The invention is of an apparatus for enabling a seated user to obtain exercise by moving muscles in their legs and/or feet to move foot pedals that extend from a base up and down in a treading motion. The novelty of this apparatus lies in its construction from tensile material with intrinsic elasticity modulus which causes high yield ratios of over 0.6. The rebound motion of the tensile material allows the unit function as an exercise unit when sitting, including when working at a desk without a negative impact on performance. Two iterations of the same apparatus are described: one where the foot pedals are irremovably part of the base, and one where separate foot pedals are slotted into a base. The latter allows for switching foot pedals to obtain different resistances. The unit can function as a footrest when not used for exercise.

Schematic top view of preferred dynamic footrest embodiment

- 3: Base
- 4: Slots for insertion of foot pedal base
- 5: Base of foot pedal
- 6: Upper surface of foot pedal

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**DYNAMIC FOOTREST ENABLING EXERCISE FOR THE LOWER BODY**

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FIGURE 1: Schematic top view of the single piece embodiment

Reference numerals:
1: Upper surface of embodiment with foot pedals
2: Lower surface forming base of embodiment
Figure 2: Schematic top view of preferred dynamic footrest embodiment

3: Base
4: Slots for insertion of foot pedal base
5: Base of foot pedal
6: Upper surface of foot pedal
FIGURE 3: Percentage rebound of foot pedals fabricated from different gauges (G) of steel (SS: spring steel; CS: carbon steel)
FIGURE 4A: Timed math test scores with and without use of CS14G dynamic footrest.

![Bar chart showing math test scores with and without footrest.]

Figure 4B: Calorie consumption during math test with and without use of CS14G dynamic footrest.

![Bar chart showing calorie consumption with and without footrest.]

FIGURE 5A: Pac-man game scores, measured using a BodyMedia Fit device worn on the calf, with and without use of dynamic footrest.

FIGURE 5B: Calorie consumption during Pac-man game with and without use of dynamic footrest.
DYNAMIC FOOTREST ENABLING EXERCISE FOR THE LOWER BODY

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is based on Provisional Patent application No. 61/573,641 filed on Sep. 9, 2011. The content of this application is incorporated herein for reference.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT.

[0002] Not applicable

THE NAMES OF THE PARTIES TO A JOINT RESEARCH AGREEMENT

[0003] Not applicable

INCORPORATION-BY-REFERENCE OF MATERIAL SUBMITTED ON A COMPACT DISC

[0004] Not applicable

BACKGROUND OF THE INVENTION

[0005] (1) Field of the Invention

[0006] This invention relates to exercise, and more specifically to equipment allowing for exercise of the lower body when seated. The applicable US Patent Classification suggested is 482/92 (User manipulated force resisting apparatus, component thereof, or accessory therefor).

[0007] (2) Description of the Related Art

[0008] There are many descriptions of footrests that function as a passive, sometimes adjustable, device, and footrests that deliver movement to provide exercise. The following survey presents a variety of innovations in this field. However, it will be noted that none of the movable footrests or leg exercise apparatus described below provide movement without some kind of physical connection, such as an articulation or moveable joint, usually linking a separate top and base.


[0013] The following footrests describe annular and rotating massage elements that can be manipulated by moving the feet on the surface of the footrest. U.S. Pat. No. 5,005,560; U.S. Pat. No. 5,527,247.

[0014] The most relevant item to this submission in the USPTO database is U.S. Pat. No. 6,679,817 (Jan. 20, 2004) by Williams which describes a lower body exercise device and method using a wedge shaped object made from polyurethane foam that can be pressed with the soles of the feet in a pumping motion. This structure uses the resilience of the material from which the object is constructed to provide the rebound for the pumping action. However, examination of the structure, the construction material of polyurethane foam, and a maximum energy return of 0.6 distinguish it from the current submission.

[0015] Online searches were also conducted and yielded two products with a similar profile or function to this submission:

[0016] 1. The Half Z-rest footrest (marketed by Stretch Now Group, 597 Canterbury Road Surrey Hills VIC 3127, Australia) has a similar profile to the current embodiment, but is different in that its construction has side support structures and is intended for adjustment to various heights, and does not permit motion.

