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Lee et al.

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(54) **EXERCISE APPARATUS HAVING GUIDED FOOT PAD CARRIERS AND A WEIGHT STACK**

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A63B 21/00 (2006.01)
A63B 23/04 (2006.01)

(52) **U.S. Cl.**
CPC ***A63B 21/1488*** (2013.01); ***A63B 21/1465*** (2013.01); ***A63B 23/04*** (2013.01)

(58) **Field of Classification Search**
CPC A63B 21/00
USPC 482/51, 52, 70, 71, 93, 99, 101
See application file for complete search history.

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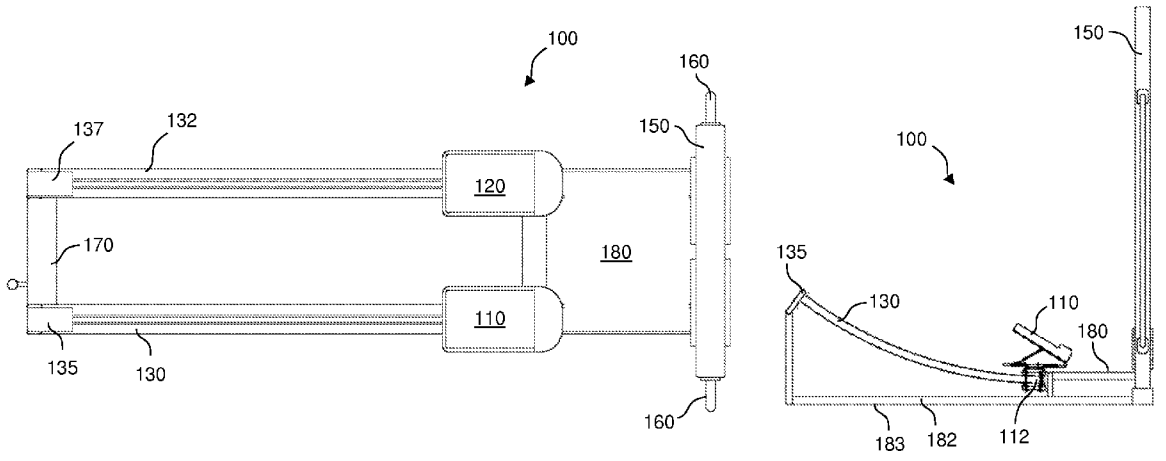
(57) **ABSTRACT**

An apparatus for human exercise in certain configurations includes a first foot pad attached to a first guided carrier member. A first curved guide rail is coupled to the first guided carrier member. The first curved guide rail prevents motion of the first guided carrier member except for translation along the first curved guide rail. A weight stack includes a first plurality of weights coupled to a first cable. The first cable is also coupled to the first foot pad. A tension in the first cable may oppose a translation of the first foot pad along the first curved guide rail. A stationary foot platform is fixed to the apparatus between the first curved guide rail and the weight stack. The first curved guide rail is curved away from an underlying ground plane, to define a rail height that decreases towards the stationary foot platform.

