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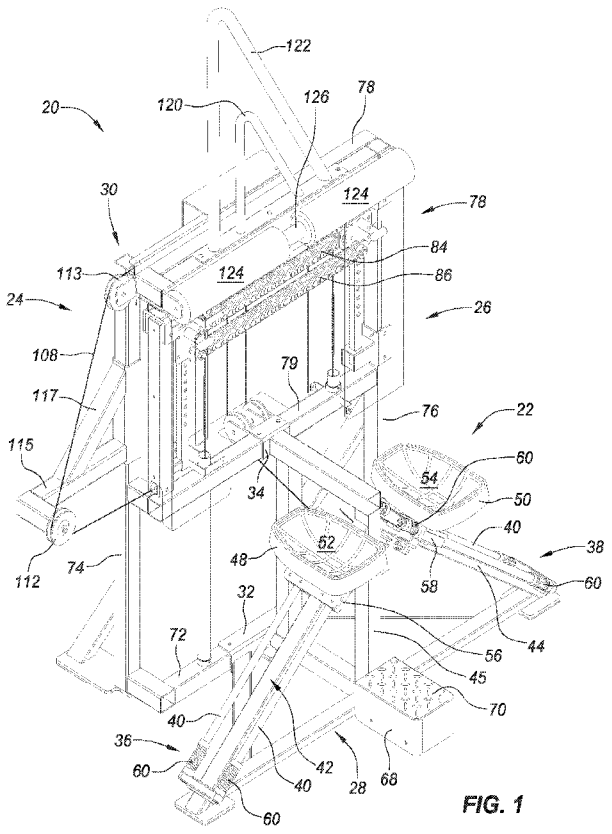

FIG. 1

(57) **Abstract**: A modular adjustable resistance apparatus to be used with one or more exercise devices to improve a users performance, power, agility, speed and quickness in sports requiring at least some lateral or vertical movement. The resistance apparatus utilizes resilient means, such as springs, that can be adjusted to increase or decrease the amount of resistance force by changing the resilient means (from one that has more or less resistance to stretching movement), the number of springs, or the location setting of the springs along a pivoting post or posts. The exercise devices used with the apparatus are reversibly attached to the resistance apparatus and functionally connected by a cable. A method of functional or performance training is also disclosed.

MODULAR ADJUSTABLE RESILIENT RESISTANCE DEVICE AND ASSOCIATED EXERCISE DEVICES

FIELD OF THE INVENTION

[0001] This invention relates generally to exercise machines used to improve performance, power, agility, speed and quickness in sports requiring at least some lateral movement, and to an adjustable resilient resistance device. More specifically, the disclosed and claimed subject matter relates to a resistance device used in combination with a modular exercise device for functional training that have pedals mounted on inclined, lateral tracks and an adjustable resistance device that uses a spring or other resilient means to provide resistance to lateral, downward movement of the pedals. An alternative modular exercise device with the pedals are mounted to vertical tracks is contemplated. The invention also relates to a method of functional or performance training on the machine.

BACKGROUND OF THE INVENTION

[0002] Competitive and recreational sports and activities have traditionally focused on forward speed. As a result, training for those sports and activities also focused on forward motion. Equipment for such training includes tread mills, elliptical machines and stepper devices. Such equipment is designed for general conditioning, and to develop stamina and muscle tone for straight forward movement.

[0003] It has been recognized in more recent years that most sports and activities require at least some element of lateral movement. Tread mills, elliptical machines, stepper devices and similar apparatuses do not address the specific muscle groups used for lateral movement and provide only limited value for that purpose.

[0004] To address the limited value of these exercise machines to lateral movement sports and activities, a series of exercise devices essentially modify tread mill, elliptical machines and stepper devices to add a lateral movement element. These machines may provide general conditioning and develop stamina, and in at least some cases develop muscle tone in some muscles expected to be engaged in lateral movement. In essence,

however, they mimic exercise machines for forward movement sports and/or activities and treat lateral movement as merely a sideways version of forward movement.

[0005] An example of such a prior art device is United States Patent No. 7,097,600, which issued to Gray in 2006. The patent describes an "Exercise Device" in which a base has two side members and front member that extends between the side members. A pair of arms are pivotally mounted on the base and foot pads position on the other ends of the arms. The foot pads move in an arcuate path towards and away from the side members of the base, and the movement of the foot pads is in a direction that is substantially parallel to the front member of the base. Movement of the arms towards the base (downward and laterally), rotates a fly wheel that provides resistance to movement.

[0006] Another such prior art patent, United States Patent No. 7,803,091, issued to Loane in 2010, describes a "Ski Exercising and Training Apparatus." The described device has two parallel, partially arcuate rails joined to an underlying frame structure at opposite ends joined to an underlying frame structure at opposite ends, the rails providing a track rising from each end, a wheeled carriage riding on the track, such that the carriage, in side-to-side movement rises to a maximum height at the center of the track, and descends from the center to each side, with an articulated footpad mounted to the wheeled carriage, and a set of power bands. The power bands provide resistance to lateral movement.

[0007] A further example of prior art is the United States Patent Application filed by Parmater that was published in 2004 as publication US 2004/0242381. This application describes a "Lateral Exercise Slide" with tubular frame members, a handle extending from the frame members, and sets of parallel rails mounted onto the frame members and oriented laterally. The center support is adjustable up and down to move the rails up and down a foot platform can slide laterally back and forth along the rails. Adjustment of the center support to increase the height of ends of the rails increases the sliding resistance.

[0008] Yet another example of prior art is United States Patent No. 3,874,656, which issued to Wintersteller in 1975 and describes an "Exercise Appratus for Skiers." The patent describes an exercise device for developing leg muscles used when skiing in the "sitting" position. It includes a pairs of slats simulating skis extending forwardly from a chair with front ends of the skies resting on the floor, which may be a base or platform on

which the chair is mounted. The rear ends of the skis are supported in an elevated position from the chair for movement up and down as well as from side to side against the resistance of the opposing force. The skis have foot receptacles. The rear ends of the skis are supported on the chair by an adjustable spring suspension system which exerts on the skis a yieldable resisting force opposing the user's leg movements. Alternatively, the rear ski ends are supported on the chair by a motor driven reciprocating cable mechanism which exerts a periodic positive elevating force on the skis for resisting the user's leg movements.

[0009] In another prior art reference, United States Patent No. 5,222, 928, which issued to Yacullo in 1993, an "Exercising and Body Toning Apparatus" is described. The apparatus is an A-frame assembly defined by a pair of side members converging to an apex, the side members defining a pair of included planar surfaces. A foot rest is movably mounted on each planar surface and means is provided to maintain each foot rest in reciprocal relationship to the other as they move along their respective inclined surface in response to the shift in weight of the person using the apparatus, as well as means to vary the resistance to movement of the footrests along the surfaces.

[0010] In yet another prior art reference, United States Patent No. 935,854, which issued to Linerode in 1909, an "Exerciser" without lateral movement is described. The described device is a vibrating bar and lever bar. Resistance to movement is provided by springs attached to the vibrating bar on the other side of a pin or bolt upon which the vibrating bar pivots up and down. The upper ends of the springs are an upper cross head, which is attached to a T-bar. By moving the T-bar to or from the pivotal point of the vibrating bar, the leverage will be increased or decreased upon the springs 19, thereby increasing or decreasing the resiliency of the springs with respect to the vibrating bar.

[0011] In yet a further prior art reference, United States Patent No. 5,201,694, which issued in 1993 to Zappel, a "Squat-Pull Exercise Apparatus" is described. The reference described a device for providing resistance to downward, not lateral, hand or arm movement. The apparatus uses a pulley and lever system in combination to stretch springs that provide an opposing force to move the seat. The lever arm has a spring attachment device that consists of a sliding member attached to the lever arm and a spring

hanger attached to the bottom of the sliding pull-up. The lifting force of the seat may be adjusted to provide the workout level desired.

[0012] Prior art references and devices, in part demonstrated by the prior art references discussed above, attempt to be useable by a wide range of body heights and types. The approach typically allows for one or more adjustments to various aspects of the stroke, angle, length, width, or other structural aspect of the device. These devices, therefore, contemplate that a short person can use the same device as a tall person, and a small person use the same device as a large person, by allowing the individual user to make adjustments to the device to modify those parameters to fit the particular user. Such devices are often if not almost always used in private or public training facilities, clubs, work-out rooms in hotels or educational institutions, multi-unit residences, or other locations where they by more than one person with varying height, size or weight. Even if located in a home, different family members having different sizes would be expected to use the same piece of equipment. Each person using the same device would have to adjust the parameters of the device prior to starting a workout.

[0013] It has even more recently been discovered that sports and physical activities including lateral movement have a "dynamic" aspect to them not found in forward movement sports and activities. The approach of prior exercise equipment was directed to merely modifying straight, forward movement, typically running, to try to be applicable to lateral leg movement. This may improve general aerobic condition and muscle tone of groups of muscles employed in such movement. However, lateral human movement is substantially more complex than straight running movement and requires the competitor or participant to employ full body coordination and balance that go well beyond mere static movement against resistance. Prior exercise devices, including those discussed above, fail (1) to adequately address these additional aspects of lateral movement, (2) to train the competitor and participant while in a controlled environment on an exercise device to employ balance and coordination required during actual lateral movement, and (3) to sufficiently train competitors and participants in performance of sports and activities involving lateral movement.

SUMMARY OF THE INVENTION

[0014] The present invention provides an exercise device to improve a user's performance, power, agility, speed and quickness in sports requiring at least some lateral movement, and to an adjustable resilient resistance device. The device can be used not only for general aerobic conditioning and stamina training, but also for training the user's balance and coordination typically engaged during lateral human movement employed in competitive sports and recreational activities. Alternatively, the present invention provides an exercise device that improves a user's performance, power, agility, speed and quickness focusing more on vertical foot and leg movement.

[0015] A modular resistance apparatus to be used potentially with one or more modular exercise devices provides resistance by resilient means such as springs, that can be adjusted incrementally by:

- changing the resilient means from one that has more or less resistance to stretching movement,
- adding or removing springs from a multi-spring resistance system,
- changing the location setting of one or more springs along a pivot post (or posts) which adjusts (a) the initial load, and (b) the working load, and alters the travel distance of one (or both) ends of the spring relative to the travel distance of the stroke of the foot pedals.

[0016] Unlike weights, the arrangement of the resilient means provided by the device increases the resistance as the length of the stroke increases. In addition, the adjustments to the level and quality of resistance can be made well above ground level, and does not require the user to dismount the device or bend over or otherwise contort in an awkward position to make such adjustment.

[0017] The exercise devices as contemplated herein accommodate users of substantially different sizes, weights and heights without adjustment to various angles, heights or other structural parameters of the device. A relatively short user, for example, can use the device after its use by a relatively tall user without adjusting structural aspects of the device. The need for any user to adjust the device before using is reduced or potentially eliminated.

[0018] In addition, the invention includes a method of functional or performance training on the machine.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] FIG. 1 is a front perspective view of an exemplary training device embodying at least some of the features described herein;

[0020] FIG. 2 is a front elevational view of an exemplary training device embodying at least some of the features described herein;

[0021] FIG. 3 is a side elevational view of an exemplary training device embodying at least some of the features described herein;

[0022] FIG. 4 is a rear elevational view of an exemplary training device embodying at least some of the features described herein, shown with weight or downward lateral force applied to one pedal by a user;

[0023] FIG. 5 is a front elevational view of the pivoting arm and associated hardware for an adjustable resilient resistance device, shown in a starting position or when no weight or downward, lateral force is applied to the pedals;

[0024] FIG. 6 is a front elevational view of the pivoting arm and associated hardware for an adjustable resilient resistance device, shown with same resistance setting as FIG. 5 and in a partially pivoted position when at least one pedal is moved with a downward, lateral force;

[0025] FIG. 7 is a front elevational view of the pivoting arm and associated hardware for an adjustable resilient resistance device, shown with a different resistance setting as FIGS. 5 and 6, and in a starting position or when no weight or downward force is applied;

[0026] FIG. 8 is a front elevational view of the pivoting arm and associated hardware for an adjustable resilient resistance device, shown with same resistance setting as FIG. 7 and in a partially pivoted position when at least one pedal is moved with a downward, lateral force;

[0027] FIG. 9 is a schematic diagram demonstrating two different settings on an exemplary adjustable resilient resistance device when the pivoting arm is in the starting position or when no weight or downward, lateral force is applied;

[0028] FIG. 10 is a schematic diagram demonstrating two different settings on an exemplary adjustable resilient resistance device when the pivoting arm is in a partially pivoted position when at least one pedal is moved with a downward, lateral force;

[0029] FIG. 11 is a schematic diagram demonstrating two different settings on an exemplary adjustable resilient resistance device when the pivoting arm is in a more fully pivoted position, i.e., when at least one pedal is moved a greater distance with an additional downward, lateral force as compared to FIG. 10;

[0030] FIG. 12 is a front elevational view of an alternative training device, showing the modular resistance apparatus in combination with an alternative exercise device, embodying at least some of the features described herein;

[0031] FIG. 13 is a side elevational view of the alternative training device of FIG. 12 embodying at least some of the features described herein;

[0032] FIG. 14 is a downward elevational view of the alternative training device of FIGS. 12-13 embodying at least some of the features described herein; and,

[0033] FIG. 15 is a rear elevational view of the alternative training device of FIGS. 12-14 embodying at least some of the features described herein, shown as if weight or downward lateral force had been applied to one pedal.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0034] The devices contemplated herein utilize an adjustable modular resistance apparatus shown in combination with either a corresponding lateral step exercise device having pedals on descending tracks for independent lateral movement against the adjustable resistance or a corresponding vertical step exercise device having pedals on vertical tracks for independent vertical movement against adjustable resistance. The modular resistance apparatus can be used with either of these exercise devices or with other training and performance equipment to obtain improvements and benefits. Additional improvements and benefits are derived when the resistance apparatus is used in combination with the lateral or vertical step exercise devices as described herein.

