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(54) ELLIPTICAL EXERCISER

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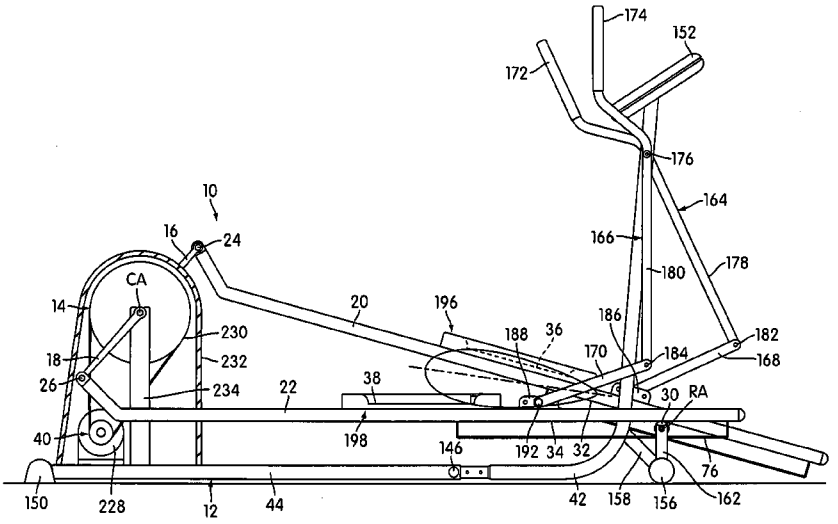
(52) **U.S. Cl.** **482/52**

(57) **ABSTRACT**

An elliptical exerciser comprising a frame, a crank assembly providing a crank axis fixed with respect to frame above the horizontal surface, crank assembly including oppositely extending left and right cranks providing parallel rotational axis spaced equidistantly from crank axis, left and right pedal members having rear portions connected with left and right cranks respectively, left and right rollers mounted on frame for rotation about a single rolling axis parallel with respect to crank axis in a forward position above the horizontal surface a distance less than the distance of crank axis above horizontal surface, left and right pedal members having straight downwardly facing surfaces rollingly supported on left and right rollers respectively, left and right pedal members providing left and right foot supporting structures of improved construction enabling a user to impart cyclical movements to the pedal members resisted by a variable resistance assembly, each cyclical movement including (1) a downward moving stroke wherein the ball of the user's foot moves forwardly along a first curved path merging into a relatively small generally arcuate end path and from generally arcuate forward end path rearwardly along a second curved path symmetrical to first path with respect to an axis of symmetry and (2) an upward return stroke wherein the ball of the user's foot moves rearwardly from second path rearwardly along a third curved path different from second path merging into a relatively large generally arcuate rearward end path and from generally arcuate rearward end path forwardly along a fourth curved path symmetrical to first path with respect to the aforesaid axis of symmetry, axis of symmetry extending downwardly and forwardly and having an extent between end paths which is generally equal to the distance between the parallel rotational axis provided by cranks and at least three times greater than the extent from a juncture between fourth and first curved paths to a juncture between third and second paths, the distance between crank axis and rolling axis, being at least three times greater than the distance between the parallel rotational axes provided by cranks.



