shown. A user can simply attach the desired handle or grip to the receiving arms 301 and 302 as desired.

Now referring to FIGS. 4 and 5, another embodiment of the present invention where the smart core 100 is secured in a housing 400 affixed with two handles 401 and 402 as shown. In practice, a user 500 would grip each handle 401 and 402 and attempt to spread the handles 401 and 402 apart or push them together in an upper body isometric exercise of this embodiment.

FIG. 14 illustrates another embodiment of the present invention where the smart core 100 is secured to two handles 1401 and 1402 as shown. In practice, a user 1403 would place each handle 1401 and 1402 against their inner thigh and attempt to squeeze the handles 1401 and 1402 together in a lower body isometric exercise of this embodiment.

Speed is a key component of many athletic endeavors, however it is difficult to specifically train or measure speed. The three main areas for athletic training are speed, strength, and endurance. Most sports incorporate two to three of these areas, however the majority of training and training equipment is biased towards Strength and Endurance. Isometric training has been shown to positively impact speed in addition to strength, even though no movement occurs during. To measure speed the device measures the force applied over time. In one scenario the user is required to get into position and apply and hold an initial lower force. The device
would then indicate by visual, audio or tactile means to rapidly increase the force as quickly as possible. No movement happens, the user is simply increasing the force they apply to the device. The graph of FIG. 6 shows how the force is plotted against time for the user with three different measurements. FIGS. 7 and 8 show how the force is plotted against time for the user during an exercise routine. In FIG. 7, the user is increasing the force and attempting to hold the constant target force for a given period of time. In FIG. 8 the user is increasing the force and attempting to hold the constant target force for a given period of time and then apply a smaller force in a lower target zone during a relaxing period in the exercise. Other variations have the muscle reaction be relaxing to a lower force the opposite of a tense.

[0037] The basic device could be completely reconfigured to simply be the force and time measurement core 900 and an interface to an existing computer 901, or smart phone 902 as shown in FIG. 9. Phones 902 that have great computing power, large displays, touch screen or smart button interfaces and a continuous network connection are becoming ubiquitous. Two examples are the IPHONE and the GOOGLE ANDROID phone. These devices have a well-developed SDK (software development kit) an application store and an always-on Internet connection 903 that would allow the exercise data to be stored on servers and accessed by the user anywhere. This would allow the user to track their progress and activity with no effort other than plugging the phone 902 into the device 900 and performing their exercise routine. The software would automatically connect and synchronize any data or exercise programs. This would also allow the device to be programmed either on a computer or via the Internet. The connection to a computer and Internet or other communications network would allow someone to compete against themselves or other users as desired.

[0034] In an alternative embodiment shown in FIGS. 10-12, rather than have a single connected device there may be some interesting uses for a device that consists of two separate sensors 901 and 902 that would both measure the force that is being applied to them. In FIGS. 10-12, a user can use the two sensing halves 901 and 902 to press together (FIG. 10), pull apart (FIG. 11), or apply pressure in opposing directions (FIG. 12) in an isometric exercise routine.

[0035] One of the main issues preventing success with any exercise program is that it is hard to stay motivated. Introducing some competition is a great way to motivate people to try harder or to continue doing something. The issue with competition and strength contests is that it is extremely hard to find someone who is local and willing to work with you and who has a similar schedule and then it is even harder to find someone who is at a similar strength level to you. This device solves this issue.

[0036] With networked exercise equipment it is easy to find someone who is interested in exercising at the same time as you are given the much larger pool of potential exercise partners. This is very similar to online game playing. Games start throughout the day and people join a server, which places them in a queue where they generally wait only a few seconds before being joined to a game. The users history of exercise will show what their peak performance and abilities are and the software will be able to scale the forces generated so that the users can compete based on their effort compared to their historical performance and not based on actual force measured. This allows the weakest user to compete against the strongest. The time for each user can be altered also. For example, if one of the users can only hold their maximum force for twelve seconds and the other competitor can hold it for thirty seconds the two would still be able to compete to see who was able to hold it closer to their personal record. Additionally the users could compete on speed to see how fast they can apply a force. With a stored history of a users performance, the user would also be able to compete against themselves and see how their performance on a routine differs on a daily basis or to compete in an open competition where the absolute measurements are compared.