[0035] With reference to FIGS. 1-3, an exercise device, apparatus or machine 20 is shown. The device is comprised of two independent components: (1) a lateral step exercise device 22, and (2) a resistance apparatus 24. The lateral step exercise device 22

and resistance apparatus 24 are both attached to a frame 26. The frame has an exercise device supporting portion 28 and a resistance apparatus supporting portion 30. The two frame portions are joined together by reversibly attachable brackets 32 and 34, such that the exercise device portion 28 and the resistance apparatus supporting portion 30 can be detached from one another if so desired. However, it is contemplated that when the exercise device 22 and resistance apparatus 24 are used together, the frame portions 28, 30 will be secured together and will not move relative to the other. The invention contemplates alternatives to brackets 32, 34 such as wing-nuts, quick-release connectors, snaps, Velcro, or other means known in the art for adequately reversibly securing two structures together.

[0036] The lateral step exercise device 22 has two inclined sets of tracks 36, 38 supported on the frame portion 22. Each track preferably has two parallel tubular rails 40 anchored to angled struts 42 and 44, which are in turn connected to and supported by vertical strut 45 of frame portion 22. The angle of the tracks 36, 38 with respect to the ground (or transverse exercise device base portion 46) is about 35 degrees to about 55 degrees, preferably about 40 degrees to about 45 degrees, and most preferably about 42-43 degrees. Alternatively, each track could be designed with a single parallel tubular rail or with three or more rails.

[0037] The lateral step exercise device 22 has two pedals 48, 50. The first or left pedal 48 is fixedly mounted to a slide 56, while the second or right pedal is fixedly mounted to slide 58. The slide 56 engages tracks 36, and slide 58 engages tracks 38 in a manner that allows movement along the length of the tracks. This is preferably achieved by the use of rollers, bearings or other means known in the art.

[0038] Pedals 48, 50 have foot pads 52, 54 to engage the foot of a user. The top portion of each pedal that engages the user's foot is preferably curved, but alternatively could be flat or have some other profile. It has been found that curved foot pads allow users of different sizes, heights, weights and body types to use the lateral step exercise device 22 without requiring adjustment to the angle or other parameters of the pedals 48, 50. Thus, the use of the curved foot pads 52, 54 contributes to the one-size fits all aspect of exercise machine contemplated herein.

[0039] The slides 56, 58 can freely move along the inclined tracks 36, 38, as described below, with relatively little friction or resistance at the slide-track connections. The tracks 36, 38 have bumpers or springs 60 at either end to dampen the movement at the ends of the tracks 36, 38. This reduces the jolt that would otherwise occur when the slides 56, 58 meet the ends of the tracks 36, 38, either at the lower portion 62 or upper portion 64 of the tracks. Prior to reaching the ends of the tracks, the slide will contact the bumpers or springs 60 and the springs 60 will absorb at least some of the kinetic energy of the slides prior to the slides reaching the ends of the tracks 36, 38.

[0040] A stationary step 66 is fixedly attached to the frame's exercise device supporting portion 28 at the mid-point between the lower ends of the tracks 36, 38. The step 66 is generally rectangular in cross-section, with longitudinal axis protruding rearwardly from the frame portion 28. (Rearward and forward directions stated herein are defined as being with respect to the direction of a user when using the exercise device 22.)

[0041] Step 66 has a base 68 and a top surface 70. The top surface 70 is preferably metal and has a knurled or other high-friction, upwardly facing surface. The step 66 allows a user to step up to the pedals 48, 50, when placing one foot on the step 66 and lifting the other foot into a pedal. Once the user has placed one foot in a pedal, the user can lift the leg that is one the step by placing the other foot in the other pedal. This allows a relatively short or out-of-shape user to engage the exercise device without undue strain, and provides relatively easy access to the device.

[0042] The resistance apparatus 24 is supported by base 72 of the resistance apparatus supporting portion 30 of the frame, as well as vertical trusses 74 and angled trusses 76. The base 72 and trusses 74, 76, support the resistance apparatus independently of the exercise device supporting portion 28, and independently stabilize the apparatus 24 against tilting forces even in the absence of exercise device supporting portion 28.

[0043] The frame portion 30 includes a generally rectangular portion 78 that is elevated above the ground-engaging base 72, which rests on a floor or other stable horizontal surface. The rectangular frame portion has lower horizontal frame strut 79. Preferably, the rectangular frame portion 78 (and lower horizontal frame strut 79) will be located above the upper ends of tracks 36, 38. This avoids the need for the user to bend over when adjusting the amount of resistance applied by the resistance apparatus to the

associated exercise device, in this case the lateral step exercise device, as is commonly the case when resistance is provided by conventional weight stacks. Due to their excessive bulk, mass and weight, stacks needs to rest on the ground. The resistance producing part of the resistance apparatus 24 described herein, on the other hand, can be located well above the ground for easy access by the user, without producing tremendous stress on the supporting frame or destabilizing the resistance apparatus or the associated exercise device.

[0044] The frame's rectangular portion 78 is connected to two arms 80, 82. Stationary arm 80 is fixedly mounted on the rectangular portion 78, while pivoting arm 82 is pivotally attached at its upper end to rectangular portion 78 at hinge 106. Hinge 106 allows pivoting arm 82 to swing or pivot away from the stationary arm 80 in a two-dimensional plane that is defined by the arms 80 and 82, and that is parallel to the plane defined by the rectangular portion 78. Movement of the pivoting arm 82 outside the plane or from the vertical toward the stationary arm 80 is prevented.

[0045] While the preferred embodiment contemplates that one arm, arm 80, is stationary and the second arm, arm 82, pivots. Alternatively, both arms could be pivoting arms. Instead of the pivoting arm 82 being configured to pivot away from a stationary arm 80, the desired result could also be achieved if both arms pivoted away from each other when force is applied against resistance. Modifications of the disclosed preferred stationary arm 80 according to the structure and function of the pivoting arm 82 disclosed herein would be within the ability of a person of ordinary skill working in the appropriate field.

[0046] Forward spring 86 and rearward spring 84 are preferably cylindrical metal coils that resist expansion along their longitudinal axis. These springs typically apply a greater resistance to movement as they expand along the longitudinal axis. Preferably, for at least some applications, the springs will increase resistance (or pull against a counter-force) linearly, applying an increasingly greater force as the expansion distance increases. For example, if the starting point is assigned the value zero, doubling the longitudinal dimension from one inch to two inches will increase the resistance (or pull against counter-force) of according to the spring force constant. Similarly, doubling the

dimension from two inches to four inches will again increase the resistance (or pull against counter-force) again according to the spring force constant.

[0047] Preferably, two springs 84, 86 are reversibly connected to arms 80, 82 by sliding mounts 88, 90. The sliding mounts 88, 90 engage the arms with bearings or rollers that reduce the friction between the mounts and arms and allow movement along the length of the arms. As shown in FIGS. 1 and 2, the ends of spring 86 are attached to the forward side of the sliding mounts 88, 90, while the ends of spring 84 are attached to the rearward side of sliding mounts 88, 90. Alternatively, the both springs could be attached to the same side of the slide mounts 88, 90.

[0048] While two springs are shown as a preferred embodiment in FIGS. 1 and 2, slide mounts 88, 90 can be modified to accommodate one, three, four or more springs that are reversibly connected between sliding mounts 88, 90, and indirectly arms 80, 82. In addition, the springs can have varying amounts of extendable resistance to movement to allow the user or other person (such as a professional trainer or health club supervisor) to set the resistance apparatus to apply the desired amount of resistance by selecting and installing between the slide mounts 88, 90 the desired number and size (and resistance) of springs to apply the desired amount of total resistance and particular resistance characteristics for the specific user.

[0049] Each arm 80, 82 contains a series of apertures or holes 92 spaced along their lengths. The sliding mounts 88, 90 each have a pin 94 that is biased (by spring (not shown) or other means) toward and to pass into the holes 92. The positions of the springs along the length of the arms is adjustable by pulling or retracting the pins 94 from the holes in the original hole positions, sliding the mounts 88, 90 along the arm to the new desired positions, and releasing the pins 94 to allow them to travel in the direction of bias into the holes 92 at the new positions. The pins 94 are T-shaped to ease grasping by a user desiring to pull a pin out of a hole 92. While holes 92 and pins 94 are contemplated for the preferred embodiment, reversible locking of positions of the sliding mounts 88, 90, spring 84, 86 ends, and arms 80, 82, alternatively, other means known in the art for reversibly locking two components can be used.

[0050] Preferably, the positioning of the sliding mounts 88, 90 is done for both spring ends simultaneously to maintain the springs 84, 86 parallel to the ground at the new

positions. Alternatively, a first slide mount, and corresponding ends of springs 84, 86 are moved to a new position first, followed by moving the second slide mount and opposite ends of springs 84, 86 to a position at the same level as the first slide mount, maintaining the springs 84, 86 in a position parallel to the ground. In another alternative, the slide mounts 88, 90 are moved to different positions on their respective arms 80, 82, resulting in springs that are not horizontal (i.e., parallel to the ground).

[0051] The adjusting the position of the springs along the arms 80, 82 changes the initial load and working load. For example, in the preferred embodiment, locating the springs at the top of the arms 80, 82, provides the lowest initial starting and working loads. In contrast, locating the springs at the bottom of the arms provides the highest initial starting and working loads. Intermediate positions provide initial and working loads that are between the lowest and highest initial staring and working loads.

[0052] The resistance apparatus 24 includes two slide mount assist wires 96. Each wire 96 is attached at a first end to a slide mount 88, 90 and runs through assist wire pulleys 98 and into wire protective tubes 100. The second end of each wire 96 is attached either directly or indirectly to the resistance apparatus supporting portion 30 (at points not shown in the FIGS.). Each wire 96 includes an extensible portion 102 (such as a spring) that allows the length of the wire to expand against a pulling force the first end of the wires 96. This provides an upward biasing force on the sliding mounts 88, 90 when the pins 94 are retracted and the mounts 88, 90 are freed to move along the lengths of arms 80, 82. This assists movement (i.e., adjustment) of the mounts 88, 90 along the arms by the user (or other person).

[0053] Pivoting frame portion 104 is connected to the frame by hinge 106 to allow swinging movement of the distal end away from the stationary arm. It is also connected to the pivoting arm 82 such that both can swing away from the stationary arm 80 within the plane defined by the two arms 80, 82 as described above. Movement of the pivoting frame portion 104, therefore, will necessarily move the pivoting arm away from the stationary arm 80, and expand the springs 84, 86 to balance the force applied on the pivoting frame 104 as described below.

[0054] The arrangement shown in the preferred embodiment of FIGS. 1-4 utilizes two cables for applying the resistance of the resistance apparatus 24 to the pedals 48, 50 of

the lateral step exercise device 22. A resistance apparatus cable 108, which is located entirely within the resistance apparatus 24, has one end attached to the distal end of the pivoting frame portion 104 and other end to moveable apparatus pulley 110 (shown in FIGS. 2 and 4). Between the two ends of resistance apparatus cable 108, the cable travels over stationary cable guides (or pulleys) 112, 113.

[0055] In particular, as shown in FIGS. 1-8, stationary cantilever cable guide (or pulley) is located on the end of a cantilever truss 115, which is connected to and projects horizontally from the frame in the direction that the pivoting arm 82 moves from a starting vertical position. The cantilever truss 115 is further supported by an angled support truss 117, which has ends attached to the cantilever truss 115 and to the resistance apparatus supporting portion 30 of frame 26. The stationary cantilever cable guide (or pulley) 112, cantilever truss 115, and angled support truss 117 remain stationary during use of the step exercise device 22, and do not move with movement of the pivoting arm 82 or pivoting frame portion 104.

[0056] As mentioned above, the resistance apparatus cable 108 is attached at one end to the moveable apparatus pulley 110 and at the other end to (or near to) the distal end of pivoting frame portion 104 and, indirectly, to the pivoting arm 82. It runs over the stationary guides (or pulleys) 112, 113, which are located on the cable's 108 path between the moveable apparatus pulley 110 and the pivoting frame portion 104. As the stationary cantilever cable guide (or pulley) 112 is located in the direction of pivotal movement of the pivoting frame portion 104 and pivoting arm 82, the portion of the cable between the cantilever cable guide (or pulley) 112 and the pivoting frame portion 104 is generally horizontal and runs in the direction away from the distal end of the pivoting frame portion 104. This assures that movement of the moveable apparatus pulley 110 downward will pull the pivoting frame portion 104 outward and away from the stationary arm 80, and that such movement will expand the length of the springs 84, 86 against the resistance force applied by the springs 84, 86.

[0057] A second cable, the pedal resistance cable 114, which travels between the lateral step exercise device 22 and resistance apparatus 24, has one end attached to pedal slide 56 and second end attached to pedal slide 58. As shown in FIGS. 1-4, between its two ends, the pedal resistance cable 114 runs over angled guides (or pulleys) 116 mounted on

vertical strut 45 of the frame device supporting portion 28 (on the lateral step exercise device 22). This same cable 114 also travels over vertical guides (or pulleys) 118 mounted on lower horizontal frame strut 79 (on the resistance apparatus 24). By traveling between the exercise device and resistance apparatus, this cable 114 communicates the resistance force applied by the adjustable springs and settings in the resistance apparatus 24 to the associated lateral step exercise device 22.

[0058] The resistance apparatus 24 contains at least three additional features for the benefit of users of the lateral step exercise device 22. First, the apparatus contains handles for the user to support him or herself. A small, inverted V-shaped handle 120 is attached to the top of the resistance apparatus supporting portion 30 of the frame 26, and projects upwardly and rearwardly from the frame 26. A larger inverted V-shaped handle 122 is also attached to the top of the resistance apparatus supporting portion 30, again projecting upwardly and rearwardly from the frame 26. The larger inverted V-shaped handle 122 is attached to the frame 26 at points lateral to the where the small inverted V-shaped handle 120 is attached to the frame 26.

