Elliptical exercise apparatus

In an exercise apparatus that includes a frame that is adapted for placement on the floor, a pivot axle supported by the frame, a pedal lever and a pedal, a mechanism is provided that allows the pedal to be selectively moved by a user relative to the pedal lever in order to produce a variety of elliptical paths. As a result, by varying the pedal position relative to the pedal lever, the corresponding elliptical path of the pedal can be changed, for example, relative to a fixed, horizontal plane, such as the floor, to simulate an uphill, horizontal or downhill gait.
FIELD OF THE INVENTION

[0001] The present invention relates generally to exercise equipment and, more particularly, to exercise equipment which can be used to provide a user with an elliptical step exercise.

BACKGROUND OF THE INVENTION

[0002] There are a number of different types of exercise apparatuses that exercise a user's lower body by providing a generally elliptical stepping motion. These elliptical stepping apparatuses provide advantages over other types of exercise apparatuses. For example, the elliptical stepping motion generally reduces shock on the user's knees as can occur when a treadmill is used. In addition, elliptical stepping apparatuses tend to produce a more natural foot motion than certain other types of exercise apparatuses. Examples of elliptical stepping apparatuses include U.S. Pat. Nos. 5,383,829; 5,499,956; 5,685,804; 5,759,136; 5,762,588; 5,779,599; 5,792,026; 5,899,833; 6,099,439 and 6,217,486.

[0003] However, known elliptical stepping exercise apparatuses suffer from various drawbacks. For example, some apparatuses are limited to certain predetermined elliptical paths and thus are limited to certain foot motions.

SUMMARY OF THE INVENTION

[0004] It is therefore it is one object of the invention to provide an elliptical stepping exercise apparatus that can be adjusted to vary the elliptical path of a foot supporting member.

[0005] Another object of the invention is to provide an elliptical stepping apparatus that can be adjusted to the individual needs and desires of different users.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] FIG. 1 is a side perspective view of the left hand portion of an elliptical step apparatus employing the preferred embodiment of the invention;

[0007] FIG. 2 provides a side view of the present invention illustrating an inclined, a neutral, and a declined elliptical pedal path for 0°, 90°, 180° and 270° crank orientations;

[0008] FIG. 3 is a combined schematic and block diagram of the preferred embodiment of the invention; and

[0009] FIG. 4 is a front view of a console for use with the apparatus of FIG. 14.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0010] FIG. 1 is an example of an elliptical step apparatus 10 which provides an illustrative environment for describing the invention. It will be appreciated that the invention can be used in many other elliptical step mechanisms such as the mechanisms described in the patents listed above. For simplicity, FIG. 1 provides a perspective view of the components of the left portion of the apparatus 10, although it is to be understood, that the right portion of the apparatus 10 would include like components that operate in a like fashion.