17 Claims, 8 Drawing Sheets



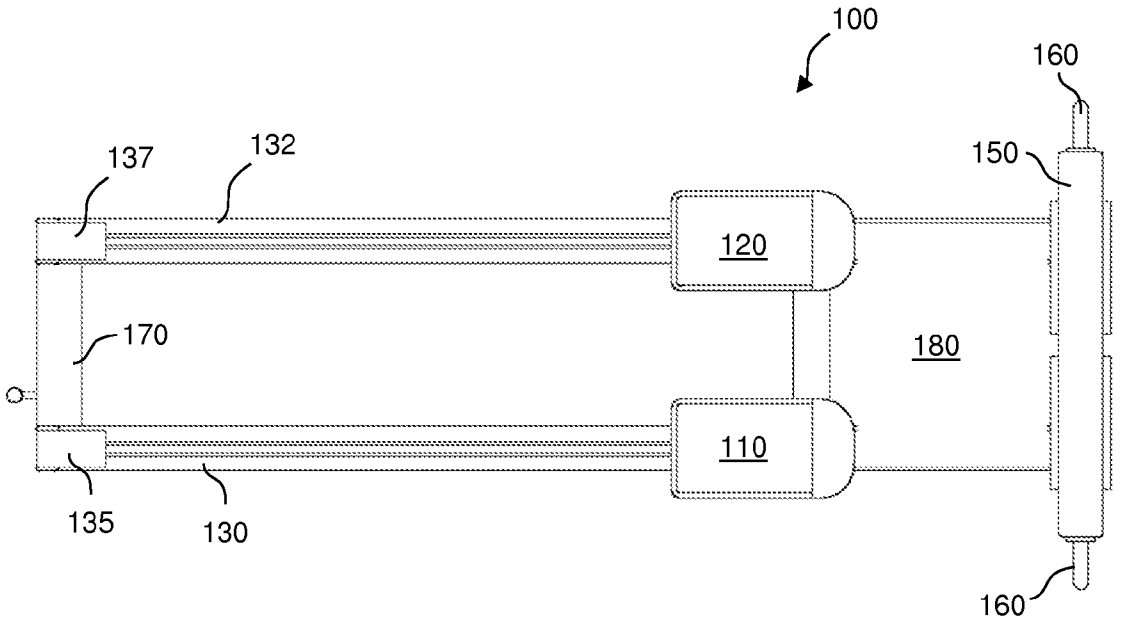


FIG. 1A

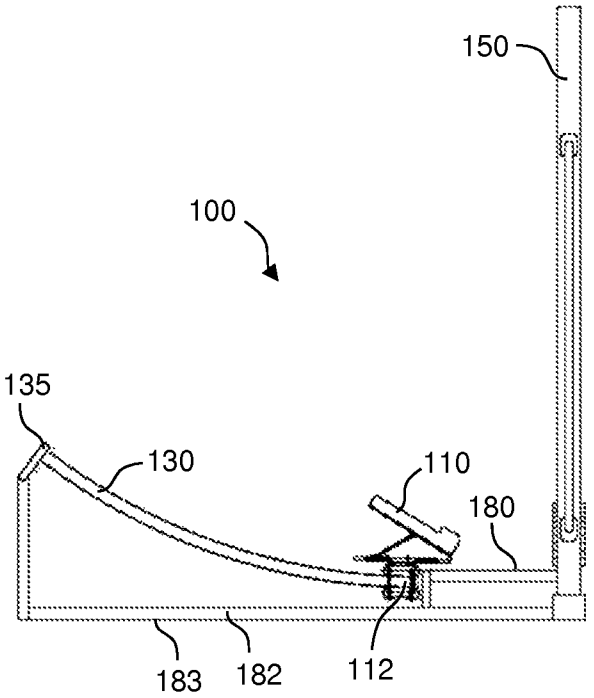

150
100
135
130
110
180
183
182
112

FIG. 1B

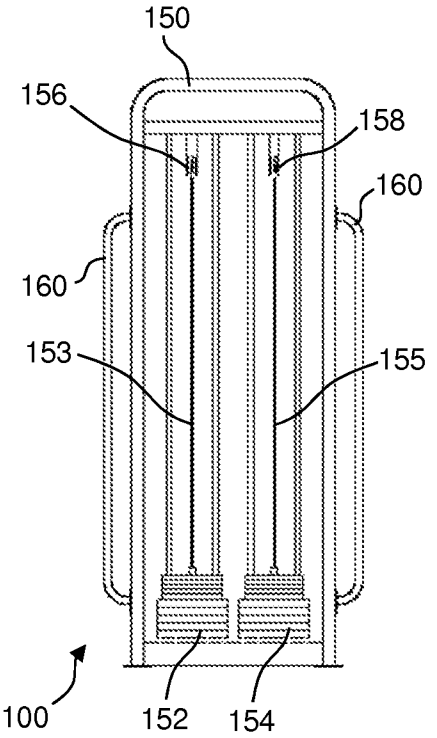

150
156
158
160
160
153
155
100
152
154