[0059] As shown in FIG. 4, a user 123 of the exercise device 22 can support themselves by holding onto the inverted V-shaped handles while mounting, subsequently exercising on, and finally dismounting the device 22, or when changing the springs 84, 86 or adjusting the spring settings on the arms 80, 82. The small inverted V-shaped handle 120 can be used by a relatively smaller user, while the larger inverted V-shaped handle 122 can be used by relatively larger user. However, the ultimate use of the handles is left to the user's discretion based on their particular size, needs and comfort, and the experience of the user with the device. Alternatively, handles of other sizes, shapes and angles to the frame 26 can be utilized to accomplish the same function.

[0060] Second, cylindrical padded bolsters 124 are supported on the top of the frame by bolster support rod 126, projecting slightly rearwardly of the frame, toward the exercise device 22 and user of the device 22. The bolsters 124 are oriented horizontally, parallel to the base-engaging base 72, and at or below the bottom of the handles 120, 122. The bolsters are preferably made of firm, resilient or elastic material, such as foam rubber or other appropriate material known in the art. Preferably, a user of the exercise device

22 who is grasping or otherwise supporting him or herself on the handles 120, 122 can position or rest his or her forearms on bolsters 124.

[0061] Third, as shown in FIGS. 1-2 and 4-8, rectangular safety plates 128 and 130 are supported on the resistance apparatus supporting portion 28, and preferably on the rectangular frame portion 78. In particular, safety plate 128 is connected to the rectangular frame portion 78 on the side corresponding to the stationary arm 80, and located between the frame portion and the user (on the rearward side of the resistance apparatus). Safety plate 130 is mounted on the pivoting frame portion 104 so that it moves along with it and the pivoting arm 82. These plates 128, 130 prevent the limbs or other items associated with a user from inadvertent contact with the arms 80 and 82, holes 92, and the ends of the springs 84, 86 while exercising.

[0062] Each plate has an elongated slot 132 located in a position opposing the arms 80, 82. Pins 94 travel from the arms 80, 82 and through the elongated slots 132. This provides access to the pins from the user-side of the plates 128, 130. The slots 132 allow the user can retract the pin or pins 94 from hole or holes 92 and move the sliding mounts 88, 90 along the arms 80, 82 to the desired new setting, and release the pin or pins 94 to be biased into the new hole or holes 92 corresponding to the new desired setting, without interference from the plates 128, 130 or the need to remove them. Thus, the slots 128, 130 help to provide easy adjustability of the springs 84, 86 and, in turn, amount of resistance applied by the resistance apparatus 24.

[0063] Preferably, the plates 128, 130 are made of transparent plastic to allow the user to see the stationary arm 80 and pivoting arm 82 on the other side of the plate. This provides full visibility of the arms 80, 82, holes 92, sliding mounts 88, 90, and ends of springs 84, 86, without having to look through the slot, and makes it easier to see the particular settings of the springs 84, 86. For example, transparent plates 128, 130 allow the number of holes 92 on the arms 82, 84 above and below the sliding mounts 88, 90, from the angle of a user standing on the pedals 48, 50. This helps the user to see if the positions mounts 88, 90 is the same on both arms 82, 84, or whether there are additional holes above or below the current settings of the sliding mounts 88, 90. Alternatively, the safety plates may be opaque and the plates 128, 130 marked next to the slots indicating the hole 92 positions.

[0064] As discussed above, the lateral step exercise device 22 and resistance apparatus 24 can be used together to provide an exercise machine to improve a user's performance, power, agility, speed and quickness in sports requiring at least some lateral movement. The machine provides a user general aerobic conditioning, stamina training, and balance and coordination training for lateral human movement employed in competitive sports and recreational activities.

[0065] A preferred manner for mounting the device is: (1) to place one foot, such as the left foot, on the top surface 70 of stationary step 66, (2) to lean forward and place hands on and grasp the inverted V-shaped handle (either small 120 or larger 122), (3) to lift the other foot, such as the right foot, into the curved foot pad 54 of right pedal 50, and (4) to lift the first foot, the left foot, into the curved foot pad 52 of the left pedal 48. The weight of the user on the pedals 52, 54, if distributed evenly, will cause the springs 84, 86 to extend to counter the force of the user's weight.

[0066] Once on the device, the user 123 (FIG. 4) can start an exercise routine of their choice. The preferred method of use is as follows: the user lifts one foot, such as the left foot, causing the resistance force of the spring to move the left pedal 48 upward to (or near to) the top of the left track 36. Simultaneously, the user shifts his or her weight onto other, right pedal 50 against the bulk (if not the entirety) of the resistance force of the springs 84, 86, causing it to move lower on the other, right track 36. This pedal position is shown in FIG. 4.

[0067] After the user (such as 123, FIG. 4) has one foot (one pedal) raised and one lowered, he or she can begin a training exercise in which the user shifts weight from one pedal to the other and back. The exercise device 22, used in combination with the resistance apparatus 24, applies a single resistance force to the total downward/lateral pressure exerted by both feet. This requires the user to engage his or her balance and coordination while simultaneously shifting weight from one foot to the other, and back again, in quick succession. It is this quick weight shifting, while maintaining balance and coordination that closely simulates the balance and coordination utilized while performing lateral movement in competitive and recreational sports.

[0068] As contemplated in the preferred embodiment, the exercise device 22 is intended to differ from a conventional stepper machine. Here, the user needs to "lock"

his or her upper body in a relatively stable position and work the lower body. In the context of the other benefits and advantages provided by the device, including the lateral movement aspects discussed herein, the user develops balance and coordination particularly suited for lateral movement, competitive sports and recreation.

[0069] A user 123 can support him or herself while climbing into the pedals 48,50 or while exercising by holding one of the inverted V-shaped handles 120, 122. The handles 120, 122 do not need to be used while exercising to obtain the benefit of the exercise. In fact, for many exercise routines and users greater benefit is obtained from not using the handles 120, 122. That is, the maximum benefit of exercising on the device is training the user's balance and coordination without the advantage of holding onto the handles 120, 122, as doing so may act somewhat as a crutch. However, the handles provide users an option, particularly desirable for new users to the device, to use their arms to maintain balance on the pedals 48, 50.

[0070] The preferred manner of dismounting from the device is essentially the opposite of the procedure described above for mounting it. While holding onto the handles, the user (1) lifts one foot, such as the left foot, out of the left foot pad 52, and lowers it the top surface 70 of the stationary step 66, (2) leans back and lifts the other foot, such as the right foot, out of the right foot pad 54, and lowers it to the floor or ground, (3) releases hold on the inverted V-shaped handle (either 120 or 122), and (4) lowers the foot on the stationary step 66 to the floor or ground.

[0071] The exercise machine disclosed herein includes a combination of elements that are particularly effective for performance training for competitive and recreational sports requiring at least some lateral movement. Weight stacks and other weight-based resistance devices and exercise equipment apply a constant force defined by the amount of weight chosen by the user and the force of gravity, both of which are constants throughout the entirety of each and every pedal stroke during the exercise. The resistance to movement felt by the user's right foot when the left foot stays stationary at the top of the track, for example is the same at the middle and end of the length of travel down the track as the resistance felt at the beginning of travel down the track.

[0072] In contrast, springs 84, 86 and other, similar resilient means, apply a force that increases linearly as the spring is extended. The resistance force changes throughout the

length of the pedal stroke. Not only does it increase, it increases in a linear way – the resistance against downward pedal movement increases as the spring length increases. The amount of resistance increase will vary according to the appropriate spring constant and the formula F = Kdx, where F equals force, K is the spring constant, and dx is the change in spring length. The value for K will vary according to the specific design characteristics of the spring or springs.

[0073] The exercise machine provides a structure and method that takes advantage of the characteristic of springs and other similar resilient means for the lateral sports performance training. According to the preferred method of use of the device, the user must apply an ever-increasing amount of force on the foot and corresponding leg to depress the pedal down the track (while the other foot remains stationary at the top). The user also must maintain balance on the pedals while the foot travels downwardly and laterally, and the leg and associated leg muscles, tendons, ligaments, and perhaps other parts of the anatomy, stretch and adjust to accommodate the foot and leg movement.

[0074] When the user reaches the end of the stroke, the upward force on the pedal by the resistance apparatus counters the user's downward and lateral effort. At that point the upward force is relatively high, but it gradually decreases as the pedal returns up the path of the track. While the first pedal travels upwards the user begins to move the other pedal down. The force is at its lowest when the pedal reaches the top (or near the top), as the user completes the shift of his or her weight and downward and lateral force to the opposite foot and corresponding leg. The force against downward and lateral movement has increased as the opposite foot and leg travel downwardly and laterally on the opposite track.

[0075] The use of spring resistance is particularly advantageous in combination with the exercise device 22 because the resistance load increases as the user starts, continues and completes a leg stroke. The load is lowest at the top or start of the stroke, where the user's leg-applied force is weakest, and the user is least capable to applying force to move the pedal against the resistance force, and most vulnerable to injury in light of the strain. The load is greatest at the bottom or end of the stroke, where the user's leg-applied force is strongest, and the user is most capable of applying force to move the pedal against the resistance force and least vulnerable to injury.

[0076] Not only does the use of springs or other similar resilient means provide advantages for the performance training contemplated here, but the disclosed resistance apparatus 24 provides the linear, increasing force may be incrementally adjusted in a number of ways. For example, the springs 84, 86 or other resilient means can be adjusted by (1) changing the one or more of the springs to one or more with different (i.e., more or less) resistance to expansion, (2) by adding or removing one or more springs, (3) by changing the location setting of one or more springs along a pivot post (or posts) which adjusts the travel distance of one (or both) ends of the spring relative to the travel distance of the stroke of the foot pedals, as further discussed below with respect to FIGS. 5-11.

[0077] In FIGS. 5 and 6 the end of spring 86 attached to sliding mount 90 is set with pin 94 in the third hole 92 down from the top of pivoting arm 82. (While not shown in FIGS.5 and 6, the FIGS. show the spring 86 in a horizontal orientation, which indicates that the other end of spring 86 is attached to sliding mount 88, which is set with pin 94 in the third hole 92 from the top of stationary arm 80.) In FIG. 5, the pivoting arm 82 is in the vertical position, which is the position the arm will be in when no force is applied counter to the resistance or stretching force of the spring 86. In FIG. 6, a counter force is applied to the resistance of the spring 86, which pulls the pivoting frame portion 104 and pivoting arm 82 away from the stationary arm 80 to a certain angle. This acts to stretch the spring 86 a certain distance.

[0078] In FIGS. 7 and 8 the end of spring 86 attached to sliding mount 90 is set with pin 94 in the last or twelfth hole 92 down from the top of pivoting arm 82. (Again, while not shown in FIGS. 7 and 8, because the spring 86 is shown in a horizontal orientation, these FIGS. teach that the sliding mount 88 attached to the other end of the spring 86 is also set with pin 94 in the final or twelfth hole 92 down from the top of the stationary arm 80.) The pivoting frame portion 104 and pivoting arm 82 in FIG. 7 is shown in the vertical position, similar to FIG. 5. The pivoting frame portion 104 and pivoting arm 82 in FIG. 8 is shown in the same angle to the frame resistance apparatus supporting portion 30 as shown in FIG. 6.

[0079] A comparison of FIGS. 5 and 6 to FIGS. 7 and 8 demonstrates one of the advantages of the use of adjustable resistance provided by springs 84, 86 (or other,

similar resilient means) in the disclosed structure and method. As the angle of the pivoting frame portion 104 and pivoting arm 82 in FIGS. 6 and 8 are the same, the travel distance of a pedal by the force of the user's foot is the same. However, because of the different settings of the sliding mount 90 (and sliding mount 88) between FIGS. 5 and 6, on the one hand, and FIGS. 7 and 8, on the other, the length of extension of the spring 86 and corresponding resistance force are substantially more in FIG. 8. In other words, while the user's stroke distance to accomplish the movement of arm 82 from FIG. 5 to FIG. 6 is the same as that needed to accomplish the movement of arm 82 from FIG. 7 to FIG. 8, the amount of force needed for the stroke was much greater for the setting shown in FIGS. 7 and 8.

[0080] Also, as previously mentioned, the starting or initial load is adjusted by moving the springs 84, 86 along arms 80, 82. For example, the spring setting in FIG. 5 provides a lower starting or initial resistance as compared to the spring setting in FIG. 7. As the springs 84, 86 are moved down arms 80, 82, the initial load increases.

[0081] The advantage of the adjustable springs as employed in the disclosed exercise device, resistance apparatus and methods is further demonstrated in schematics of FIGS. 9-11. In these schematics, Settings A and B are settings of the sliding mounts 88, 90, on arms 82, 84. Also, Positions I, II and III represent different angular positions of the pivoting frame portion 104 and pivoting arm 82 relative to the vertical or starting position.

[0082] FIGS. 9, 10 and 11 compare two springs, one set at Setting A at a relatively higher position, and the other with Setting B at a relatively lower position along the pivot arm 82. In FIG. 9, the pivot arm 82 is in Position I, the starting vertical position and neither spring setting provides a resistance to a counter-force being applied by the pedals 48, 50 in the lateral step exercise device 22. The difference in travel distance, d1, between the two spring ends attached to the pivot arm 82, is zero.

[0083] In FIG. 10, the counter-force of the pedals 48, 50 has moved the pivot arm to Position II. In Position II, the total travel distance of the pedals is greater than zero. The difference in travel distance, d2, between the end of the spring attached to the pivot arm, is greater than zero, and greater for Setting B than for Setting A. The spring in Setting B must extend the additional distance d2 even though the pivot arm 82 moved to the same

angle for both Setting A and Setting B in FIG. 10. Therefore, the amount of force needed to move arm 82 from Position I to Position II, is substantially more for spring Setting B as compared to Setting A.

[0084] In FIG. 11, the counter-force of the pedals 48, 50 has moved the pivot arm even further away from the stationary arm 80 to Position III. In Position III, the total travel distance of the pedals is, like Position II, greater than zero. However, the difference in travel distance, d3, between the end of the spring attached to the pivot arm is even greater than it was for Position II shown in FIG. 10. Here, the spring in Setting B must extend the even further, the distance d3, even though the pivot arm 82 moved to the same angle for both Setting A and Setting B in FIG. 11. Therefore, the amount of force needed to move arm 82 from Position II to Position III, is substantially more for spring Setting B as compared to Setting A, and even greater than the difference in force between Settings A and B in FIG. 10.