[0017] 2. The Sit-N-Stroll Pedal Exerciser (marketed by Gold Violin, PO BOX 147, Jessup, Pa. 18434) has a similar function to the device described here, but is quite different in composition and construction, being constructed with a linking unit between the foot pedals and is made of a plastic material.

[0018] While all the devices described above seek to provide lower extremity support and/or exercise, none use the intrinsic elasticity of the material of construction as the facilitator for motion. While many are portable, fit under desks, and provide quiet movement, most are subject to a certain amount of maintenance to keep the moving parts in working order. The embodiment presented here is distinguished by the lack of maintenance required, and the option for using different construction materials, metals, alloys and synthetic composites with varying intrinsic elasticities to provide different resistances and yield ratios.
The United States and much of the developed world, and increasingly the developing world also, is anticipating an epidemic of obesity with the associated medical and social impact of poor health outcomes. Part of the reason for obesity is attributed to diet, and part to lack of adequate exercise to ensure good health. In addition, many people, while not obese, still do not obtain adequate exercise. The recent “Let’s Move” initiative sponsored by First Lady Michelle Obama calls attention to this lack of exercise, but activity is not easily integrated into situations such as being in the school classroom; reading; traveling in a car, by rail, or air; working in an office or on an assembly line; or during recreational pastimes such as watching TV or gaming. It has been estimated that, within groups with similar calorie intake, people who tend to fidget are leaner because they burn up more calories through the low-grade exercise of fidgeting. If the option for activity while seated were available in environments ranging from workplaces to schools to transport to the home, the additional expenditure of calories through low-grade activity will have a positive impact on fitness and weight gain.

Many products such as the treadmill desk, and assorted exercise machines for use while seated, have been developed. The major impediment to large scale uptake of these products has been either their relatively high cost or the inconvenience of using some of them while working at a task. As demonstrated experimentally, the current invention exploits the calorie-burning value of low-grade activity while sitting makes calorie-burning possible without hindering performance on a task. This structure of the apparatus lends itself also to use on airplanes, cars, buses, and trains, where prolonged sitting are required. In fact, long distance air travel has been known to increase the probability of deep vein thrombosis, and use of apparatus such as this may ameliorate this problem. The portability, relative low cost, and low space impact of this design lends this apparatus to being used also in schools, offices, and at home. The apparatus can be used to burn calories while working at a task, or partaking in leisure activities such as gaming without a negative impact on performance (FIGS. 4A,B and 5A,B).

Another benefit of this design is that the activity, while burning calories slowly and steadily, is low-impact and can be modified by changing pedal position to exercise different parts of the leg and/or foot, or changing resistance by using a foot pedal with a different stiffness to provide more or less intense exercise. Thus it is equally beneficial for use to develop or maintain muscle tone and for burning calories.

BRIEF SUMMARY OF THE INVENTION

A dynamic footrest for use to obtain exercise for the lower body is described. The novel feature of the footrest is its construction from stiff tensile material with an elasticity modulus that provides a high yield measured as a rebound factor greater than 0.6 (FIG. 3). The user obtains calorie-burning exercise by treading on foot pedals that spring back up due to the high yield ratio. The resistance and rebound can be varied by using materials with different elasticities to construct the pedals. The footrest is compact in size for use at a desk or couch, and comes in two embodiments: one made from a single piece of material and the other containing a base with slots to interchange pedals with different resistances. It can be used to obtain exercise when working, or gaming, without a negative impact on performance.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

FIG. 1: Schematic top view of the one-piece embodiment of the invention
FIG. 2: Schematic top view of a preferred embodiment of the invention with independent foot pedals that insert into the base
FIG. 3: Graph showing percentage rebound of foot pedals of the dynamic footrest
FIG. 4A: Graph showing timed math test scores with and without using dynamic footrest
FIG. 4B: Graph showing calorie usage during math test with and without using dynamic footrest
FIG. 5A: Graph showing Pac-man game scores with and without using dynamic footrest
FIG. 5B: Graph showing calorie usage during Pacman game with and without using dynamic footrest