FIG. 1C

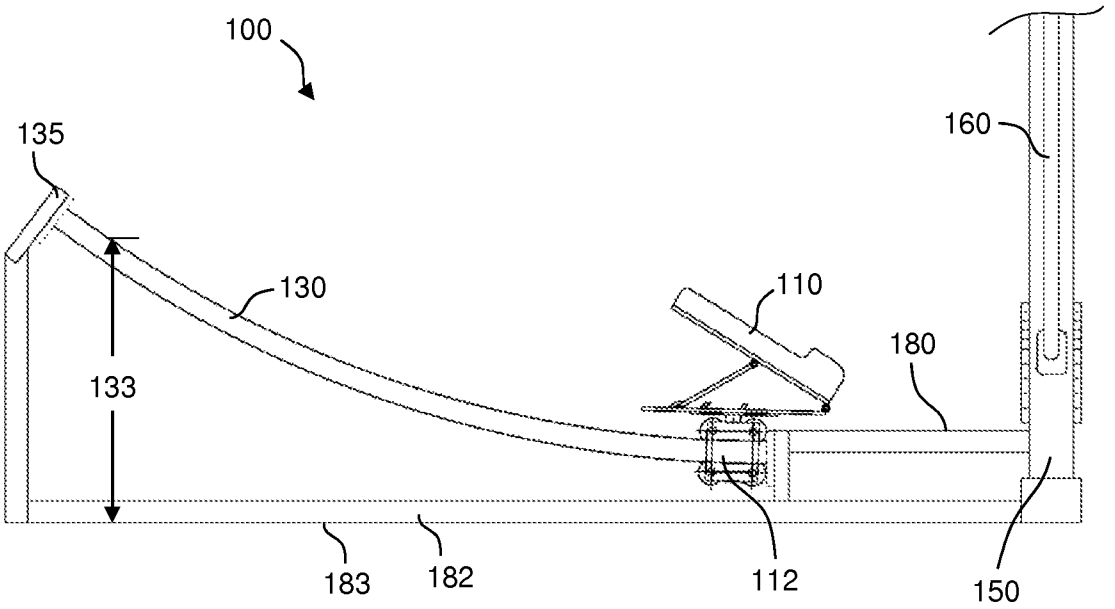


FIG. 1D

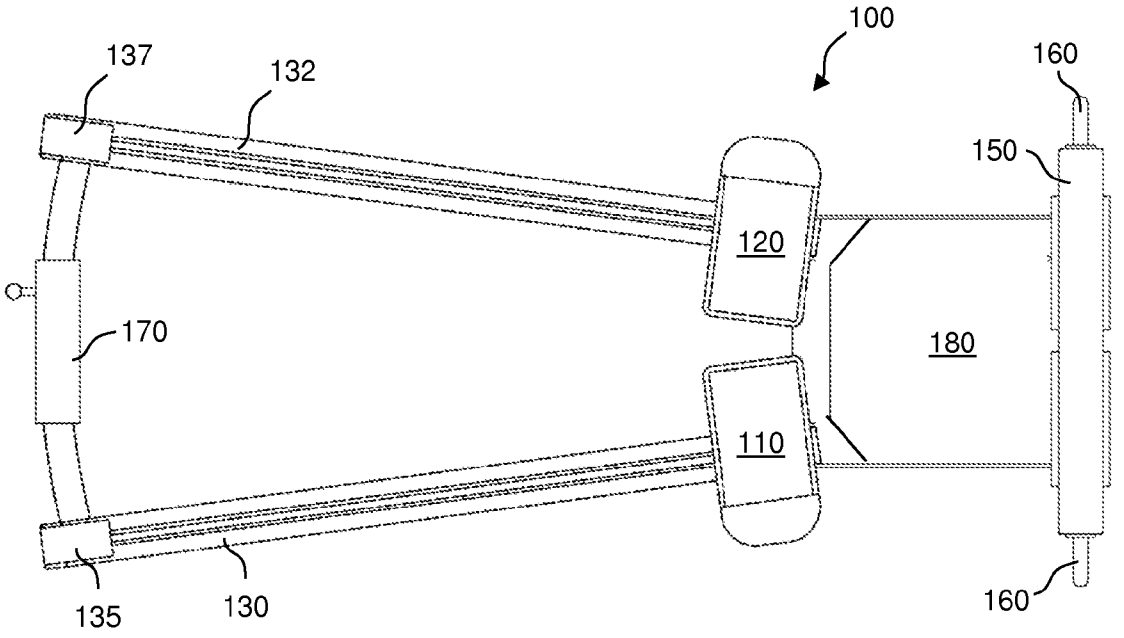


FIG. 2

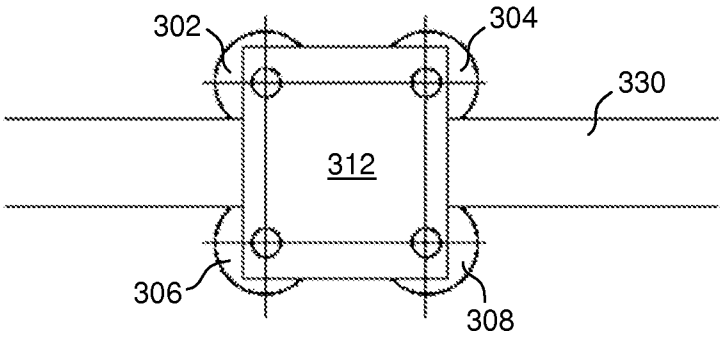


FIG. 3A

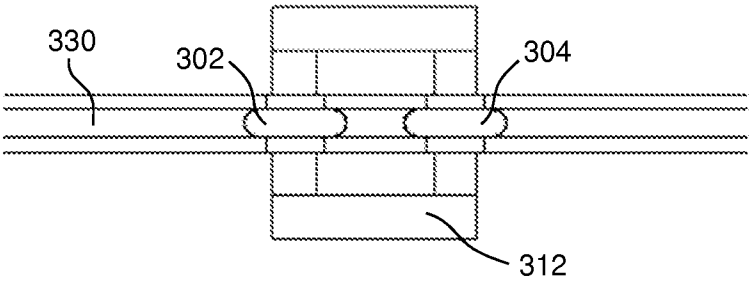


FIG. 3B

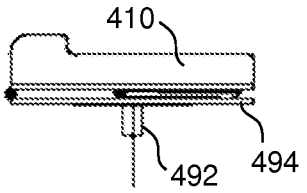