[0085] As mentioned above, the device, apparatus and methods disclosed herein could be practiced with both arms pivoting away from one another rather than as shown in the preferred embodiment with one pivoting arm 82 and one stationary arm 80. The principles employed and described herein would be applicable to a two pivoting arm arrangement.

[0086] The device as contemplated herein accommodates users of substantially different sizes, weights, heights and body types without adjustment to various angles, heights or other structural parameters of the device. As previously mentioned, a relatively short user, for example, can without adjusting structural aspects of the device access and effectively use the device immediately after its use by a relatively tall user. The need for a user to adjust the device before using is reduced or potentially eliminated. In other words, the height of the top of the track, the angle of the track, the pedal height, the stroke length and other parameters of the exercise device do not need to be adjustable for a large variety of users to use it.

[0087] The universal setting aspect of the disclosed device is accomplished by using tracks with angles, and other set and non-adjustable parameters disclosed herein. The particular arrangement and structure means users of a wide variety of heights, weights,

sizes and abilities can use the same device without making adjustments to the structural aspects of the device in advance of mounting and using it.

[0088] This universal setting advantage avoids the need for users to make adjustments to the exercise device before using it, and prevents the potential for a user to misadjust the device in a way that injures him or herself. Moreover, a second user who mounts a device has less risk of injury if a prior user has adjusted the device in a way that is not appropriate for the later user. In either situation, even without injury, if adjustable settings are not properly adjusted, the user will not obtain the maximum performance training experience. The device contemplated herein does not suffer from these potential problems.

[0089] With reference to FIGS. 12-15, an alternative exercise device 140 is shown in combination with modular resistance apparatus 24. Together a unitary exercise machine is comprised of two independent components: (1) the vertical step exercise device 140, and (2) the resistance apparatus 24. Similar to the lateral step exercise device 22, the vertical step exercise apparatus 140 and resistance apparatus 24 are both attached to a frame. Here, mentioned above, the frame has a vertical step exercise device supporting portion 142 and a resistance apparatus supporting portion 30. The two frame portions are joined together by reversibly attachable brackets 32 and 34 (shown in FIG. 1), such that the horizontal exercise device portion 142 and the resistance apparatus supporting portion 30 can be detached from one another if so desired. However, it is contemplated that when the exercise device 140 and resistance apparatus 24 are used together, the frame portions 142, 30 will be secured together and will not move relative to the other.

[0090] The vertical step exercise device 140 has two vertical sets of tracks 144, 146 supported on the frame portion 142. Each track preferably has two parallel tubular rails 148. The angle of the tracks 144, 146 with respect to the ground (or vertical exercise device base portion 150) is about 90 degrees. Alternatively, each track could be designed with a single parallel tubular rail or with three or more rails.

[0091] The vertical step exercise device 140 has two pedals 152, 154. The first or left pedal 152 is fixedly mounted to a slide 156, while the second or right pedal is fixedly mounted to slide 158. The slides 156, 158 engage tracks 144, 146 in a manner that

allows movement along the length of the tracks. This is preferably achieved by the use of rollers, bearings or other means known in the art.

[0092] The slides 156, 158 can freely move along the inclined tracks 144, 146, as described below, with relatively little friction or resistance at the slide-track connections. The tracks 144, 146 have bumpers or springs 160 at either end to dampen the movement at the ends of the tracks 144, 146. This reduces the jolt that would otherwise occur when the slides 156, 158 meet the ends of the tracks 144, 146, either at the lower or upper ends of the tracks. Prior to reaching the ends of the tracks, the slide will contact the bumpers or springs 160, which will absorb at least some of the kinetic energy of the slides prior to the slides reaching the ends of the tracks 144, 146.

[0093] Two stationary steps 162 are fixedly attached to the frame's exercise device supporting portion 142, one to the left of left pedal 152 and another to the right of right pedal 154. The steps 162 are generally rectangular in cross-section, with longitudinal axis protruding rearwardly from the frame portion 142.

[0094] Each of the steps 162 has a base 164 and a top surface 166. The top surface 166 is preferably metal and has a knurled or other high-friction, upwardly facing surface. The steps 162 allow a user to step up to the pedals 152, 154, when first placing one foot on each of the steps 162, and subsequently lifting the one foot into a pedal from the step 162. Once the user has placed one foot in a pedal, the user can lift his or her other foot from the other step 162 and place it in the other pedal.

[0095] If desired the user can use one or both of the V-shaped handles 120, 122 to assist movement of the feet onto the steps 162 and/or from the steps 162 to the pedals 152, 154. Use of the steps 162, with or without also using the V-shaped handles 120, 122, allows a first-time, relatively short, or out-of-shape user to engage the exercise device without undue strain, and provides the option of relatively easy movement into position to engage the device.

[0096] The handles 120, 122 do not need to be used while exercising to obtain the benefit of the exercise. In fact, for many exercise routines on the vertical exercise device 140 and users thereon obtain greater benefit from not using the handles 120, 122. That is, the maximum benefit of exercising on the device is training the user's balance and coordination without the advantage of holding onto the handles 120, 122, as doing so

may act somewhat as a crutch. However, the handles provide users an option, particularly desirable for new users to the device, to use their arms to maintain balance on the pedals 152, 154.

[0097] The vertical exercise device 140 is intended to differ from a conventional stepper machine. Here, it is intended that the user "lock" his or her upper body in a relatively stable position and work the lower body. In the context of the other benefits and advantages provided by the device, the user develops balance and coordination particularly suited for vertical leg and foot movement, competitive sports and recreation.

[0098] The preferred manner of dismounting from the device is essentially the opposite of the procedure described above for mounting it. While holding onto the handles, if desired, the user (1) lifts one foot, such as the left foot, out of the left pedal 152, and lowers it the left step top surface 166 of the stationary step 162, (2) leans back and lifts the other foot, such as the right foot, out of the right pedal 154, and lowers it to right step top surface 166, (3) lifts left foot off the top surface 166 and lowers it to the ground (floor), (4) lefts right foot off the top surface 166 and lowers it to the ground (floor), and if needed, (5) releases hold on the inverted V-shaped handle (either 120 or 122). Other foot movement sequences also will accomplish the dismount and disengagement from the vertical exercise device 140.

[0099] The combination of the vertical exercise device 140 in combination with the modular resistance apparatus 24 as described herein is particularly effective for performance training for competitive and recreational sports requiring as described above. Weight stacks and other weight-based resistance devices and exercise equipment apply a constant force defined by the amount of weight chosen by the user and the force of gravity (which does not change as a result of being lifted), both of which are constants throughout the entirety of each and every pedal stroke during the exercise.

[00100] In contrast, the vertical step exercise device 140 when used in combination with the resistance apparatus herein provides increasing resistance to movement, for example, of the user's right foot when the left foot stays stationary at the top of the track. In other words, the force needed to continue to move the pedal downward increases as the right pedal moves down the track. Conversely, the force upward against the right foot decreases as the pedal moves upward on the track, as long as the left foot stays stationary

at the top of the opposing track. The same would be true for movement of the left foot on the left pedal 152 downward and upward along track 144.

[00101] Both exercise devices, the lateral exercise device 22 and the vertical exercise device 140, can be used with a single modular resistance apparatus 24 to make different operative exercise equipment. For example, a complete machine 20 can be configured by joining resistance apparatus 24 with the lateral step exercise device 22 by reversibly attaching brackets 32, 34 on the exercise device 22 to the frame 30 of the resistance apparatus 24. The two components are then temporarily structurally secured together to operate as a single exercise unit.

[00102] A complete machine also can be configured by joining resistance apparatus 24 with the vertical step exercise device 140 by reversibly attaching brackets 32, 34 on the exercise device 140 to the frame 30 of the resistance apparatus 24. These two components are thereby temporarily structurally secured together to operate as a different, single exercise unit. A complete machine can subsequently be separated into two pieces by detaching the brackets 32, 34 and combined with a different exercise device, by attaching brackets in that device, to produce a different, complete exercise unit.

[00103] The exercise devices 22, 140 are functionally connected to the resistance apparatus 24 by a cable that communicates with the hanging moveable apparatus pulley 110. With respect to lateral exercise device 22, the pedal resistance cable 114 is attached to both pedals 48, 50 (through attachment to sliding mounts 88, 90), one cable end to one pedal 48 and the other end to the other pedal 50. As described above, between the two pedals 48, 50, the cable 114 runs over the pulley 110. As a result, movement of either pedal 48, 50, results in downward displacement of the pulley against the resistance provided by the resistance apparatus 24.

[00104] Similarly, the vertical step exercise device 140 is functionally connected to the resistance apparatus 24 by a cable that communicates with the hanging moveable apparatus pulley 110. In particular, cable 168 of the vertical exercise device 140 is connected to both pedals 152, 154 (through attachment to sliding mounts 156, 158), one cable end to one pedal 156 and the other end to the other pedal 158. Between the two pedals 152, 154, the cable runs over the pulley 110. Movement of either pedal 152, 154,

results in downward displacement of the pulley against the resistance provided by the resistance apparatus 24.

[00105] The cable 168 travels from the moveable apparatus pulley 110 to the pedals 152, 154 (sliding mounts 156, 158) over a series of circular guides or pulleys. First, the each cable travels over vertical guides 118 mounted on the resistance apparatus 24. Second, the cable runs laterally over a series of horizontal cable guides 170, preferably two on each side. Third, the cable travels from the horizontal cable guides 170 to a set of lower vertical cable guides 172. Finally, the cable loops over a set of upper cable guides 174 and downwardly to connect with the sliding mounts 156, 158. Thus, downward movement of one or both pedals 152, 154 (and the attached mounts 156, 158) is against the resistance provided by the moveable apparatus pulley 110 and the resistance of the springs 84, 86.

[00106] As mentioned above, there are advantages to using the step exercise devices 22, 140 in combination with the resistance apparatus 24, as shown in the FIGS. However, it is also contemplated that the resistance apparatus 24 could be employed with other exercise devices and still obtain at least some of the advantages described herein as well as others not described but would be otherwise obtained from use.

[00107] The above embodiments described herein are intended only as examples of how the contemplated subject matters can be realized. However, specific details, even if helpful to the understanding and practice of the subject matter, are not intended to be incorporated into the claims unless specifically recited.

WHAT IS CLAIMED IS:

1. An apparatus for providing resistance to a training machine, the apparatus comprising:

a support structure having a base and a frame extending upwardly from the base;

a first arm supported on the frame;

a first adjustment means capable of being reversibly fixed in position along said first arm;

a second arm supported on the frame;

a second adjustment means capable of being reversibly fixed in position along said second arm; and,

means affixed between the first and second adjustment means for resisting movement of the second arm relative to the first arm;

wherein movement of one arm relative to the other can be accomplished only with the application of a force against the means affixed between the first and second adjustment means.

2. The resistance apparatus of claim 1 wherein the first arm is fixedly connected to the frame, wherein the second arm has a proximal end and a distal end, and wherein the proximal end is pivotally connected to the frame.

3. The resistance apparatus of claim 2 further comprising a cable that connects the distal end of the second arm to a hanging pulley.

4. The resistance apparatus of claim 1 in which the means affixed between the first and second adjustment means is a spring.

5. The resistance apparatus of claim 1 wherein the first arm and second arm each contain multiple apertures, and first and second adjustment means each have a pin that is biased to register in said apertures to reversibly fix the position of each plate relative to each arm.

6. The resistance apparatus of claim 1 in which the first and second adjustment means are plates.

7. The resistance apparatus of claim 1 further comprising a wire connected at one end to the first adjustment means and at the other end to the support structure to assist movement of the first adjustment means along the first arm.

8. The resistance apparatus of claim 7 in which the wire has an extensible portion.

9. The resistance apparatus of claim 3 further comprising a truss cantilevered from the support structure with distal end projecting away from the frame in the direction of pivotal movement of the second arm.

10. The resistance apparatus of claim 9 further comprising a cable guide connected to the cantilevered truss for engaging the cable between the second arm and the hanging pulley.

11. The resistance apparatus of claim 1 further comprising an inverted V-shaped handle attached to the support structure.

12. The resistance apparatus of claim 1 further comprising means attached to the support structure for reversibly connecting a training machine to the resistance apparatus.

13. The resistance apparatus of claim 3 further comprising a training machine cable that is supported on the hanging pulley.

14. The resistance apparatus of claim 11 further comprising a cylindrical padded bolster attached to the support structure below the inverted V-shaped handles, the bolster capable of supporting a user's forearms.

15. The resistance apparatus of claim 1 further comprising a reversibly attached exercise device having two pedals each slideably mounted on at least one track, the pedals being connected to at least one arm by one or more cables.

16. The resistance apparatus of claim 15 wherein a single cable is attached at one end to one pedal and at the opposite end to the other pedal.

17. The resistance apparatus of claim 16 further comprising a hanging pulley, and wherein the single cable travels over the hanging pulley.

18. A lateral step training machine comprising:

two tracks inclined from a lower lateral position to a higher central position;

a first pedal slideably mounted on one track and a second pedal slideably mounted on the other track;

a first pulley located near the central position;

a second pulley located above the first pulley, the second pulley capable of movement relative to the first pulley;

a first cable having two ends, one end attached to each pedal, the cable traveling from the first pedal, around the first pulley, through the second pulley, around first pulley and to the second pedal; and,

a second cable attached between the second pulley and a means for resisting a force on the second pulley toward the first pulley;

wherein the means for resisting force biases the pedals toward the top of the inclined tracks, and resists movement of the pedals in downward, lateral directions on the tracks.

19. The lateral step training machine of claim 18 in which the means for resisting force comprises:

a support structure having a base and a frame extending upwardly from the base;

a first arm supported on the frame;

a first adjustment plate slideably mounted on the first arm, the plate being capable of being reversibly fixed in position along said first arm;

a second arm supported on the frame;

a second adjustment plate slideably mounted on the second arm, the plate being capable of being reversibly fixed in position along said second arm; and,

means affixed between the first plate and second plate for resisting movement of the second arm relative to the first arm;

wherein movement of the second pulley toward the first pulley moves the first and second arms away from each other against the means affixed between the first plate and the second plate.