[0011] As shown in FIG. 1, the representative elliptical step apparatus 10 includes a frame, shown generally at 12. The frame 12 includes a set of vertical support members 14, 16A, and 16B, that are secured to a longitudinal support member 18. The frame 12 further includes a pair of members 20 and 22 that are also secured to the longitudinal support member 18 and are configured for placement on a floor 24 or other generally horizontal support surface. The apparatus 10 further includes a rocker 30, a pedal 32, a pedal actuation assembly indicated at 34 and a resistance assembly indicated. In this example of an elliptical step apparatus, the motion controlling assembly 36 includes a pulley 38 mounted for rotation on an axle 40 along with resistive force and control components including an alternator 42 of the type described in more detail in U.S. Patent No. 6,217,486. Also in this example 10 of an elliptical step apparatus, the pedal actuation assembly 34 includes a pedal lever 44 and a stroke link 46 connected to the pedal 32 at one end and connected to an extension arm 48 at the other end. In addition the pedal actuation assembly 34 includes, and a crank member 50 having the extension arm 48 attached to its distal end and rotatable around the axle 40 with a roller 52 also mounted for rotation on its distal end for supporting the rearward portion of the pedal lever 44. As illustrated in FIG. 1, the crank 50 is pivotally coupled between pivot axle 40 and the roller 48 in a manner similar to that disclosed in the aforementioned '486 Patent. In this embodiment 10, the rocker 30 provides a generally linear or horizontal movement to the forward end of the pedal lever 44 and the pedal actuation assembly 34 provides a vertical as well as horizontal motion to the rearward end of the pedal lever 44 resulting in a generally elliptical foot path for the pedal 32 with its major axis generally parallel to the floor 24. This type of motion can be achieved by other arrangements such as having the first end of the pedal lever move along a linear or curved track. By the same token, a pedal actuation assembly can include a variety of other mechanical arrangements to achieve motion of the rearward end of the pedal lever 44 in a generally elliptical or circular motion with respect to the pivot axle 40 including simply connecting of this embodiment 10 which provides an illustrative environment for describing the invention. It will be appreciated that the invention can be used in many other elliptical step mechanisms such as the mechanisms described in the patents listed above. For simplicity, FIG. 1 provides a perspective view of the components of the left portion of the apparatus 10, although it is to be understood, that the right portion of the apparatus 10 would include like components that operate in a like fashion.

[0012] In order to provide a method of repositioning the pedal 32 on the pedal lever 44, the preferred embodiment of exercise apparatus 10 includes a mechanism for selectively moving the pedal 32 into different positions along the length of the pedal lever 44. As shown if FIG. 1, the each side of the pedal 32 is configured with a pair
of downwardly extending brackets 54 effective to retain the pedal 32 on an upper planar 56 surface of the pedal lever 34 while permitting the pedal 32 to move forward and aft along the pedal lever 44. In this embodiment of the invention, an actuator assembly 58 is secured to the pedal lever 44 and the pedal 32. In this arrangement, the actuator assembly 58 includes a shaft 60 secured at each end to the pedal lever 44 and a linear motor mounted 62 on the shaft 60 and attached to the pedal bracket 54. It should be noted that the actuator assembly 58 can be located on either side as well as the top or bottom of the pedal lever 44 depending upon the characteristics of a particular design of the apparatus 10. The linear actuators 62 are coupled to the pedals 32 such that the pedal 32 can be moved along the upper surface 56 of the pedal lever 44 between an aft position, see the foot path ellipse A in FIG. 2; an intermediate position, see the foot path ellipse B in FIG. 2; and a forward position, see the foot path ellipse C in FIG. 2. Each of these various positions can produce a modified elliptical path capable of simulating a downhill, neutral, or an uphill gait.

In this particular mechanism 10, the stroke link 46 is pivotally interconnected between pedal 32 and crank 50 and has a fixed length. Accordingly, as pedal 32 is placed in different locations along the top of the pedal lever 34 by the actuator mechanism 58, the corresponding shape of the elliptical path traversed by the pedal 32 will be substantially the same for each position but the major axis of the ellipse will be in either an inclined position, an intermediate position, or a declined position with respect to the floor 24. This variation in the elliptical path of pedal 32 is illustrated by the ellipses A, B and C in FIG. 2.

FIG. 2 provides an illustration of an arrangement producing the elliptical path A generally inclined upwardly with respect to the floor 24. Specifically, FIG. 2 shows exercise apparatus 10 in one of four stages of rotation—the crank 50 at 0°, 90°, 180°, and 270°. As can be seen for ellipse A, the pedal 32 is positioned in a far aft position relative to the pedal lever 44. In other words, the actuator mechanism 58 has moved the pedal 32 rearward. Because stroke link 46 is a fixed length, this movement of the pedal 32 rearward causes the pedal lever 44 to be driven forward and the rocker 30 in a clockwise direction. A consequence of varying the relative geometry of the system is that the elliptical path B has a modified orientation. As can be seen in FIG. 2, the elliptical path B is traverses throughout the cycle. The elliptical path B is less-inclined than that described in connection with the elliptical path A and serves to simulate a horizontal gait. In other words, the major axis of the elliptical path B is generally parallel to a horizontal plane or the floor 24.