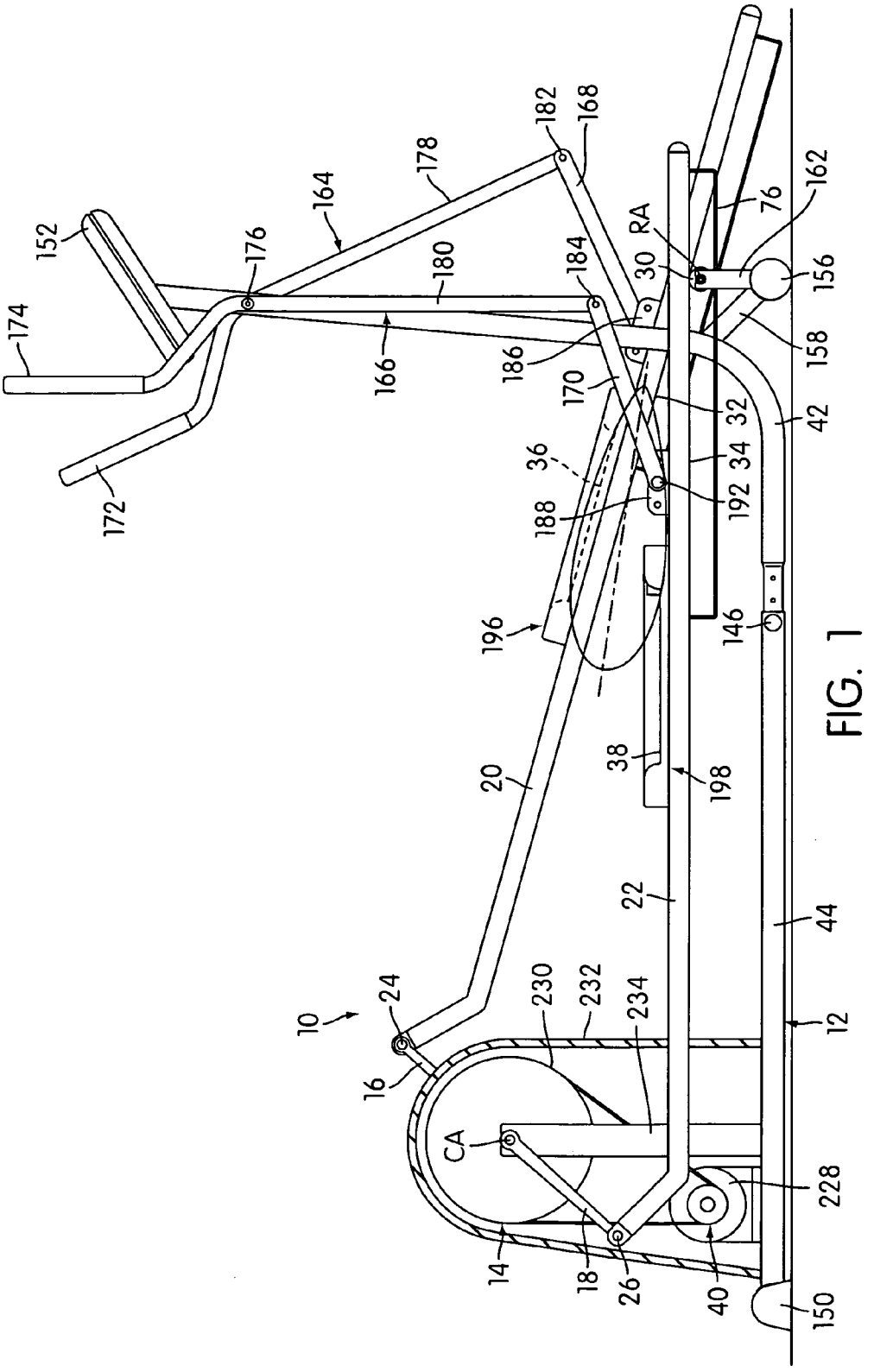

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FIG. 1

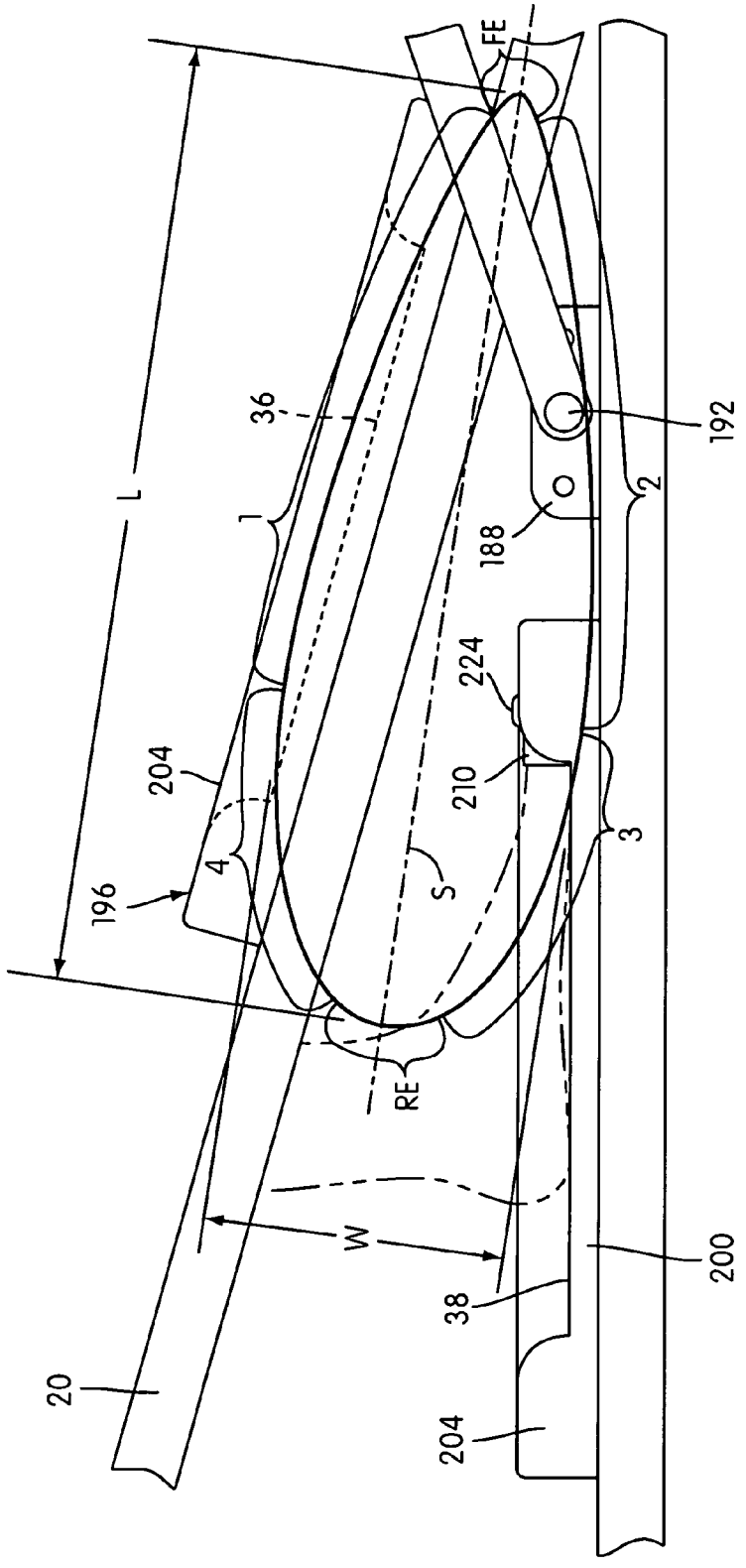