20. The lateral step training machine of claim 19 wherein the first arm is fixedly connected to the frame, wherein the second arm has a proximal end and a distal end, and wherein the proximal end is pivotally connected to the frame.

21. The lateral step training machine of claim 20 wherein the second cable that connects the distal end of the second arm to the second pulley.

22. The lateral step training machine of claim 19 in which the means affixed between the first plate and the second plate is a spring.

23. The lateral step training machine of claim 19 wherein the first arm and second arm each contain multiple apertures, and first and second plates each having a pin that is biased to register in said apertures to reversibly fix the position of each plate relative to each arm.

24. The lateral step training machine of claim 19 wherein the inclined tracks are supported on the base.

25. The lateral step training machine of claim 19 in which the tracks are straight.

26. The lateral step training machine of claim 25 wherein the inclined tracks are canted at an angle between 40 and 45 degrees relative to the base.

27. A lateral step training machine comprising:

a supporting structure having a base and a frame extending upwardly from the base;

first and second straight tracks, each track extending between the base and the frame at an angle of between 40 and 45 degrees relative to the base;

a first pedal slideably mounted on the first track and a second pedal slideably mounted on the second track;

a first pulley connected to the frame near intersection of the tracks and the frame;

a second pulley located above the first pulley, the second pulley capable of movement relative to the first pulley;

a first cable having two ends, one end attached to each pedal, the cable traveling from the first pedal, through the second pulley and to the second pedal;

a second cable attached between the second pulley and a means for resisting a force on the second pulley toward the first pulley;

wherein the means for resisting force biases the pedals toward the top of the inclined tracks, and resists movement of the pedals in downward, lateral directions on the tracks.

28. The lateral step training machine of claim 27 in which the means for resisting force comprises:

a support structure having a base and a frame extending upwardly from the base;

a first arm supported on the frame;

a first adjustment plate slideably mounted on the first arm, the plate being capable of being reversibly fixed in position along said first arm;

a second arm supported on the frame;

a second adjustment plate slideably mounted on the second arm, the plate being capable of being reversibly fixed in position along said second arm; and,

means affixed between the first plate and second plate for resisting movement of the second arm relative to the first arm;

wherein movement of the second pulley toward the first pulley moves the first and second arms away from each other against the means affixed between the first plate and the second plate.

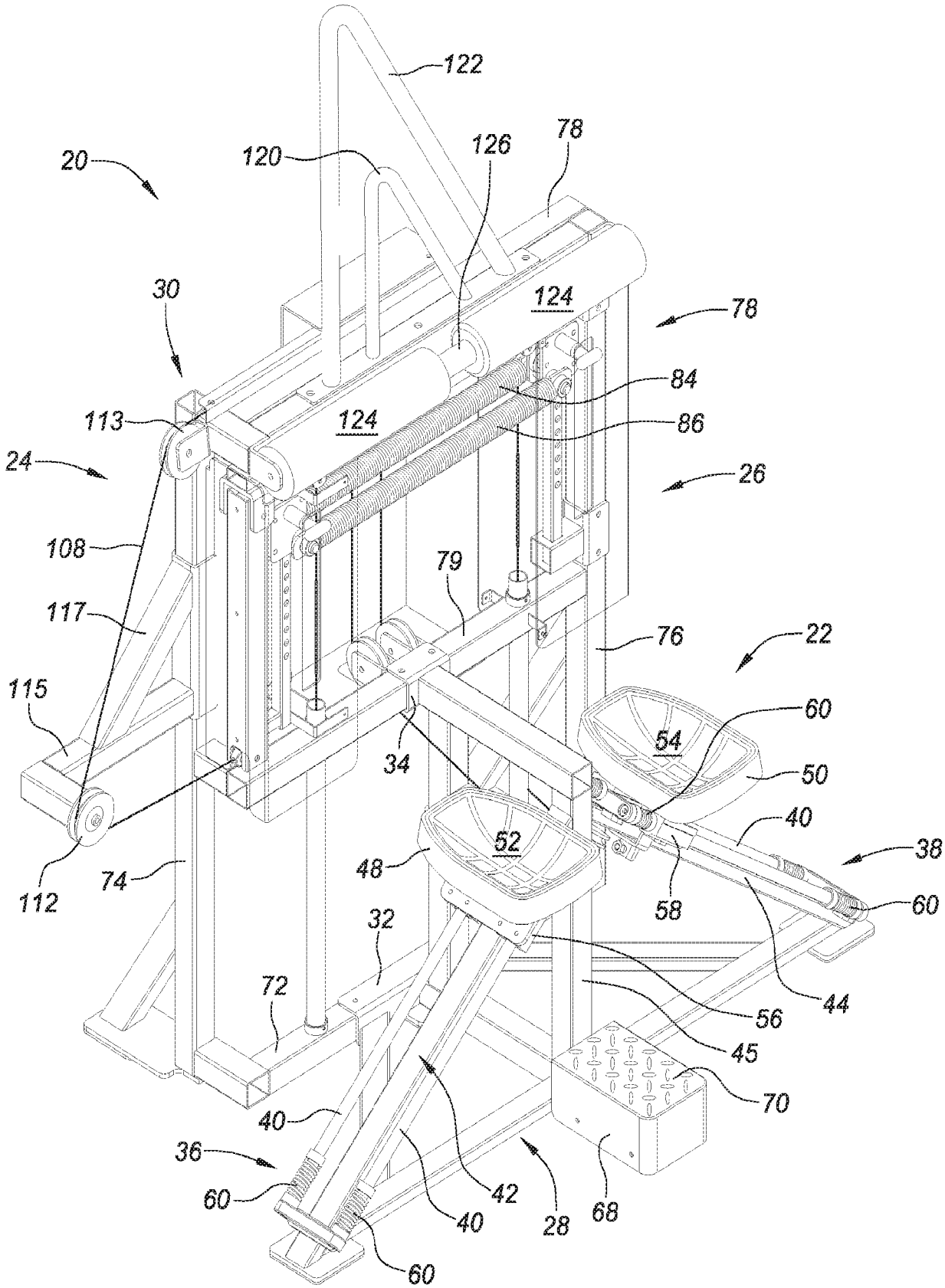
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FIG. 1

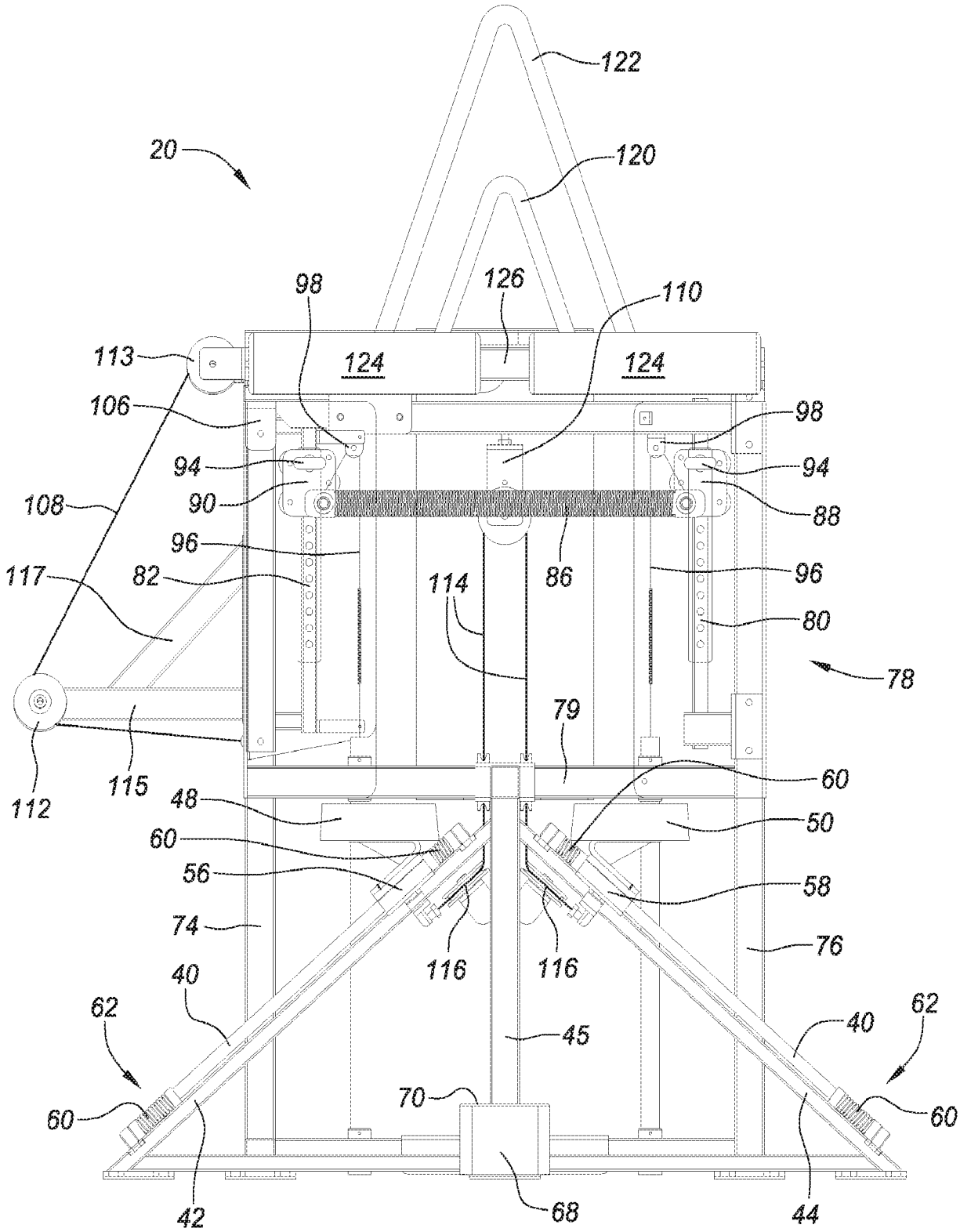
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FIG. 2

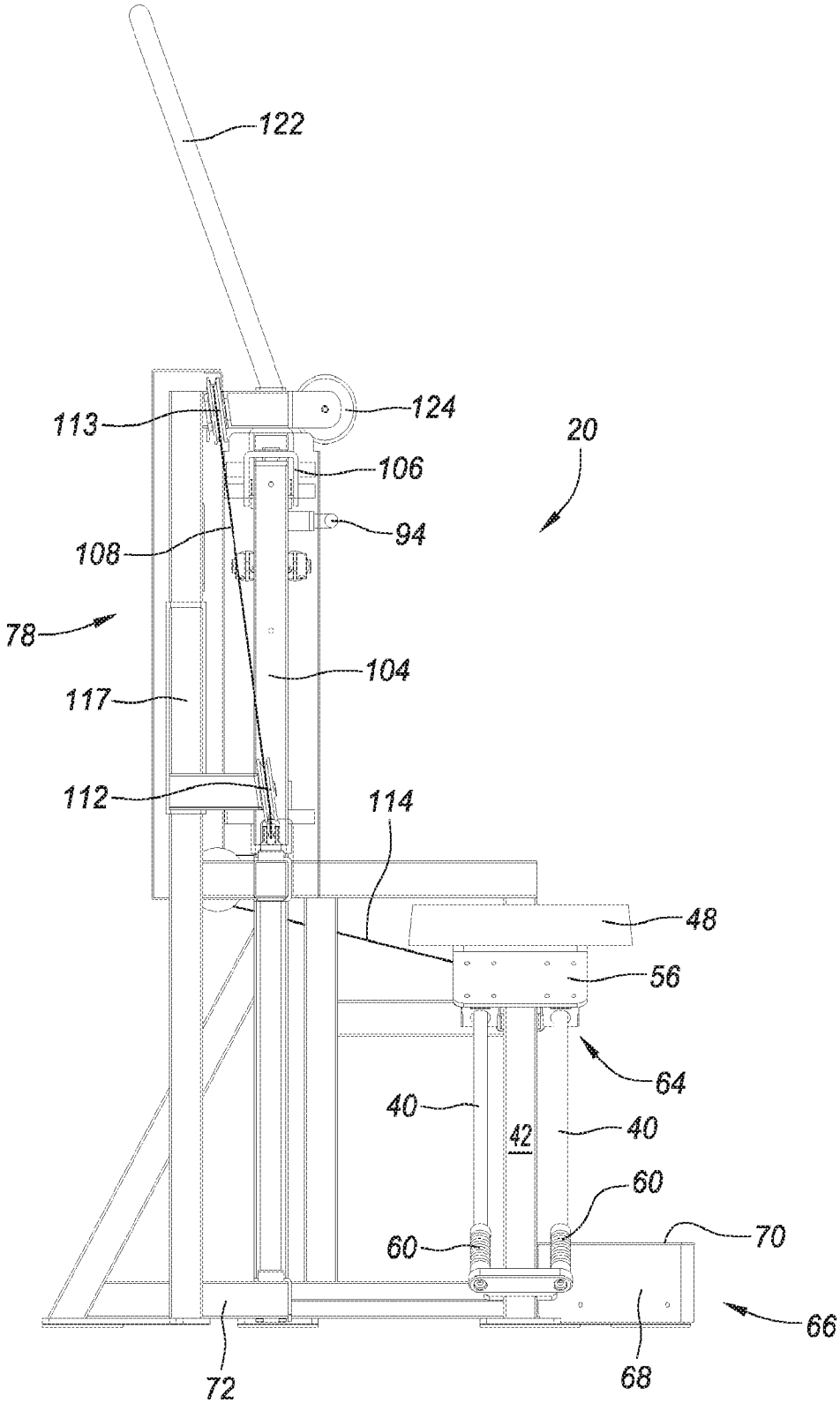
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FIG. 3