DETAILED DESCRIPTION OF THE INVENTION

This patent describes a dynamic footrest that provides a mechanism to obtain low-grade exercise while seated. The footrest is made from material with intensive tensile strength and a Young’s Modulus of Elasticity that is sufficient to obtain a rebound value of over 60% (0.6) for best function. In our tests with three types of materials (14-gauge carbon steel; 16-gauge carbon steel; 14-gauge spring steel), the 14-gauge spring steel showed the highest resistance to being pushed down and highest rebound, followed by the 14-gauge carbon steel and the thinner 16-gauge carbon steel. This correlation applies to other materials, then materials with Young’s Modulus of Elasticity values of between 25x10⁶ and 35x10⁶ psi values at 21° C. with a high yield point to stress are appropriate for use. The choice of material(s) for construction of the preferred embodiment is based on resistance desired. Linear materials are preferred, but the determinations for anisotropic composite or novel materials are best made by practitioners skilled in the art. While changing resistances are preferably carried out by changing the foot pedal material, alternate methods such as inserting or fixing an object such as fabric, a simple spring, or gas spring into the foot pedal’s “V” area will also provide a temporary increase in resistance. The orientation of the pedals relative to the body can be changed as desired by rotating the footrest.

The first design iteration is a single-piece footrest composed of a sheet of tensile material bent into a V-shape with one arm of the V forming the base and the other arm forming the foot pedals. The foot pedal section ideally has a notch to allow each foot to be depressed independently as shown in FIG. 1. Reference numeral 1 indicates the upper portion of the footrest and the hatched area (Reference numeral 2) indicates the attached base section of the embodiment.

The second design iteration (FIG. 2) allows foot pedals of different resistances to be interchanged by slotting independent pedals into slots of a common base. Reference numeral 3 indicates the separate base; reference numeral 4 indicates the slot in the base into which the foot pedal is inserted; reference numeral 5 indicates the base of the separate foot pedal that inserts into the slot (4); reference numeral 6 indicates the upper “pedal” portion of the foot pedals. Based on the same principles of resistance and rebound, different pedals can be interchanged depending on the amount of exercise required because higher foot pressure is needed to
depress a foot pedal with higher resistance and rebound. For reasons of economy the actual tensile material to obtain rebound can be used mainly in the region near the “V” that experiences the stress and different and less expensive materials used to fabricate the support areas which do not experience stress.

[0033] In the prototypes of the two iterations described above, good performance was obtained with carbon steel gauge 14 or spring steel gauge 14. The dimensions for the single-unit footrest were 14" length, 12" width for base, with height of the foot pedals varying from 1" at the angle of the “V” to 4" at the free end; a slope of 3° over a 10" length. These measurements are provided to exemplify suitable configurations, but are not intended to be limiting in any way. Elevation of the apparatus or embedding the apparatus in substrates, based on location, for release for use when desired may be carried out without impacting performance. Reference to the figures provided will be edifying when assessing the embodiments described.

[0034] The size of the preferred embodiment of the apparatus may be varied depending on the location serviced or the age of the practitioner. For example, for use with young children in a school setting, the size and resistance of the apparatus may be modified appropriately. A multiplicity of alternate methods to secure the foot pedals to the base will be obvious to practitioners skilled in the art. Preferred embodiments should preferably operate quietly or silently to avoid being a distraction to the user. Preferred embodiments will provide low-grade exercise rather than exhausting, highly aerobic exercise. The apparatus provides exercise while sitting to the lower body while sitting, mainly the legs, ankles and toes of the user without putting strain on the knees or hips. The risk of strain or injury is minimal when used as intended. When used with the angle of the V towards the person, the front end of the foot can be used to push the pedal down, or alterately, the toes can be hooked on the edge of the pedal to lift the pedal up. The whole unit can be turned laterally around through 180 degrees, reversing the orientation with the angle of the V now distal from the person, with the heel used to press down the free portion of the pedal. Padding and aesthetic molding for comfort or visual appeal can be made. Embodiments for use with bare feet may be padded for comfort. Preferred embodiments will not need lubrication or regular maintenance beyond wiping down occasionally for hygiene. In the case of padded or covered foot pedals, maintenance to preserve appearance will be desirable.