As before, a consequence of this varying of the relative geometry of the system is a tilted elliptical path C that is tilted downwardly with respect to the floor 24. As illustrated, the pedal 32 is positioned in a forward position on the pedal lever 44, that is, the actuator assembly 58 has been used to move the pedal 32 to its most forward position. As before, a consequence of this varying of the relative geometry of the system is the elliptical path C. As can be seen in FIG. 2, the elliptical path C is declined to the left in the figure and serves to simulate a downhill gait. In other words, the major axis of the elliptical path C is declined relative to a horizontal plane.

FIG. 3 is a combined schematic and block diagram that provides a further illustration of the invention and a preferred method of operation. The mechanical portions of the elliptical step apparatus 10 are shown in schematic form with, again, only one side of the apparatus 10 illustrated. A microprocessor 200 contained within a console 202 is used to control the actuator mechanisms 58 via a signal line 204. As is conventional in exercise apparatus, a data input center 206 is included in the console 202 and generally includes a keyboard 207 and various switches to allow a user to input data and to control the apparatus.

FIG. 4 provides a view of the console 202 where, as is conventional the console 202 includes various displays such as a video display 208 and a set of LED indicators or displays 210. In one embodiment of the invention, the data center 206 can include a switch 212, shown in FIG. 4, that for purposes of describing this embodiment of the invention can be termed a "stride incline" switch. In this embodiment, operation of the stride incline switch 212 will cause the microprocessor 200 to activate the actuators 58 so as to reposition the pedals 32 along the pedal levers 44 thus altering the orientation of the pedal ellipse path. For example, the user can use the incline switch 212 to selectively change the incline of the ellipse as shown in FIG. 2. Also, the location of the pedals 32 or the degree of incline can be shown on the display 208. In some embodiments of the invention it would also be desirable to equip the pedal levers 44 or the actuator mechanisms 58 with position sensors to provide the microprocessor 200 with a positive indication of the location of the pedals 32 on the pedal levers 44. Similarly, the microprocessor 200 can be programmed to insure that the actuators 58 move both pedals 32 at the same time and in the same direction as well as being located in the same relative position on the pedal levers.
Additionally, the microprocessor 200 can be programmed with user programs that would for example provide an interval type exercise workout where the incline of the ellipse varies periodically from horizontal to either a positive or negative inclination. Thus, an elliptical step apparatus of the type 10 as described above, can provide a wide variety of exercise programs simulating either a downhill, neutral, or uphill gait without the need for risers or other cumbersome structures and further the apparatus can be tailored to meet an individual user’s unique tastes or training desires.

The foregoing description of the invention is merely exemplary in nature. The invention was described in terms of an elliptical step apparatus of the type shown in U.S. Patent No. 6,217,486 where a pedal lever rides on a roller attached to a crank arm. However, there are a large variety of elliptical step mechanisms, such as the devices shown in U.S. Patent Nos. 5,383,829, 6,176,814 and 6,099,439 where the relative position of a foot pedal on a pedal lever or its equivalent can be selectively changed in order to alter the orientation of the generally elliptical path of a user’s foot motion. As an example, in an elliptical step apparatus where the pedal lever is connected directly to the end of the crank 50 and a stroke link 46 and roller 52 are not used, the actuator mechanism 58 can still be used with the pedal lever of the type 56 as shown. Moreover, the specific mechanical components described represent the preferred embodiment of the invention in terms of the particular apparatus 10 used as the environment for describing the invention and as a result, depending upon the size, cost and other factors the use of other components might become desirable. For example, the actuator mechanisms 58 are described as electrically operated linear actuators 62 but other actuators such as hydraulic actuators can be used for certain applications. By the same token, in some applications, it might be desirable to use a manually operated pedal mounting mechanism for selectively locating a pedal on a pedal lever or its equivalent where such a mechanism might include a simple pin and hole arrangement or a mechanical latch.