FIG. 4A

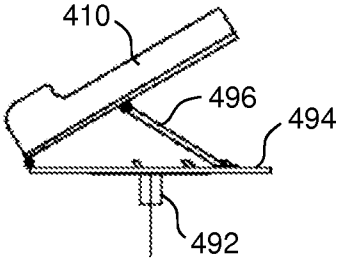


FIG. 4B

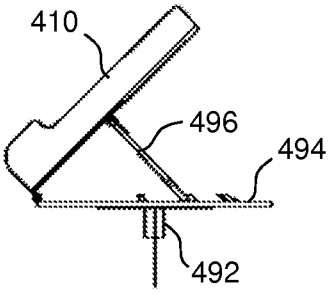


FIG. 4C

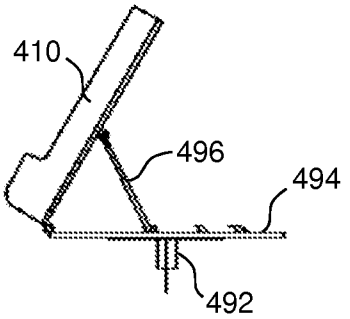


FIG. 4D

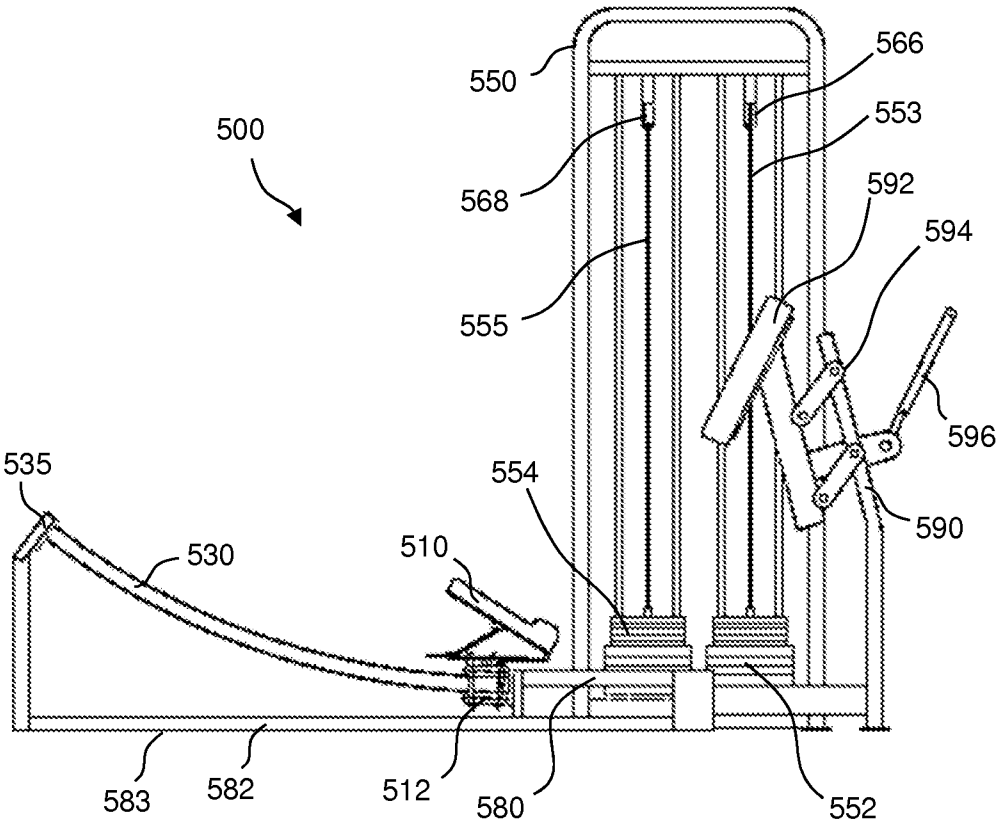
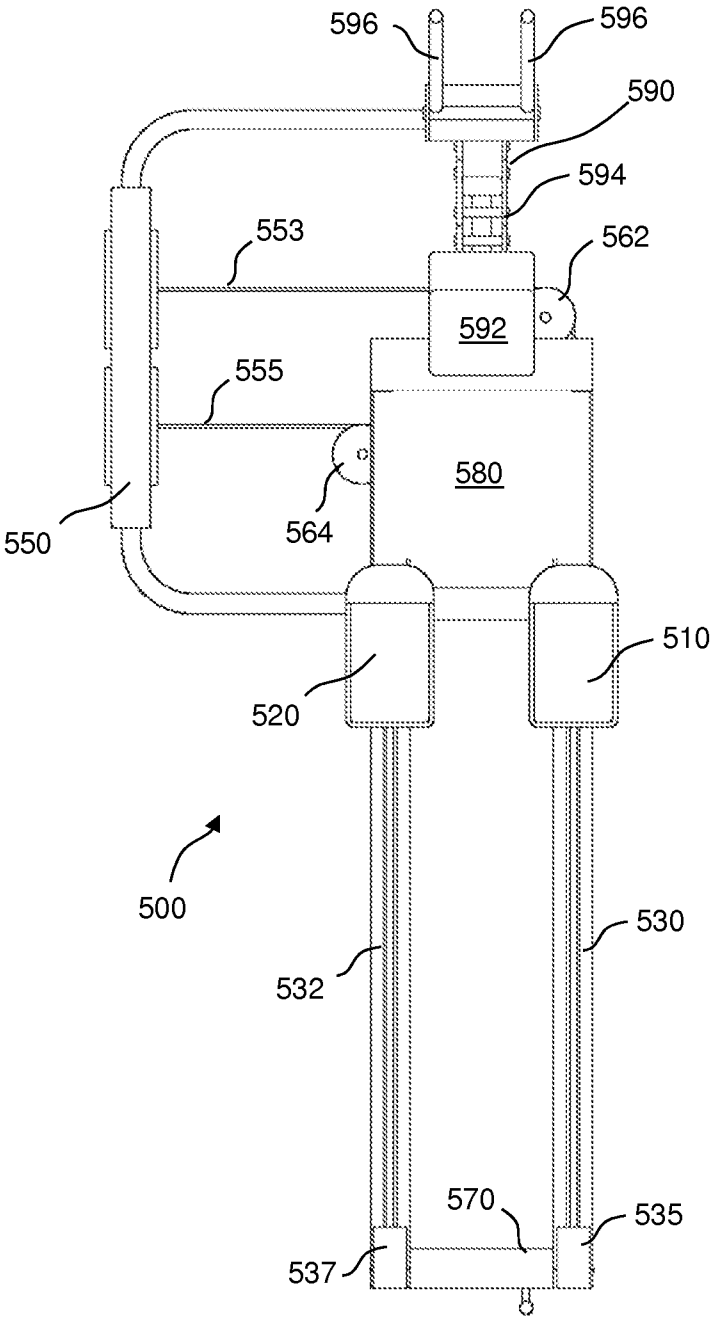