FIG. 1A

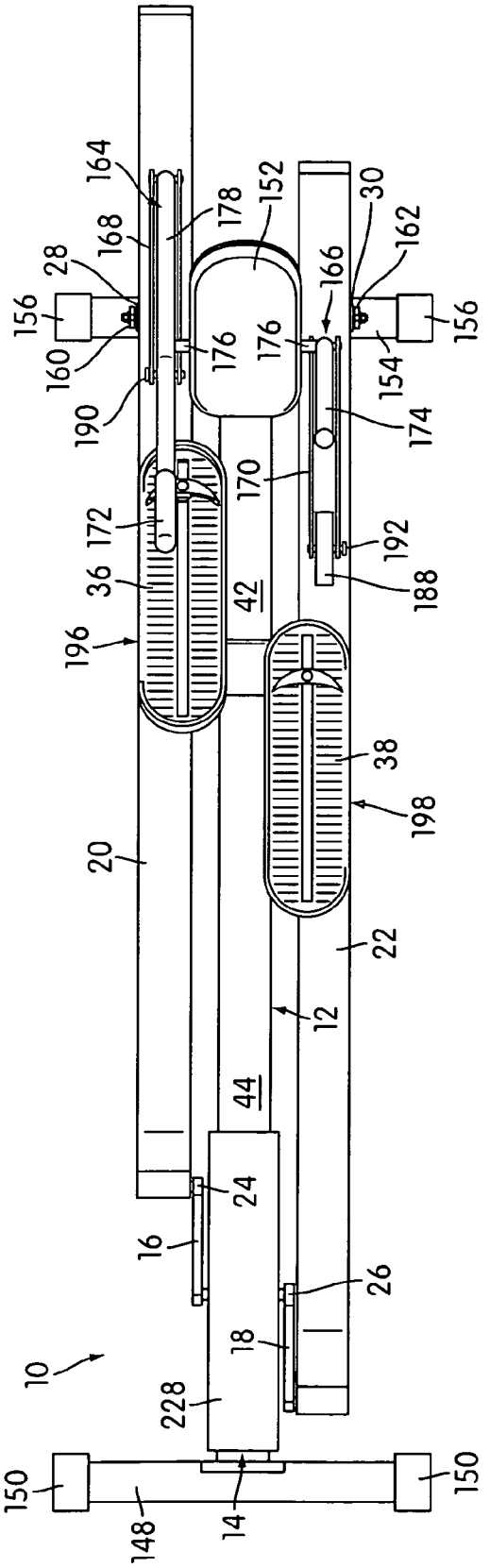
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FIG. 2