[0037] The device can be handheld, but it also could be used by the feet or knees or other parts of the body to exercise different muscle groups. It is also imagined that the device could have accessories that mount it to chairs, tables, doorways etc. to facilitate a multitude of different exercises.

[0038] The typical way to train for sports is to play the sport itself. This improves coordination, muscle memory and instinct on the playing field. But to excel, the athlete utilizes specialty training to augment. The football player who only plays football would be at a disadvantage to a similarly talented player who also works strength training into his routine. That is because strength training produces muscle forces beyond those that the player would see just playing the game. The body adapts to this training load because it is above a habitual level. This is the theory of super compensation: after a stress period (workout) and a restorative period (rest), the preparedness level (fitness) is higher than it was originally. The weight-training player will become stronger than the non-weight training player. This specialty training typically takes one of two directions: strength or endurance. This is typical and, for some sports, all that is needed. In fact, for the fitness oriented person (as opposed to athletic oriented person), strength and endurance is all that is needed/desired.

[0039] However, in order to be more competitive in many sports, the other dimension that is needed is speed. In some sports it is the dominant dimension. There are few if any devices for speed training and even fewer that can measure progress created by the training. The invention presented here can be used to both train for speed and to measure progress. It is generally accepted that muscle fiber types can be broken down into two main types: slow twitch (Type I) muscle fibers and fast twitch (Type II) muscle fibers. These distinctions seem to influence how muscles respond to training and physical activity, and each fiber type is unique in its ability to contract in a certain way. The majority of people have approximately the same distribution of muscle fibers. Studies have shown that sedentary people have about 50 percent slow twitch and 50 percent fast twitch fibers in most of the muscles used for movement. The activity and training that has been undertaken will change muscle type distribution. E.g a distance runner may have only 25% fast twitch muscle fiber, while a sprinter may have >80% fast twitch muscle fiber.

[0040] Slow Twitch (Type I).

[0041] The slow muscles are more efficient at using oxygen to generate more fuel (known as ATP) for continuous, extended muscle contractions over a long time. They fire more slowly than fast twitch fibers and can go for a long time before they fatigue. Therefore, slow twitch fibers are great at helping athletes run marathons and bicycle for hours.

[0042] Fast Twitch (Type II).

[0043] Because fast twitch fibers use anaerobic metabolism to create fuel, they are much better at generating short bursts of strength or speed than slow muscles. However, they fatigue.
more quickly. Fast twitch fibers generally produce the same amount of force per contraction as slow muscles, but they get their name because they are able to fire more rapidly. Having more fast twitch fibers can be an asset to a sprinter since she needs to quickly generate a lot of force. It is obvious how you create the overload conditions for strength and endurance that will produce super compensation? However in most cases for speed training, you can’t just do the motion faster in order to get the overload.

[0044] If you are a baseball player you can’t just swing your bat three times faster in training. Currently there is no device on the market that can show conclusively over a training period of days/weeks that the athlete has directly increased the speed of the muscle group that they are training. Training effectiveness is measured through ancillary observations of sport performance, which is extremely difficult to correlate with training. The device is used for isometric exercising. Isometric exercise is a type of training where the joint angle and muscle length do not change during the exercise muscle contraction. As shown in FIGS. 7 and 8, the device consists of a core measurement unit that can measure the force being applied by the user and also the force/time.

[0045] In the preferred embodiment the device would be provide direct feedback to the user to indicate both force applied but also the time taken to reach a predefined force. There have been a number of studies that have shown that isometrics/resistance training is one of the most effective methods of increasing the percentage of fast twitch muscle and therefore of increasing the speed of the practitioner. The core of the device would have some means of measuring force, torque, pressure etc. that can be correlated to the external force applied by the user. There would be a user interface component that would provide feedback to the user (e.g. When to commence applying force, what level of force they are applying).

[0046] To measure speed the device measures the force applied over time. In one scenario the user is required to get into position and apply and hold an initial lower force as shown in FIG. 7. The device would then indicate by visual, audio or tactile means to rapidly increase the force as quickly as possible. No movement happens, the user is simply increasing the force they apply to the device. The graph of FIG. 6 shows how the force is plotted against time for the user for different measurements.