500
550
566
553
568
592
594
555
596
535
554
590
530
510
583
582
512
580
552

FIG. 5A


596
596
590
594
553
562
592
555
580
564
550
510
520
500
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532
570
535
537

FIG. 5B

EXERCISE APPARATUS HAVING GUIDED FOOT PAD CARRIERS AND A WEIGHT STACK

This application claims priority under 35 U.S.C. §120 as a continuation-in part to pending U.S. patent application Ser. No. 14/304,886 filed on 2014 Jun. 14, entitled "Exercise Apparatus Having Guided Foot Pad Carriers," which is hereby incorporated by reference.

BACKGROUND

There are hundreds of different muscles in the human body, and a plethora of other connective tissues and anatomical structures for which exercise and stretching may improve strength and/or mobility. Different stretches or exercises may benefit different subsets of these muscles and connective tissues, with tens of thousands of combinations being possible. Moreover, human fitness can be defined or measured in various ways, many of which are personal and subjective to the exercise apparatus user. Hence, subtle differences in an exercise apparatus may unpredictably change the commercial or practical success of the apparatus.

Many contemporary exercise machines focus on muscle groups that are already well developed in the average user. Other contemporary exercise machines may focus on often under-developed muscle groups, but may invite injury by presenting too much or too little resistance to motion, and/or too easily allow over-stretching of muscles or connective tissue. Other contemporary exercise machines may avoid one or more of the foregoing pitfalls, but at a cost or with complexity that inhibits market acceptance.

Hence there is an ongoing substantial need in the art for improved exercise apparatus designs that can safely improve strength and/or flexibility of connective tissue and muscle combinations that are often under-developed in the average human, with adequate service life and reliability, and that can be practically manufactured at a cost that allows marketability at a profit.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1**A is a top view of an apparatus for human exercise according to an example embodiment of the present invention.

FIG. **1**B is a side view of the apparatus of FIG. **1**A.

FIG. **1**C is an end view of the apparatus of FIGS. **1**A and **1**B.

FIG. **1**D is an expanded portion of FIG. **1**B.

FIG. **2** is a top view of the apparatus of FIG. **1**A, in another configuration.

FIG. **3**A is a side view of an example rolling guided carrier member for guiding a foot pad along a guide rail, according to certain embodiments of the present invention.

FIG. **3**B is a top view of the example rolling guided carrier member of FIG. **3**A.

FIG. **4**A is a side view of a tilting foot pad assembly for use with certain embodiments of the present invention, in a non-tilted 0° position.

FIG. **4**B is a side view of the tilting foot pad assembly of FIG. **4**A, in a 30° tilted position.

FIG. **4**C is a side view of the tilting foot pad assembly of FIG. **4**A, in a 45° tilted position.

FIG. **4**D is a side view of the tilting foot pad assembly of FIG. **4**A, in a 60° tilted position.

FIG. **5**A is a side view of an apparatus for human exercise according to another example embodiment of the present invention.

FIG. **5**B is a top view of the apparatus of FIG. **5**A.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. **1**A is a top view of an apparatus **100** for human exercise according to an example embodiment of the present invention, which may safely improve strength and/or flexibility of connective tissue and muscle combinations that are often under-developed in the average human user. FIG. **1**B is a side view of the apparatus **100**, FIG. **1**C is an end view of the apparatus **100**, and FIG. **1**D is an expanded portion of FIG. **1**B. The embodiment of FIGS. **1**A-D include a first foot pad **110** and a second foot pad **120**. As shown in FIGS. **1**B and **1**D, the foot pad **110** is attached to a first guided carrier member **112**. Likewise, the second foot pad **120** is attached to a similar second guided carrier member. In this context, the first and second foot pads **110**, **120** need not be soft or include a cushion to be referred to herein as a pad; rather, the first and second foot pads **110**, **120** may be hard foot pedals.

In the embodiment of FIGS. **1**A-D, the apparatus **100** includes first and second curved guide rails **130** and **132**. The first curved guide rail **130** is coupled to the first guided carrier member **112**. Likewise, the second curved guide rail **132** is coupled to the second guided carrier member to which the second foot pad **120** is attached. Functionally, the curved guide rails **130** and **132** may substantially prevent translation of the first and second foot pads **110** and **120** except for translation along the curved guide rails **130**, **132**, respectively.