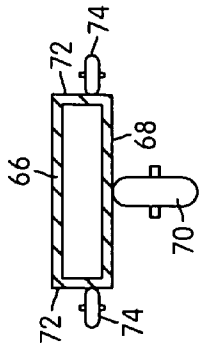


FIG. 6

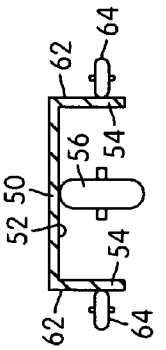


FIG. 5

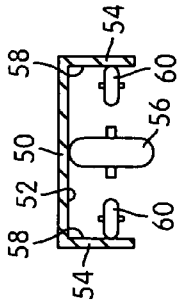


FIG. 4

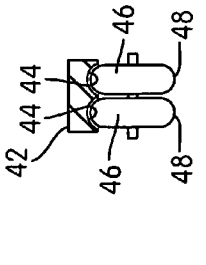


FIG. 3

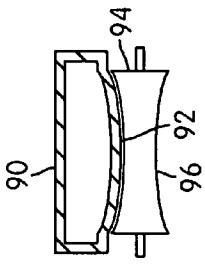


FIG. 10

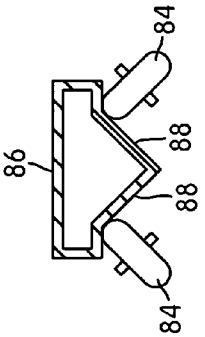


FIG. 9