Claims

1. An exercise apparatus comprising:

   a frame;
   a pivot axel rotatably supported by said frame;
   a pedal lever having a first and a second end;
   a first assembly engaged with said pedal lever to permit said first end of said pedal lever to move in a generally linear direction;
   a second assembly including a member secured to said pivot axel engaged with said pedal lever to permit said second end of said pedal lever to move in a generally circular or elliptical motion with respect to said pivot axel; and
   a pedal mounting mechanism including a pedal movably secured to said pedal lever such that said pedal is selectively positionable in at least a first position and in a second position along the length of said pedal lever.

2. The exercise apparatus according to Claim 1 wherein said pedal mounting mechanism includes an actuator secured to said pedal lever and said pedal being effective to move said pedal from said first position to said second position.

3. The exercise apparatus according to Claim 1 wherein said pedal travels in a generally elliptical path and when said pedal is in said first position said elliptical path has a different orientation than when said pedal is in said second position.

4. The exercise apparatus according to Claim 1 wherein said first position of said pedal results in a generally inclined orientation of said elliptical path.

5. The exercise apparatus according to Claim 1 wherein said second position on said pedal lever results in a generally horizontal orientation of said elliptical path of said pedal.

6. The exercise apparatus of Claim 1 wherein said first assembly includes a rocker arm pivotally attached to said frame and wherein said second end of said pedal lever is pivotally attached to said rocker arm.

7. The exercise apparatus of Claim 1 wherein said second assembly said member is a crank arm secured to said pivot axel.

8. The exercise apparatus of Claim 1 wherein said second assembly includes a roller rotationally secured to said crank arm and supporting said pedal lever.

9. The exercise apparatus of Claim 2 wherein said actuator is a linear actuator.

10. The exercise apparatus of Claim 2 additionally including a console and a processor operatively connected to said actuator and said console having a data input center wherein said processor is effective to move said pedal from said first position to said second position in response to a user input to said data input center.

11. The exercise apparatus of Claim 10 wherein said data input center includes a stride incline switch.

12. The exercise apparatus of Claim 10 wherein said console includes a display for displaying the position of said pedal on said pedal lever.
13. An exercise apparatus comprising:

- a frame;
- a pivot axle supported by said frame;
- a pedal lever;
- a first assembly for connecting a first portion of said pedal lever to said pivot axle;
- a second assembly for connecting a second portion of said pedal lever to said frame;
- a pedal moveably mounted to said pedal lever; and
- a mechanism including an actuator for selectively moving said pedal to a plurality of positions on said pedal lever including a first position and a second position such that said pedal travels along a substantially inclined elliptical path when said pedal is in said first position and along a substantially horizontal elliptical path when said pedal is in said second position.

14. The exercise apparatus according to Claim 13, wherein said actuator is a linear actuator fixedly coupled to said pedal lever, said pedal being operably coupled to a portion of said linear actuator to permit said selectable movement of said pedal on said pedal lever.

15. The exercise apparatus according to Claim 13 wherein said substantially inclined elliptical path generally simulates an uphill gait.

16. The exercise apparatus according to Claim 13 wherein said substantially horizontal elliptical path generally simulates a horizontal gait.

17. The exercise apparatus according to Claim 13 additionally including user controls and a processor operatively connected to said actuator and said user controls thereby permitting a user to selectively move said pedal between said first position and said second position.

18. The exercise apparatus according to Claim 17 additionally including a display for displaying the position of said pedal on said pedal lever.

19. The exercise apparatus according to Claim 17 additionally including a display for displaying the incline of said elliptical path.

20. An exercise apparatus comprising:

- means, including a pedal mounted on a pedal lever, for generating an elliptical motion of said foot pedal; and
- means for selectively moving said pedal on said pedal lever to alter said elliptical motion.