Each of the first curved guide rail **130** and the second curved guide rail **132** is preferably curved away from an underlying ground plane **183**, so that a guide rail height **133** increases distally (towards the left in FIG. **1**D), as does the guide rail slope. Therefore, as shown in FIG. **1**D, the guide rail height **133** is greater at the distal end of the curved guide rail **130** (left side in FIG. **1**D) than at the proximal end (right side in FIG. **1**D), with a concavity facing upwards. The second guide rail **132** is similarly curved. In certain applications of the apparatus **100**, such curvature of the guide rails **130**, **132** may advantageously improve body kinematics during certain leg extension exercises.

In certain embodiments, an impact dampening layer or other conventional shock absorbing mechanism may be placed at either or both ends of the curved guide rails **130**, **132**, to reduce the severity of impacts at the limits of foot pad travel. For example, as shown in FIGS. **1**B and **1**D, the curved guide rail **130** may optionally include an impact dampening end plate **135** (e.g. having a viscoelastic damping layer disposed thereupon) at one of the limits of travel of the first guided carrier member **112**. Likewise, as shown in FIG. **1**A, the curved guide rail **132** may include a similar impact dampening end plate **137**.

The apparatus **100** may include a stationary platform **180** that does not translate and that is fixed to a horizontal base member **182** adjacent to the first and second curved guide rails **130**, **132**. Optionally the horizontal base member **182** may include a downward facing conventional polymer traction grip for increasing friction with an underlying floor or ground surface upon which the apparatus **100** rests. In certain embodiments, the optional addition of the stationary platform **180** may allow additional exercises to be performed, such as abdominal exercises that may be facilitated

by a user placing hands on the stationary platform **180** and feet on the foot pads **110** and **120**.

The embodiment of FIGS. **1**A-D may also include a cable and pulley operated weight stack **150** for resisting motion of the foot pedals **110** and **120** along the guide rails **130**, **132**, respectively, for example to increase muscle fatigue during exercise. As shown in FIG. **1**C, the weight stack **150** may include first and second pluralities of weights **152**, **154**, which may provide a tension force to cables **153**, **155**, respectively. The tension force may be user-selectable by placement of a lifting pin into one of the pluralities of weights, at a desired height. The cable tension may be communicated to act upon the foot pads **110** and **120** by conventional cable routing by pulleys (e.g. pulleys **156**, **158**). Aspects of the structure, assembly, cable routing, and operation of the weight stack **150** that are not described herein, are conventional.

In the embodiment of FIGS. **1**A-D, the exercise apparatus **100** optionally includes side handles **160** fixed to the sides of the weight stack assembly **150**. In certain applications, the user of the apparatus **100** may grasp one or both of the side handles **160** for body support while accomplishing an exercise involving the foot pads **110** and **120**. In FIG. **1**A, the stationary platform **180** is disposed between the weight stack **150** and the first and second curved guide rails **130**, **132**.

In certain embodiments, a frame of the weight stack assembly **150**, or the side handles **160**, may optionally include a plurality of conventional anchors (e.g. hooks, eyelets, etc) for selectively attaching elastic members, for example to facilitate the performance of various conventional upper body exercises in conjunction with other uses of the exercise apparatus **100**. Such elastic members may be conventional bungee cords with handles at each end (not shown), for enabling upper body (e.g. arm) exercise—optionally simultaneously with user operation of the foot pads **110**, **120**.

In the embodiment of FIG. **1**A, the apparatus **100** may include a transverse spacer **170** that may be oriented horizontally and transverse to the curved guide rails **130**, **132**. FIG. **2** is a top view of the apparatus **100**, in an alternative configuration. As shown in the example of FIG. **2**, the first transverse spacer **170** optionally may be of telescopic construction, to allow adjustable extension to increase the spacing between the distal ends of the curved guide rails **130**, **132**. In certain embodiments, the angular divergence of the guide rails **130**, **132** caused by extending the transverse spacer **170** may provide improved body kinematics during certain exercises that employ the foot pedals **110** and **120**. For conciseness, the description of features in FIG. **2** that are labeled with the same number as corresponding features that were described with reference to FIGS. **1**A-D may not be repeated.

In certain embodiments, each of the first and second foot pads **110**, **120** optionally may be pivotably attached to a corresponding guided carrier member by a conventional pivot attachment. Such pivot attachment optionally may include a conventional torsional elastic member (e.g. torsional spring) that applies a restoring torque to the foot pad. In this context, applying a restoring torque means that if/when the user pivots the foot pad **110** or **120** from a rest angular position, the conventional torsional elastic member torques that foot pad in an opposite sense to tend to return that foot pad to the rest angular position. This may provide an advantageous exercise or stretching resistance to the user of the apparatus **100**.

Note that in FIG. **2**, the foot pads **110** and **120** are optionally pivoted to an orientation that is transverse to the corresponding guide rail **130**, **132**. By contrast, FIG. **1**A depicts the foot pads **110** and **120** being optionally pivoted to an orientation that is parallel to the corresponding guide rail **130**, **132**. In certain applications, such optional ability of the foot pads to pivot may facilitate certain exercises or a greater variety of exercises. For example, the transverse orientation of FIG. **2** may facilitate exercise of the user's body in a sideways axis, with the primary movement being in the frontal plane, and while introducing various degrees of flexion and extension. By contrast, the parallel orientation of FIG. **1**A may facilitate exercise of the user's body in a forward and backward axis, with the primary movement being in the sagittal plane, and while introducing various degrees of abduction.