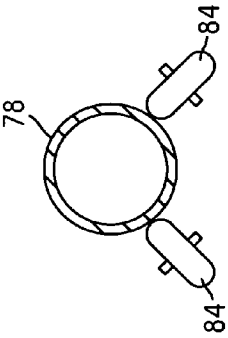


FIG. 8

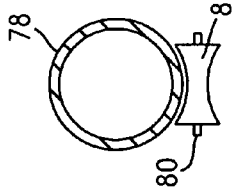


FIG. 7

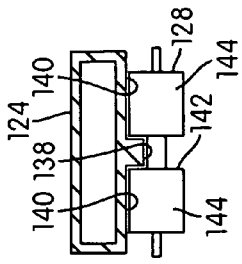


FIG. 14

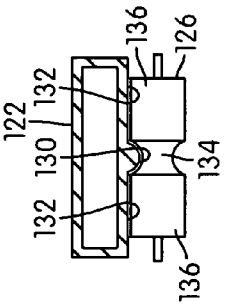


FIG. 13

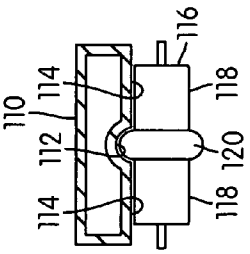


FIG. 12

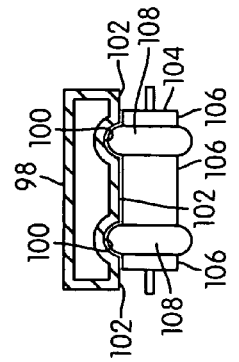


FIG. 11