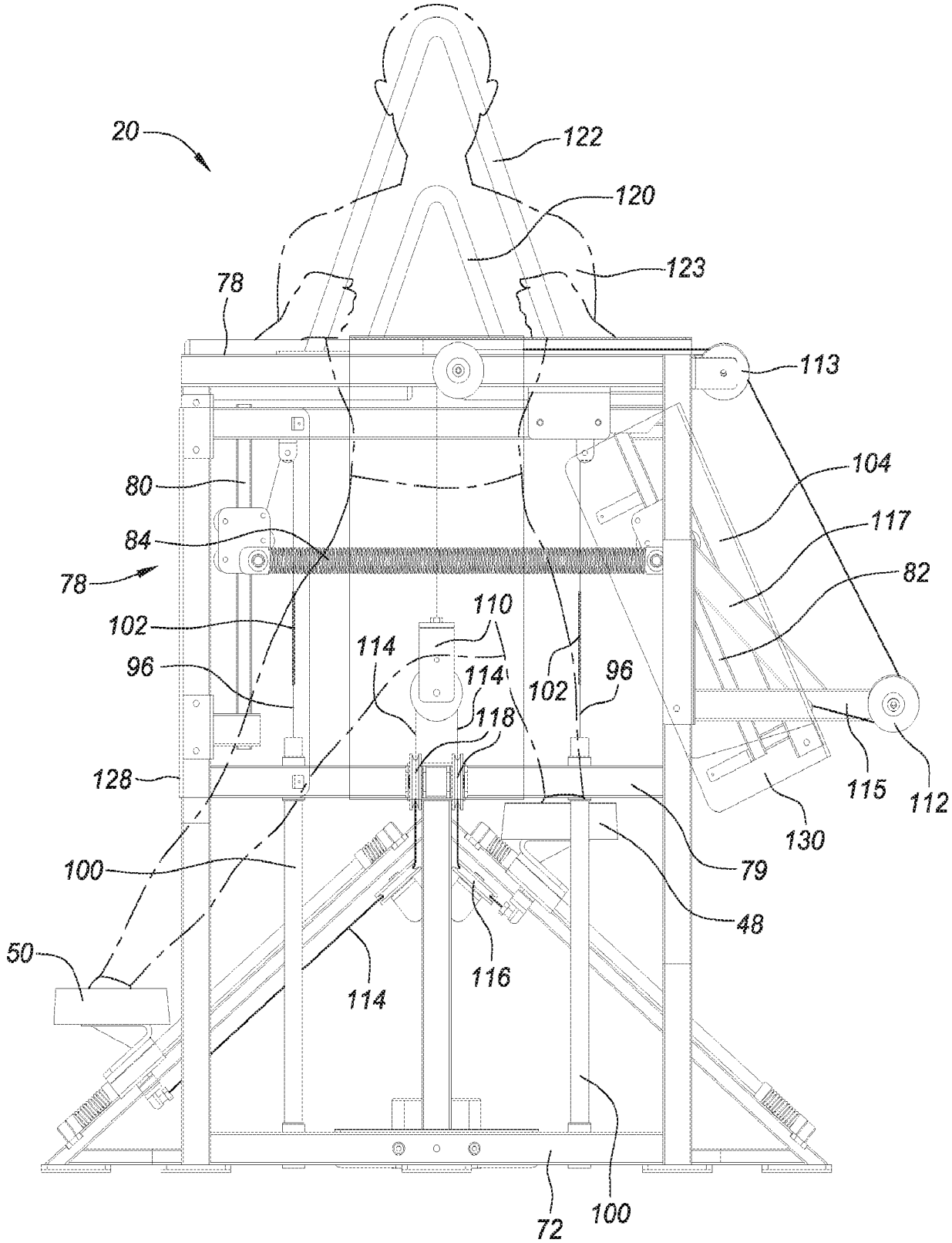
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FIG. 4