FIG. **3**A is a side view of an example guided carrier member **312** for guiding a foot pad along a guide rail **330**, according to certain embodiments of the present invention. FIG. **3**B is a top view of the example guided carrier member **312**. In the embodiment of FIGS. **3**A-B, the guided carrier member **312** may include four rollers **302**, **304**, **306**, **308** that may contact the guide rail **330** to substantially prevent motion of the guided carrier member **312** except for translation along the guide rail **330**.

Note that the foot pad **110** is shown in a tilted configuration in FIGS. **1**B and **1**D. An example mechanism for the tilting of foot pads may be described with reference to FIGS. **4**A-**4**D. FIG. **4**A is a side view of a tilting foot pad assembly **410** for use with certain embodiments of the present invention, in a non-tilted 0° position. FIG. **4**B is a side view of the tilting foot pad assembly **410** in a 30° tilted position. FIG. **4**C is a side view of the tilting foot pad assembly **410** in a 45° tilted position. FIG. **4**D is a side view of the tilting foot pad assembly **410** in a 60° tilted position. In certain applications, the foregoing tilted positions may advantageously help the exercising user to achieve a neutral or various non-neutral plantar flexion positions.

In each of the tilted positions shown in FIGS. **4**B-D, the desired tilting is optionally accomplished by engagement of a hinged plate **496** with a selected one of a plurality of plate stops in or on a foot pad base **494**. In the non-tilted position shown in FIG. **4**A, the hinged plate is collapsed without engagement with any of the plate stops of the foot pad base **494**. Note that the foot pad assembly **410** optionally may include a downwardly protruding pivot post **492** for rotatable engagement with a receiving bore in an underlying guided carrier member.

FIG. **5**A is a side view of an apparatus **500** for human exercise according to another example embodiment of the present invention, which may safely improve strength and/or flexibility of connective tissue and muscle combinations that are often under-developed in the average human user. FIG. **5**B is a top view of the apparatus **500**. The embodiment of FIGS. **5**A-B include a first foot pad **510** and a second foot pad **520**. As shown in FIG. **5**A, the foot pad **510** is attached to a first guided carrier member **512**. Likewise, the second foot pad **520** is attached to a similar second guided carrier member. In this context, the first and second foot pads **510**, **520** need not be soft or include a cushion to be referred to herein as a pad; rather, the first and second foot pads **510**, **520** may be hard foot pedals.

In the embodiment of FIGS. **5**A-B, the apparatus **500** includes first and second curved guide rails **530** and **532**. The first curved guide rail **530** is coupled to the first guided carrier member **512**. Likewise, the second curved guide rail **532** is coupled to the second guided carrier member to which the second foot pad **520** is attached. Functionally, the curved guide rails **530** and **532** substantially prevent translation of

the first and second foot pads **510** and **520** except for translation along the curved guide rails **530**, **532**, respectively.

Each of the first curved guide rail **530** and the second curved guide rail **532** is preferably curved away from an underlying ground plane **583**. In certain applications of the apparatus **500**, such curvature of the guide rails **530**, **532** may advantageously improve body kinematics during certain leg extension exercises.

In certain embodiments, an impact dampening layer or other conventional shock absorbing mechanism may be placed at either or both ends of the curved guide rails **530**, **532**, to reduce the severity of impacts at the limits of foot pad travel. For example, as shown in FIG. **5**A, the curved guide rail **530** may optionally include an impact dampening end plate **535** (e.g. having a viscoelastic damping layer disposed thereupon) at one of the limits of travel of the first guided carrier member **512**. Likewise, as shown in FIG. **5**B, the curved guide rail **532** may include a similar impact dampening end plate **537**.

The apparatus **500** may include a stationary platform **580** that does not translate and that is fixed to a horizontal base member **582** adjacent to the first and second curved guide rails **530**, **532**. Optionally the horizontal base member **582** may include a downward facing conventional polymer traction grip for increasing friction with an underlying floor or ground surface upon which the apparatus **500** rests. In certain embodiments, the optional addition of the stationary platform **580** may allow additional exercises to be performed, such as abdominal exercises that may be facilitated by a user placing hands on the stationary platform **580** and feet on the foot pads **510** and **520**.

The embodiment of FIGS. **5**A-B may also include a cable and pulley operated weight stack **550** for resisting motion of the foot pedals **510** and **520** along the guide rails **530**, **532**, respectively, for example to increase muscle fatigue during exercise. As shown in FIG. **5**A, the weight stack **550** may include first and second pluralities of weights **552**, **554**, which may provide a tension force to cables **553**, **555**, respectively. The tension force may be user-selectable by placement of a lifting pin into one of the pluralities of weights, at a desired height. The cable tension may be communicated to act upon the foot pads **510** and **520** by conventional cable routing by pulleys (e.g. pulleys **562**, **564**, **566**, **568**). Aspects of the structure, assembly, cable routing, and operation of the weight stack **550** that are not described herein, are conventional.

In the embodiment of FIG. **5**B, the apparatus **500** may include a transverse spacer **570** that may be oriented horizontally and transverse to the curved guide rails **530**, **532**. The first transverse spacer **570** optionally may be of telescopic construction, to allow adjustable extension to increase the spacing between the distal ends of the curved guide rails **530**, **532**. In certain embodiments, an angular divergence of the guide rails **530**, **532** caused by extending the transverse spacer **570** may provide improved body kinematics during certain exercises that employ the foot pedals **510** and **520**.