[0035] The apparatus in its preferred embodiment allows low-grade exercise to be carried out while sitting, thus burning calories steadily. Use of the dynamic footrest does not impact performance on a task. The dynamic footrest was tested to obtain data on its effect on performance of a timed math test (FIG. 4A) and on a Pac-man game (FIG. 5A). In both cases, there was no detrimental effect on performance; however 4-5 times more calories were consumed using the foot rest compared to sitting still (FIGS. 4B and 5B).

[0036] Its use in locations which predispose to lack of movement such as working at an office desk or even during long-distance transport may reduce the incidence of circulation problems such as deep vein thrombosis. Movement increases blood transport with its attendant benefits, such as improved oxygen transport around the body, reduction of mental stress, promoting immune responses, and improved recovery when used in a therapeutic setting.

[0037] The use of logos and trademarks, accessories such as calorie counters and timers, items for harvesting or storing electricity such as capacitors or battery chargers, decorative or aesthetic elements, may all provide added functionality or desirability.

[0038] While this list is not exhaustive, addition of elements designed to expand the functionality of the apparatus should be construed as being part of the versatility of this apparatus.

[0039] Finally, the elements described here have not been organized to provide a hierarchy of ordering of provisions, but rather to provide understanding of the function and design of the apparatus.

SUMMARY OF THE INVENTION

[0040] The purpose of the apparatus is to provide an inexpensive and convenient method for a seated user to achieve aerobic exercise by moving muscles in their leg and/or foot to move foot pedals up and down. The benefit to low-grade activity while seated is that calories are burned during an otherwise inactive period, contributing to weight loss.

[0041] The apparatus consists of a tensile material that can be bent to a “V” shape with one leg of the V forming a base and the other forming the foot pedal. A preferred gap between the two pedals allows them to move independently. Sustained, low-grade aerobic exercise can be achieved with low impact, and the resistance can be varied for different desired levels of effort by using construction materials with varying elasticity modulus. Aesthetic, design, and comfort elements can be incorporated to enhance the appeal of the apparatus.

[0042] Further embodiments of the apparatus allows for varying resistances to be used with a single base unit. Thus, the base unit can have slots or grooves to house the foot pedals, which can be switched out to provide different resistances. The variations allow for a plethora of options for use; providing foot pedals in pre-installed and stowable bases in transport vehicles such as airplanes and long-distance buses. Permutations for allowing various members of a single family or classroom with different fitness needs to use the same base unit at different times, or for a single user to vary resistance based on need can be achieved. Provisions for pre-installed or separate base units that extend the length of furniture also allow for removable pedals to be installed in the resistances and number as needed. The dynamic footrest may be used at work; during leisure activities such as watching television or playing computer games; or other sedentary activities such as reading or sitting in a waiting room.

What is claimed:

1. An apparatus made from a single, tensile piece of material bent into a “V” shape, where one arm of the V functions as the base and the other arm functions as the foot pedal, that enables a seated user to use the muscles in the legs and/or feet in a stepping motion to move pedal(s) up and down to obtain exercise.

The treading action of the foot causes the free end of the pedal to bend toward the base and then restore back up in reaction due to the material’s high relative energy return (>0.6), which can be varied by using different construction materials to obtain different rebound values and resistances (FIG. 3).

The addition of aesthetic, comfort, measurement or energy harvesting devices including, but not limited to padding, non-skid liners, containers for storing, color schemes, calorie counters, step counters, capacitors, bat-
tery chargers and modifying dimensions to fit given spaces or for economy can be incorporated as needed.

2. An apparatus as described in claim 1, with a portion of the material on the top of the “V” section fabricated or cut out so as to produce foot pedals with a gap between the pedals in order to permit their separate movement (FIG. 1).

3. An apparatus as described in claim 1, but where individual pedals are inserted snugly into a slot in the base (FIG. 2), allowing foot pedals of materials with different tensile elastic modulus to be introduced as pairs, or mixed and matched, to produce the desired resistance for each leg/foot.

4. The apparatus as described in claim 3, but consisting of a single base unit with multiple slots into which multiple individual pedals can be introduced to fit at the base of a multi-seat units such as those found in transport vehicles, schools or waiting rooms.

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