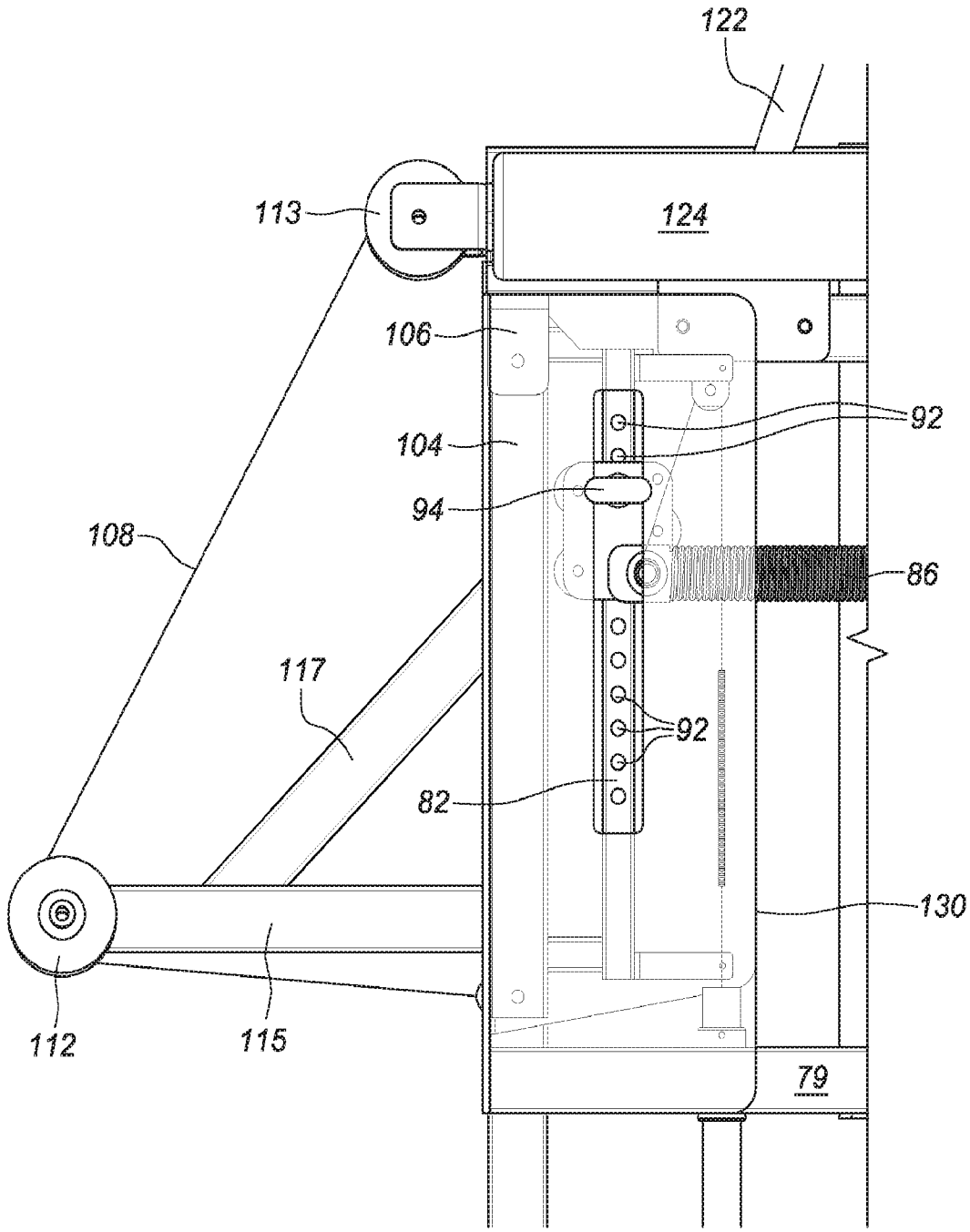


FIG. 5

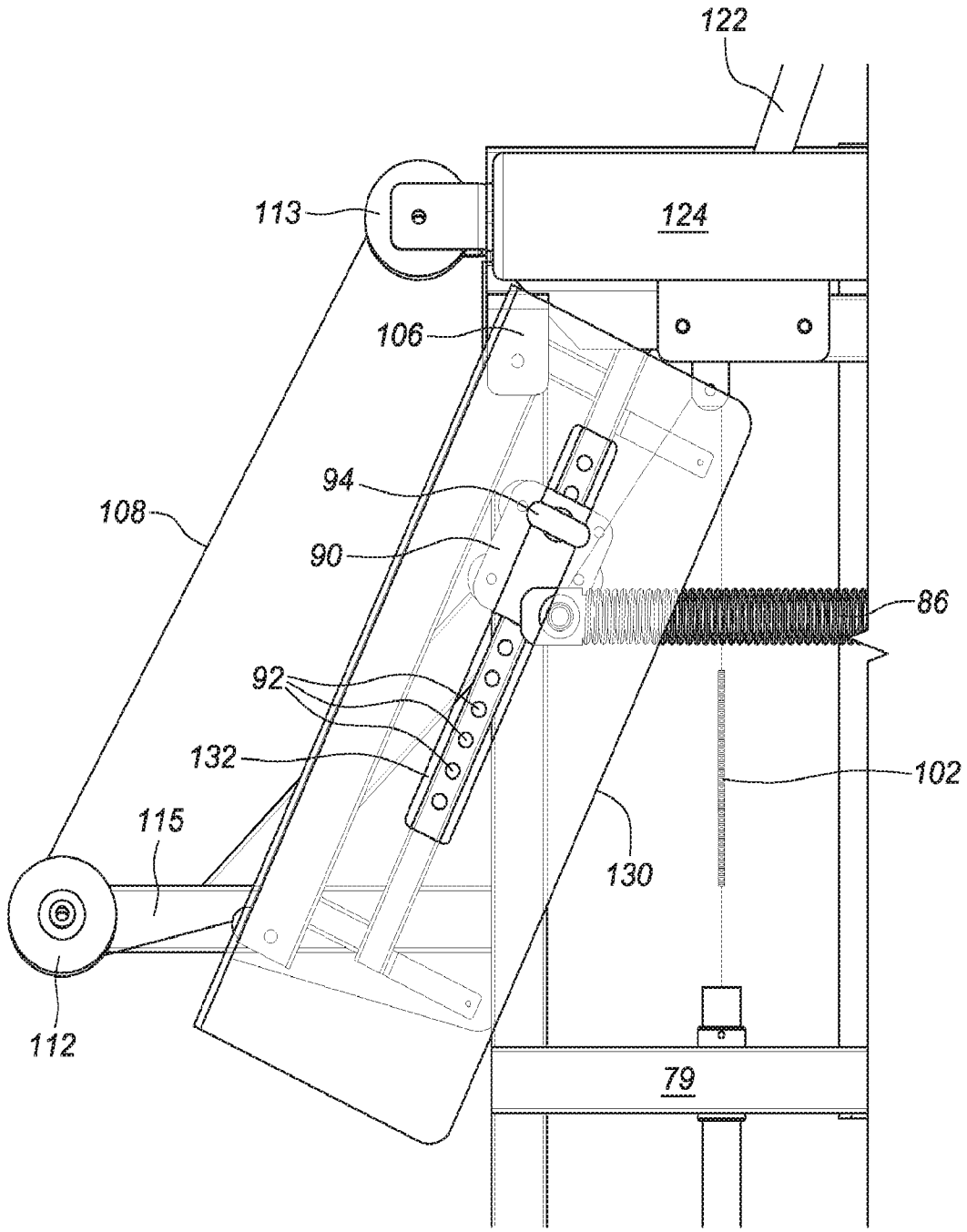


FIG. 6

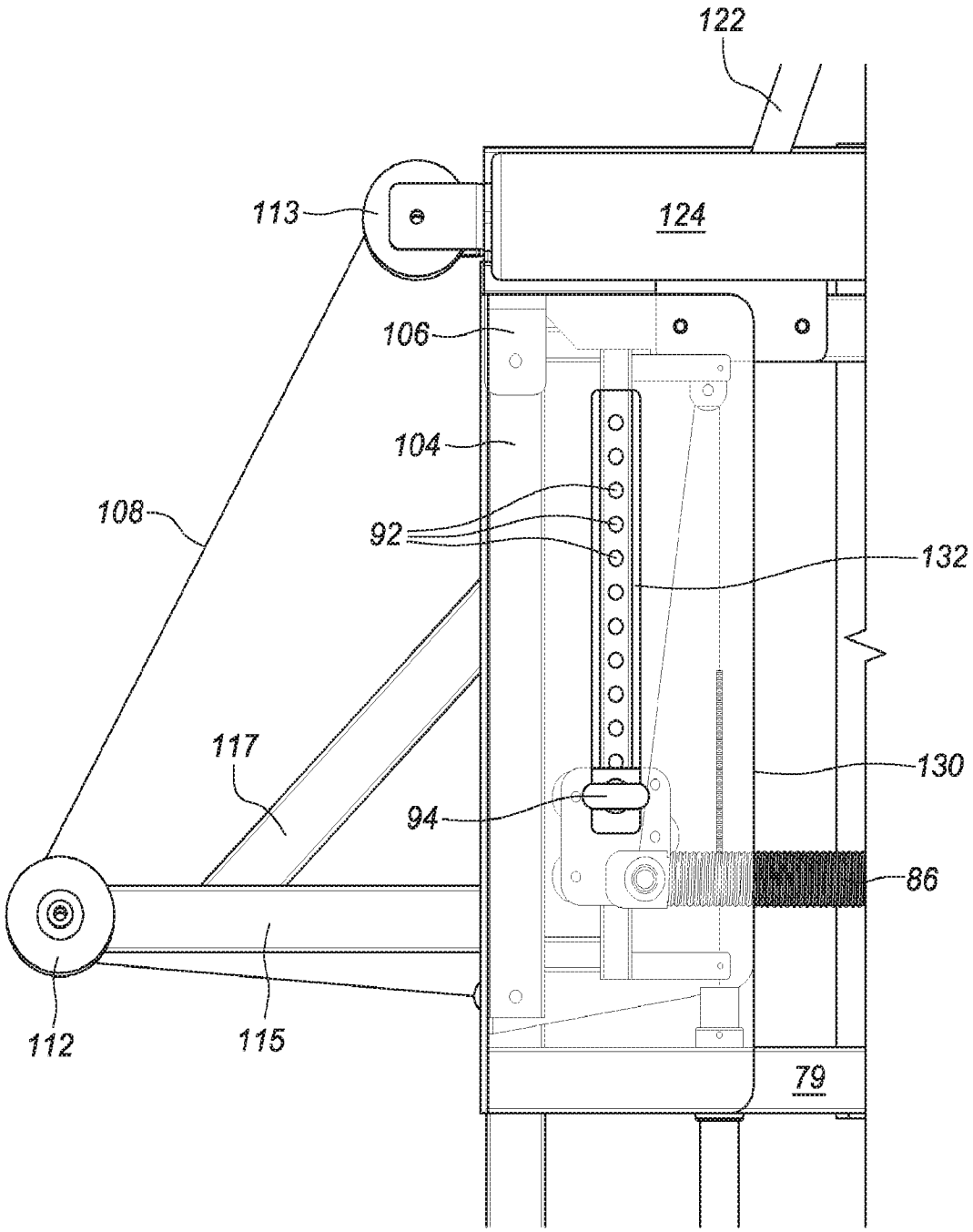


FIG. 7

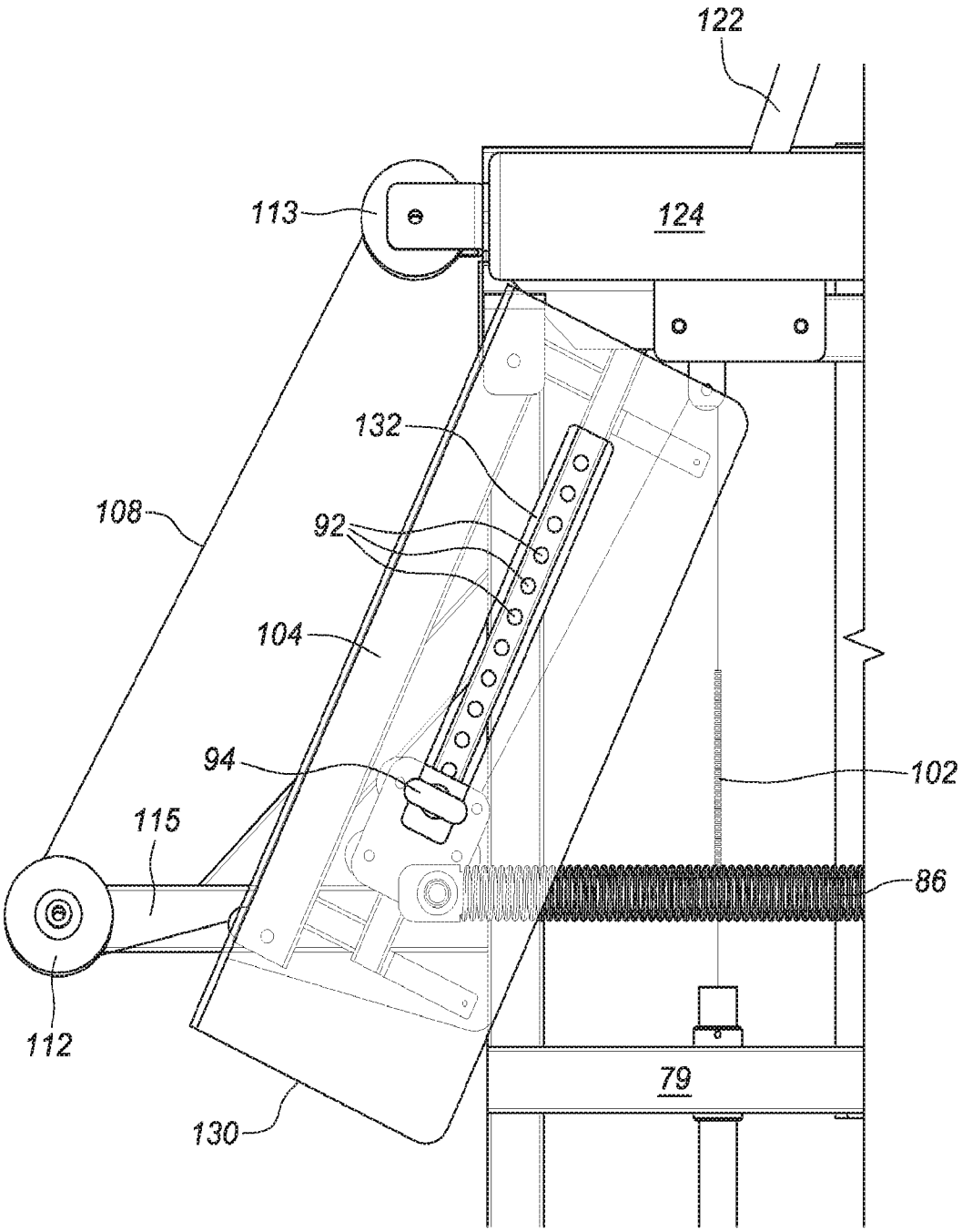


FIG. 8

FIG. 9

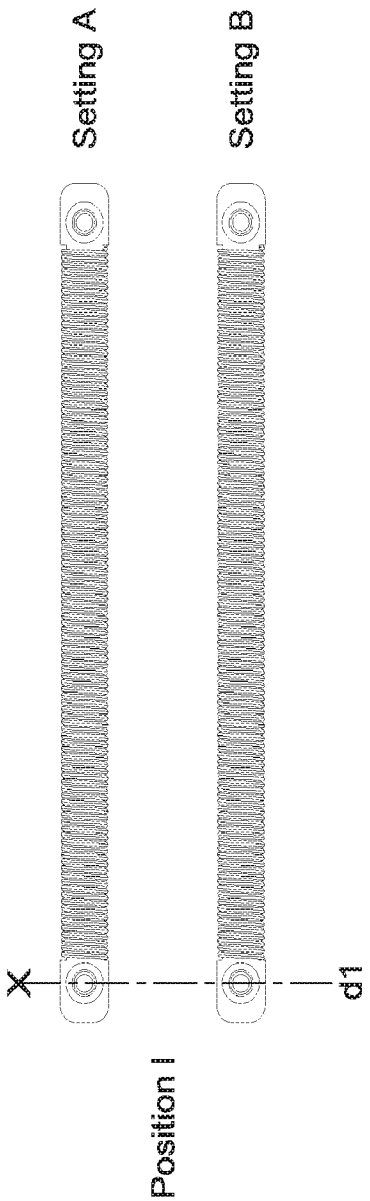


FIG. 10

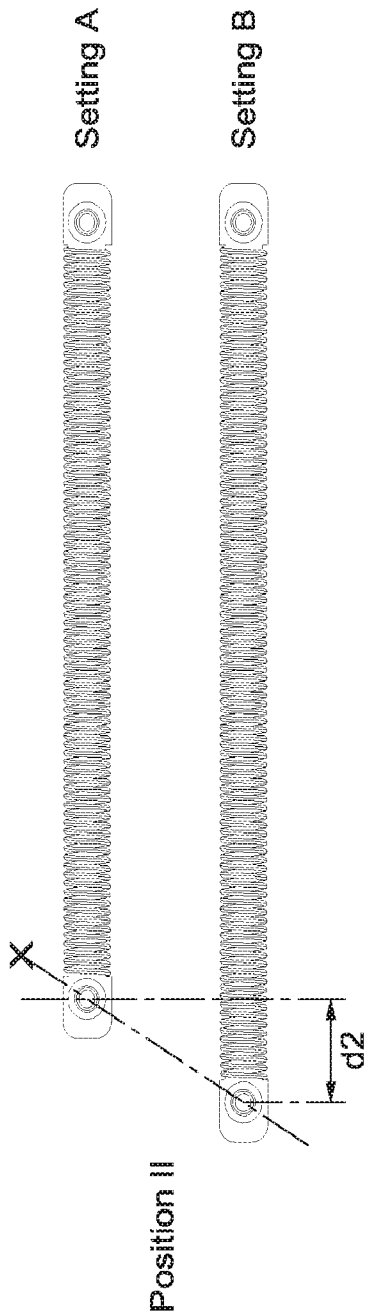
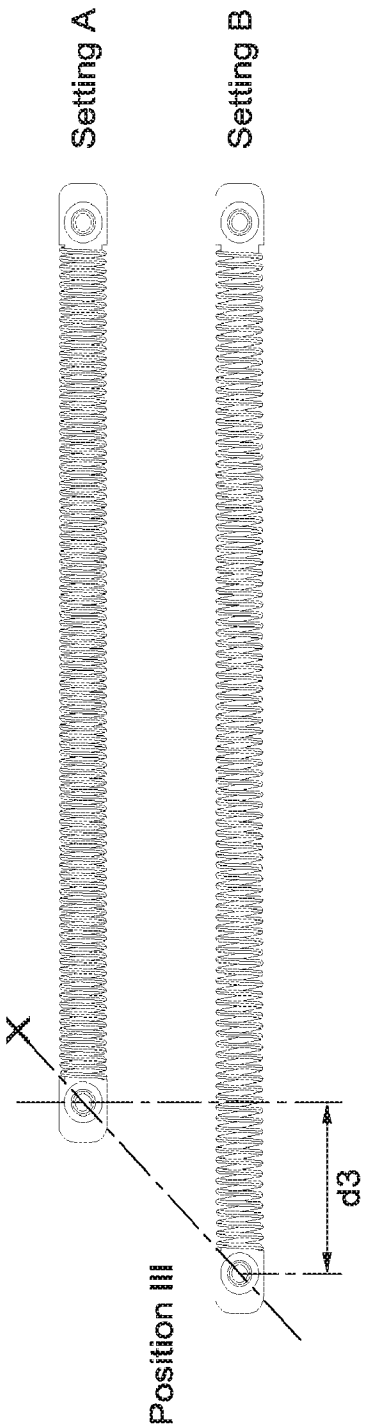