As shown in FIGS. **5**A-B, the weight stack **550** is oriented parallel to the second curved guide rail **532**, and is disposed adjacent a side of the second curved guide rail **532**. In this context, the weight stack **550** is considered to be oriented in alignment with the longest dimension of its footprint. By contrast, in the embodiment of FIGS. **1**A-D, the weight stack **150** is oriented transverse to the first curved guide rail **130**, and is disposed adjacent an end of the first curved guide rail **130**. The parallel orientation of the weight stack **550** in FIGS. **5**A-B optionally may be facilitated by redirection of the cables **553**, **555** by the pulleys **562**, **564**, respectively.

In the embodiment of FIGS. **5**A-B, the apparatus **500** may include an upper body supporting assembly **590** disposed adjacent an end of the first curved guide rail **530**. In certain embodiments, the upper body supporting assembly **590** may include a chest supporting pad **592** that may preferably be disposed in a tilted relationship to a vertical plane. In the embodiment of FIGS. **5**A-B, the upper body supporting assembly **590** may include a four-bar linkage **594** that serves as a height adjustment mechanism to which the chest supporting pad **592** is coupled for height adjustment of the chest supporting pad **592**. In certain embodiments, the upper body supporting assembly **590** may also include a pair of hand grips **596** to which the user may grasp for better control during exercise.

In the foregoing specification, the invention is described with reference to specific exemplary embodiments, but those skilled in the art will recognize that the invention is not limited to those. It is contemplated that various features and aspects of the invention may be used individually or jointly and possibly in a different environment or application. The specification and drawings are, accordingly, to be regarded as illustrative and exemplary rather than restrictive. For example, the word "preferably," and the phrase "preferably but not necessarily," are used synonymously herein to consistently include the meaning of "not necessarily" or optionally. "Comprising," "including," and "having," are intended to be open-ended terms.

We claim:

1. An apparatus for human exercise comprising:
- a first foot pad attached to a first guided carrier member;
- a first curved guide rail coupled to the first guided carrier member, the first curved guide rail preventing motion of the first guided carrier member except for translation along the first curved guide rail;
- a weight stack comprising a first plurality of weights coupled to a first cable, the first cable also coupled to the first foot pad, a tension in the first cable opposing a translation of the first foot pad along the first curved guide rail; and
- a stationary foot platform that is fixed to the apparatus between the first curved guide rail and the weight stack;
- wherein the first curved guide rail is curved away from an underlying ground plane, to define a rail height that decreases towards the stationary foot platform.

2. The apparatus of claim **1** further comprising
- a second foot pad attached to a second guided carrier member; and
- a second curved guide rail coupled to the second guided carrier member, the second curved guide rail preventing motion of the second guided carrier member except for translation along the second curved guide rail;
- wherein the weight stack further comprises a second plurality of weights coupled to a second cable, the second cable also coupled to the second foot pad.

3. The apparatus of claim **2** further comprising an extendable transverse spacer between a distal end of the first curved guide rail and a distal end of the second curved guide rail.

4. The apparatus of claim **1** wherein first guided carrier member includes a plurality of wheels in contact with the first curved guide rail.

5. The apparatus of claim **1** wherein the first foot pad defines a foot pad surface normal, and the first foot pad includes a hinge for tilting the foot pad surface normal relative to the underlying ground plane.

6. The apparatus of claim 1 wherein the first foot pad defines a foot pad surface normal, and the first foot pad includes a pivot for pivoting the first foot pad about the foot pad surface normal.

7. The apparatus of claim 6 wherein the first foot pad is pivotably attached to the first guided carrier member by the pivot.

8. The apparatus of claim 1 wherein the first guided carrier member includes a first locking mechanism for selectively immobilizing the first guided carrier member with respect to the first curved guide rail.

9. The apparatus of claim 1 wherein a rail height of the first curved guide rail increases distally away from the weight stack.

10. The apparatus of claim 1 wherein the apparatus includes a polymer traction grip in contact with the underlying ground plane, for increasing friction with an underlying floor upon which the apparatus rests.

11. The apparatus of claim 1 wherein the weight stack further comprising a weight stack frame, and wherein the apparatus further comprises a side handle attached to the weight stack frame.

12. The apparatus of claim 1 wherein the weight stack is oriented transverse to the first curved guide rail, and is disposed adjacent an end of the first curved guide rail.

13. The apparatus of claim 2 wherein the weight stack is oriented parallel to the second curved guide rail, and is disposed adjacent a side of the second curved guide rail.

14. The apparatus of claim 1 further comprising an upper body supporting assembly disposed adjacent an end of the first curved guide rail, the upper body supporting assembly including a chest supporting pad.

15. The apparatus of claim 14 wherein the upper body supporting assembly includes a height adjustment mechanism to which the chest supporting pad is coupled for height adjustment of the chest supporting pad.

16. The apparatus of claim 15 wherein the height adjustment mechanism comprises a four-bar linkage.

17. The apparatus of claim 14 wherein the upper body supporting assembly further includes a pair of hand grips.

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