[0047] There are two components that affect speed. The first is a neural response—the body’s reaction time. The second is the force time curve that your muscles can produce—your explosiveness. Combined, these two components represent the speed of the athletic movement. The device of the present invention is specifically intended to improve the second component, the force time curve of the muscle or muscle group. However, this device has the added benefit of being able to measure the neural reaction time as a separate component of the overall speed, which can be advantageous from a training standpoint.

[0048] The explosiveness is correlated to the percentage of fast twitch muscle fibers that exist in the muscle group being measured. The slope of the Force/Time curve as illustrated in FIG. 6, shows the speed (explosiveness) of the exerciser. This shows how the device could directly show the speed of the muscle response.

[0049] One of the complaints held against isometric exercise is that the muscles do not move and therefore the muscle is only exercised in one position. In yet another alternative embodiment illustrated in FIG. 13, by adding a stepper motor 1303 or some form of controlled clutch in addition to the force measurement the device’s handles 1301 and 1302 would very slowly move during the exercise. This gives the benefit of isometric exercising while also increasing the range over which the muscles are exercised. The stepper motor 1303 or clutch would move or allow the handles 1301 and 1302 to move while the user maintained the desired force on the device 1300. Alternatively the motor could simply allow the device to walk the user through an exercise routine by moving the handles to different positions for a variety of different exercises.

[0050] Furthermore, other areas of art may benefit from this method and adjustments to the design are anticipated. Thus, the scope of the invention should be determined by the appended claims and their legal equivalents, rather than by the examples given.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. Modular isometric device comprising:
   a smart core consisting of:
   a housing or frame;
   a force and time measurement component, a feedback interface providing at least one of visual, auditory, or tactile interaction, and a housing.
2. The device of claim 1 wherein the core is further comprised of wireless connection means to connect the device to a wireless network.
3. The device of claim 1 wherein the smart core is further comprised of an electronic memory allowing the device to be programmed to walk the user through a routine or to allow the user to see previous workouts.
4. The device of claim 1 further comprising one or more physical extensions moveably attached to the housing.
5. The device of claim 1 wherein, the force and time measurement component is electronic.
6. The device of claim 1 wherein, the force and time measurement component is a pressure indicator or physical force gauge.
7. The device of claim 4 wherein, the physical extensions include upper body and core extensions.
8. The device of claim 7 wherein, the physical extensions for upper body and core extensions include: fixed handgrips, scissor handgrips, T-handle grips, cord pulls, a medicine ball, or moveable handle bars attached to the smart core as alternative housings.
9. The device of claim 4 wherein, the physical extensions include lower body and core extensions.
10. The device of claim 3 wherein, a memory card is provided to transfer information from the device to a computer.
11. The device of claim 1 wherein, the housing is further comprised of two receiving arms for attachably receiving numerous grips.
12. The device of claim 11 wherein, the grips include a short handle, bulb handle, and an extended handle.
13. The device of claim 2 wherein, the wireless connection means connect the device to a wireless computer network.
14. The device of claim 2 wherein, the wireless connection means connects the device to a mobile wireless device; said mobile wireless device provides a continuous network connection;
15. The device of claim 14 wherein the mobile wireless device is a smart phone.

16. The device of claim 1 comprising two smart cores whereby the two smart cores are press together, pulled apart, or apply pressuring in opposing directions during an isometric exercise routine.

17. The device of claim 2 wherein, the memory includes a users history of exercise will show what their peak performance and abilities are and is able to scale the forces generated so that the users can compete based on their effort compared to their historical performance and not based on actual force measured.

18. The device of claim 17 wherein, users compete on speed to see how fast they can apply a force.

19. The device of claim 1 wherein, said device is provided with accessories that mount it to stationary objects.

20. The device of claim 1 wherein,
the device consists of a core measurement unit that can measure the force being applied by the user and also the force/time; and
said device provides direct feedback to the user to indicate force applied, the time taken to reach a predefined force, and the neural reaction time.

21. The device of claim 1 further comprising means of measuring force, torque, and pressure that are correlated to the external force applied by the user.

22. The device of claim 11 further comprising a controlled motion attachment attached to the two receiving arms for attachably receiving numerous grips providing very slow movement during the exercise of the receiving arms and attached grips while the user maintained the desired force on the grips.

23. The device of claim 22 wherein the controlled motion attachment is either a stepper motor or a governor.

24. The device of claim 22 wherein the controlled motion apparatus allows the device to walk a user through an exercise routine by moving the handles to different positions for a variety of different exercises.

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