FIG. 11



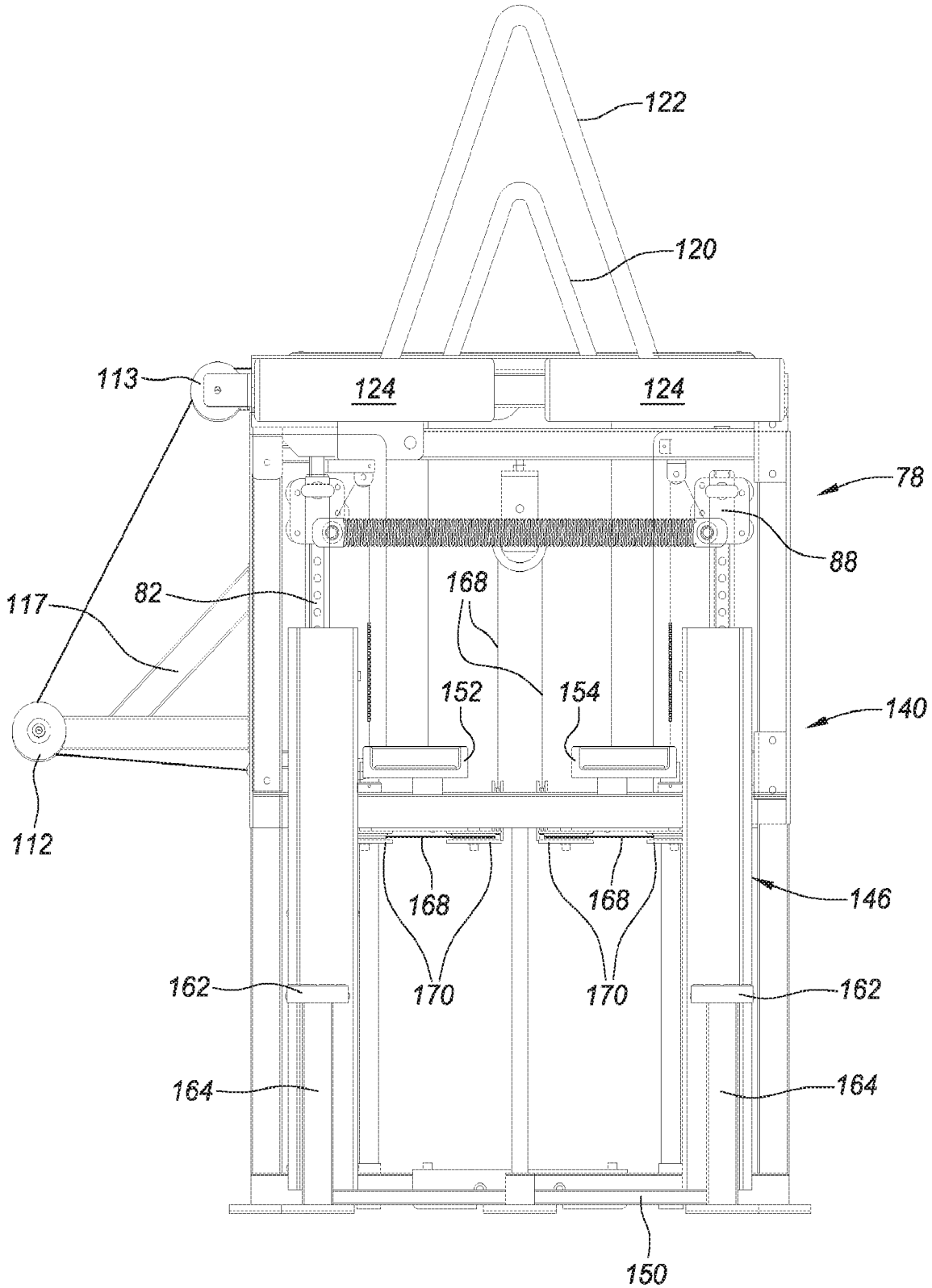

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FIG. 12

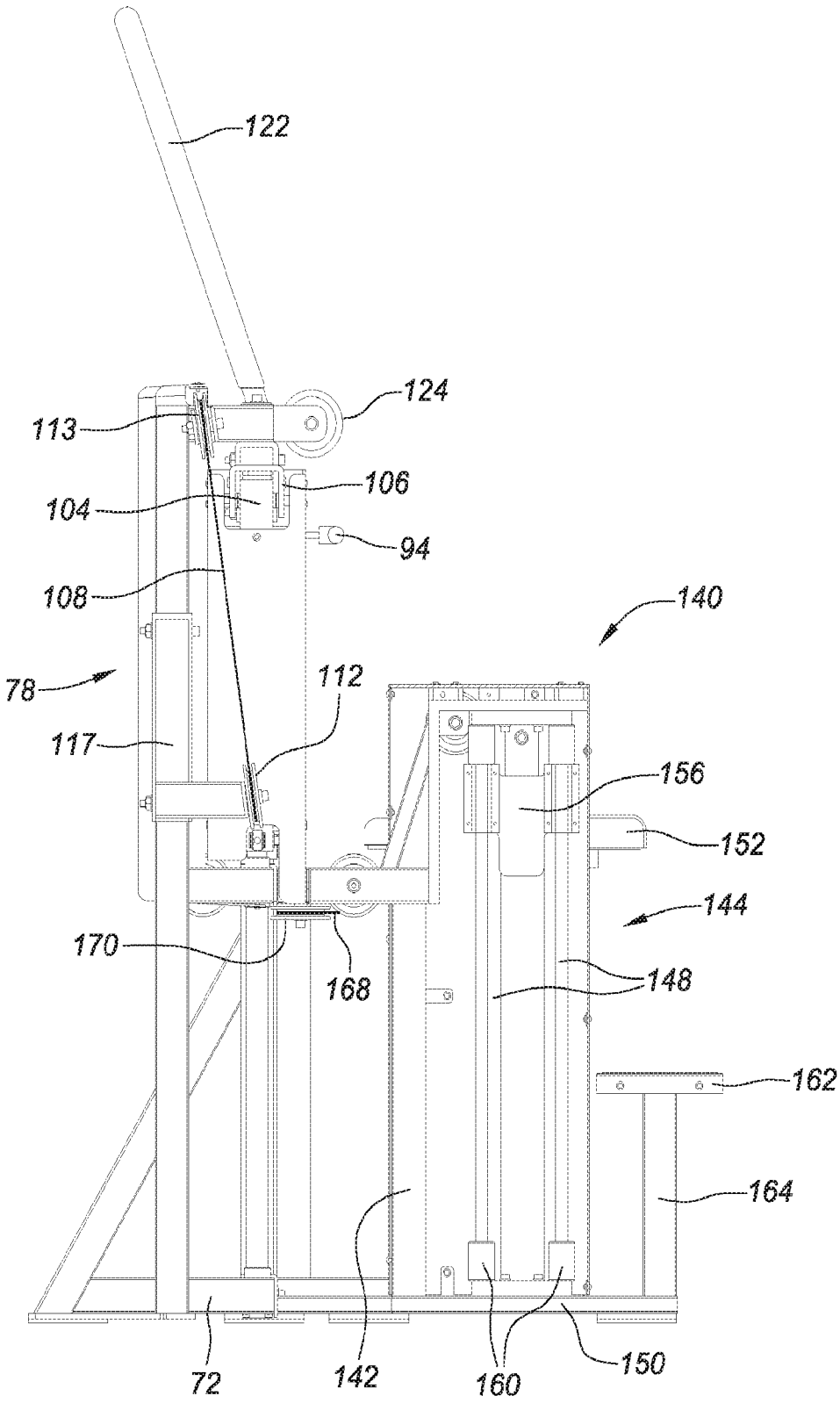
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FIG. 13

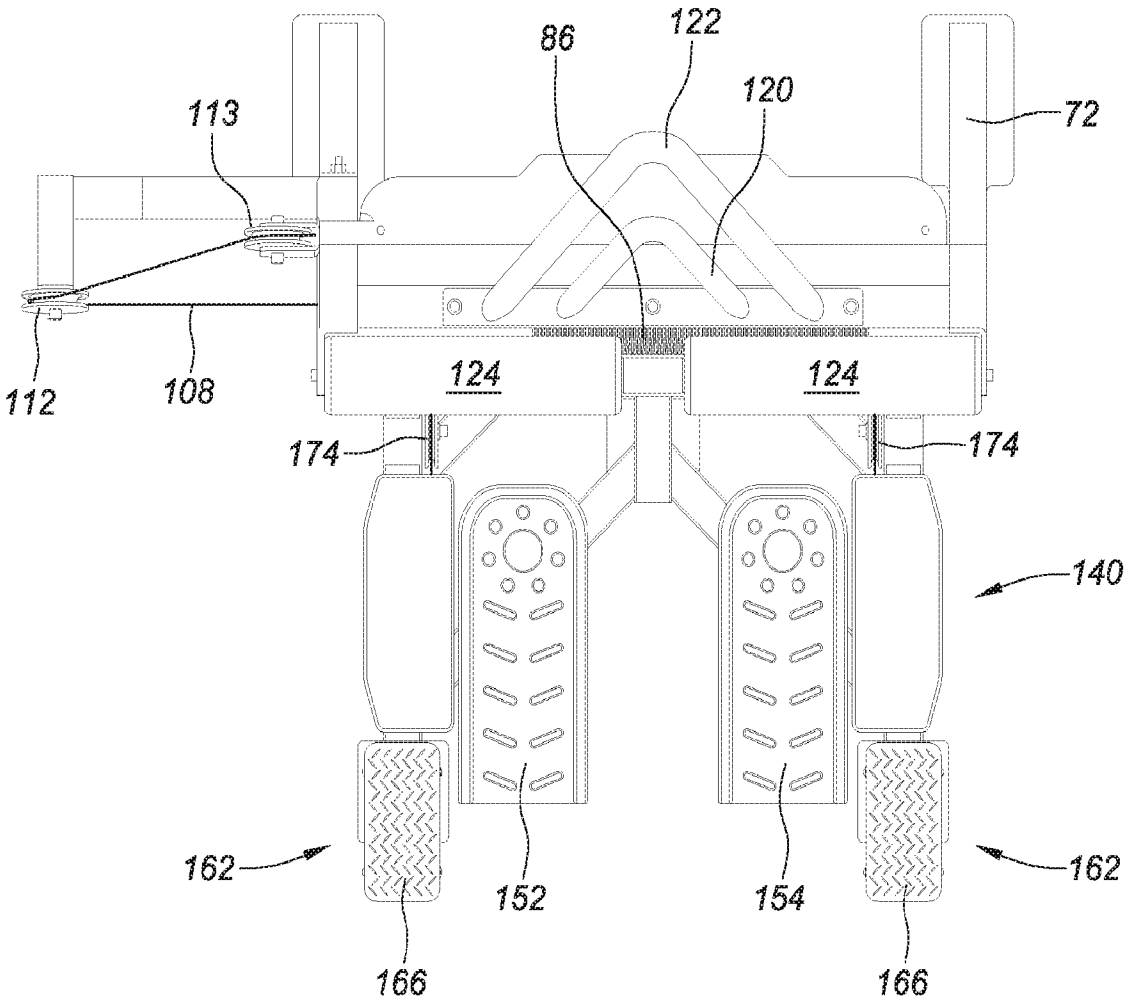
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FIG. 14

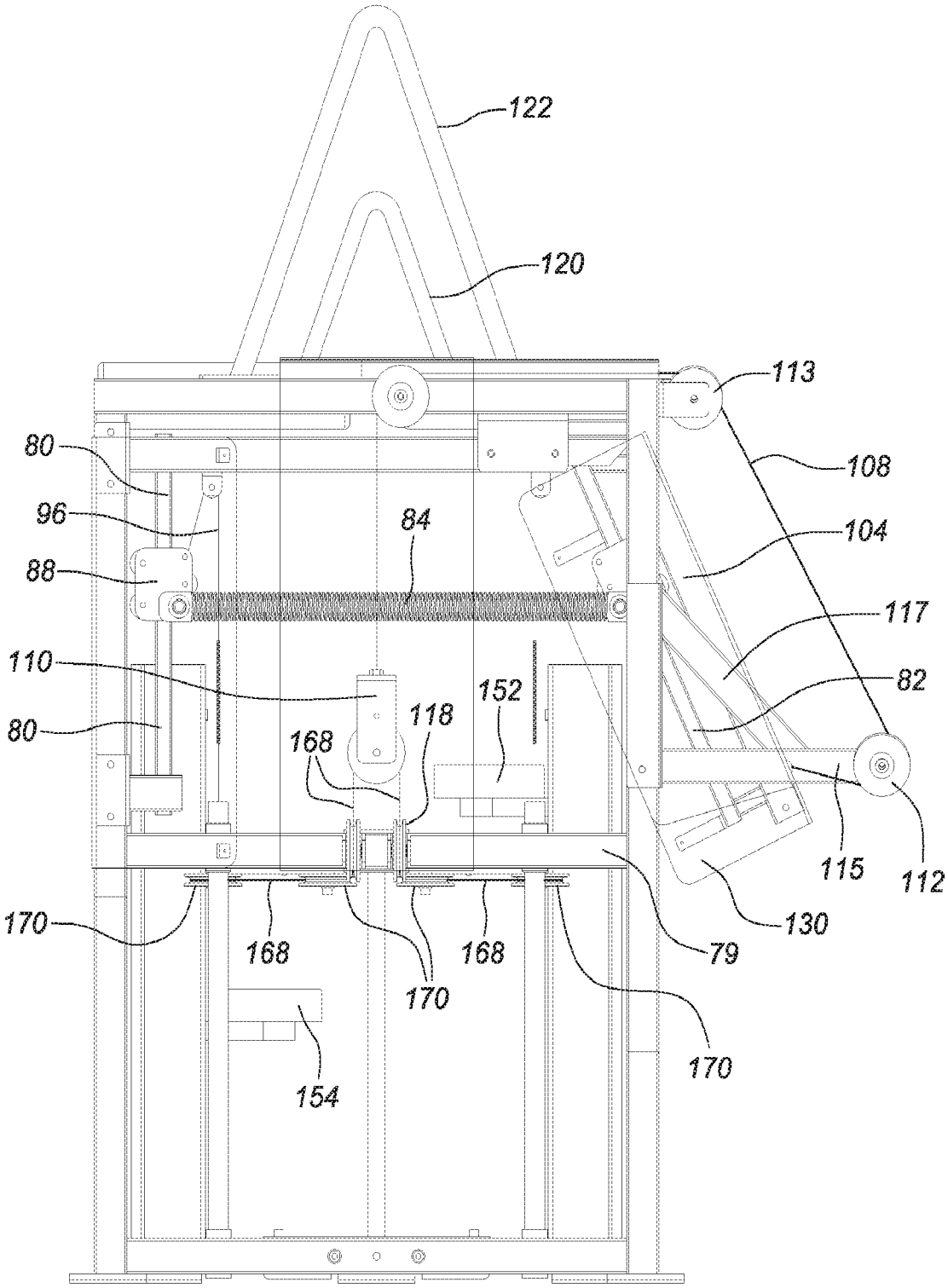
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FIG. 15

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2015/068270

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - A63B 23/04 (2016.01)
CPC - A63B 23/04 (2016.02)
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8) - A63B 21/02, 21/04, 21/055, 22/00, 22/04, 22/14, 23/04, 69/18, 71/00 (2016.01)
CPC - A63B 21/02, 21/04, 22/0046, 22/0056, 22/0061, 22/04, 23/04 (2016.02)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC - 434/253; 482/51, 52, 70, 79, 92, 93, 94, 101, 121, 122, 127, 129, 133, 135, 138 (keyword delimited)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PatBase, Google Patents, Google Scholar, Google
Search terms used: resistance, training, exercise, spring, biasing, expand, extend, stretch, cable, wire, cord, pulley, sheave, drum, wheel, feet, foot, leg, incline, slope, ramp, slant, lateral, track, adjustable arm, pivot arm

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4,902,006 A (STALLINGS, JR.) 20 February 1990 (20.02.1990) entire document	1-28
A	US 5,536,225 A (NEUBERG et al) 16 July 1996 (16.07.1996) entire document	1-28
A	US 5,222,928 A (YACULLO) 29 June 1993 (29.06.1993) entire document	1-28
A	US 5,180,351 A (EHRENFRIED) 19 January 1993 (19.01.1993) entire document	1-28
A	US 2004/0092368 A1 (GRAMACCIONI) 13 May 2004 (13.05.2004) entire document	1-28

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
08 April 2016	22 APR 2016
Name and mailing address of the ISA/ Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, VA 22313-1450 Facsimile No. 571-273-8300	Authorized officer Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2015/068270

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

See supplemental page

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☒ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2015/068270

Continued from Box No. III Observations where unity of invention is lacking

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees need to be paid.

Group I, claims 1-17 are drawn to an apparatus for providing resistance to a training machine.

Group II, claims 18-28 are drawn to a lateral step training machine.

The inventions listed in Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1, because under PCT Rule 13.2 they lack the same or corresponding special technical features for the following reasons:

The special technical features of Group I, an apparatus for providing resistance to a training machine comprising a first arm, a first adjustment means, a second arm, a second adjustment means, and a means affixed between the first and second adjustment means for resisting movement of the second arm relative to the first arm, wherein movement of one arm relative to the other can be accomplished only with the application of a force against the means affixed between the first and second adjustment means, are not present in Group II; and, the special technical features of Group II, a lateral step machine comprising two tracks, a first pedal slideably mounted on one track and a second pedal slideably mounted on the other track, a first pulley, a second pulley, a first cable, and a second cable, are not present in Group I.

Groups I and II share the technical features of a training machine comprising a support structure having a base and a frame extending upwardly from the base.
However, these shared technical features do not represent a contribution over the prior art. Specifically, US 5,823,920 A to Grider teaches of a training machine (exercise machine 10, Fig. 1) comprising a support structure (machine frame 12, Fig. 1) having a base (base 36, Fig. 1) and a frame (upright frame members 38 and a connecting frame portion 40, Fig. 1) extending upwardly from the base (38, 40 extend upwardly from 36, Fig. 1).

Since none of the special technical features of the Groups I-II inventions are found in more than one of the inventions, unity is lacking.