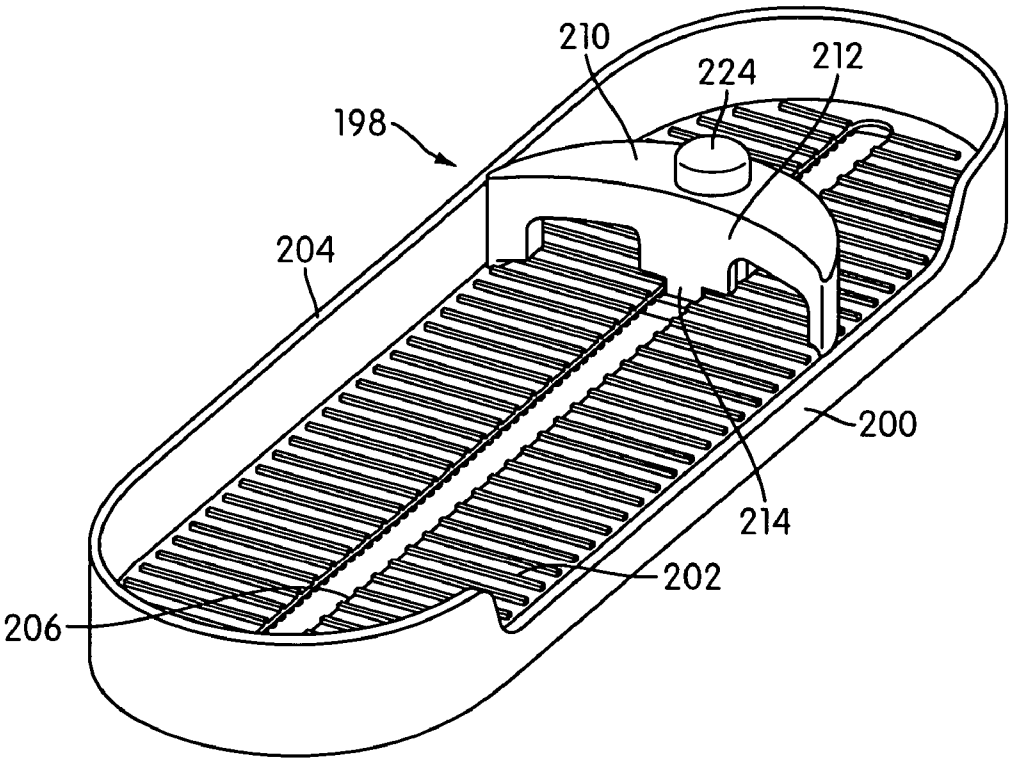


FIG. 15

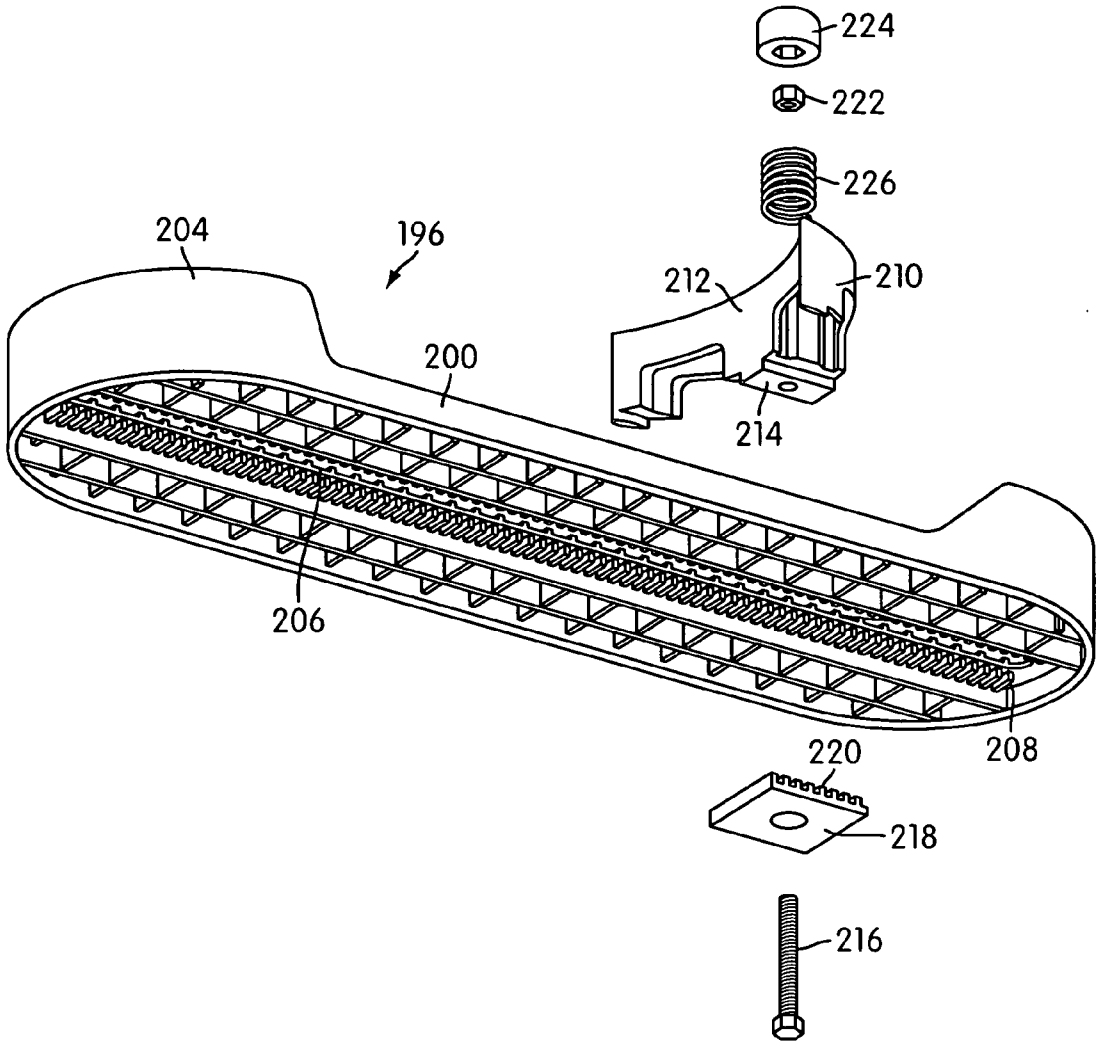


FIG. 16

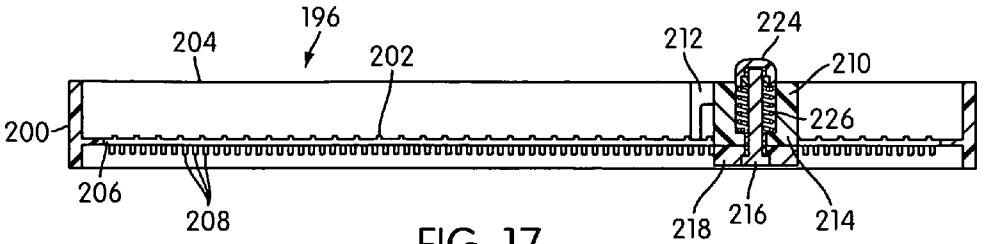


FIG. 17

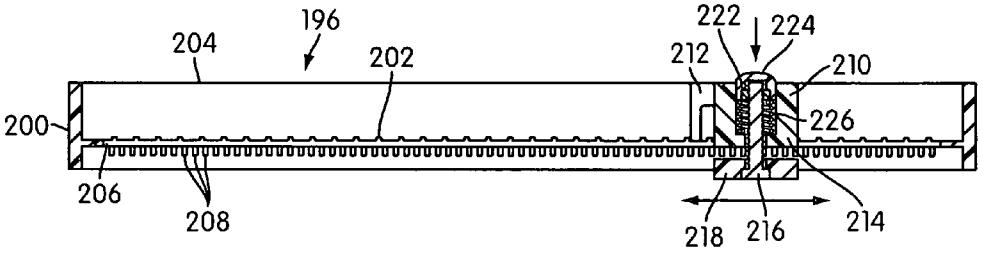
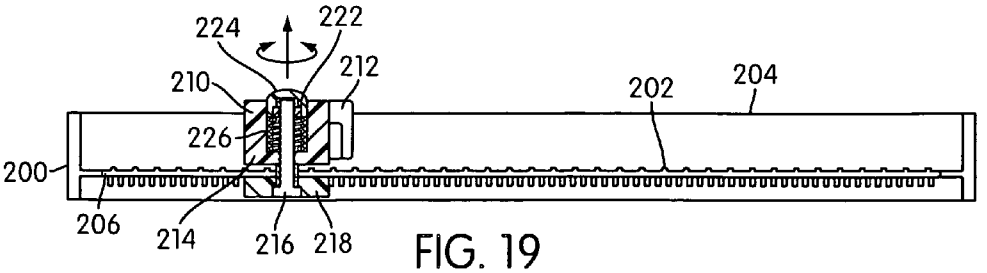


FIG. 18



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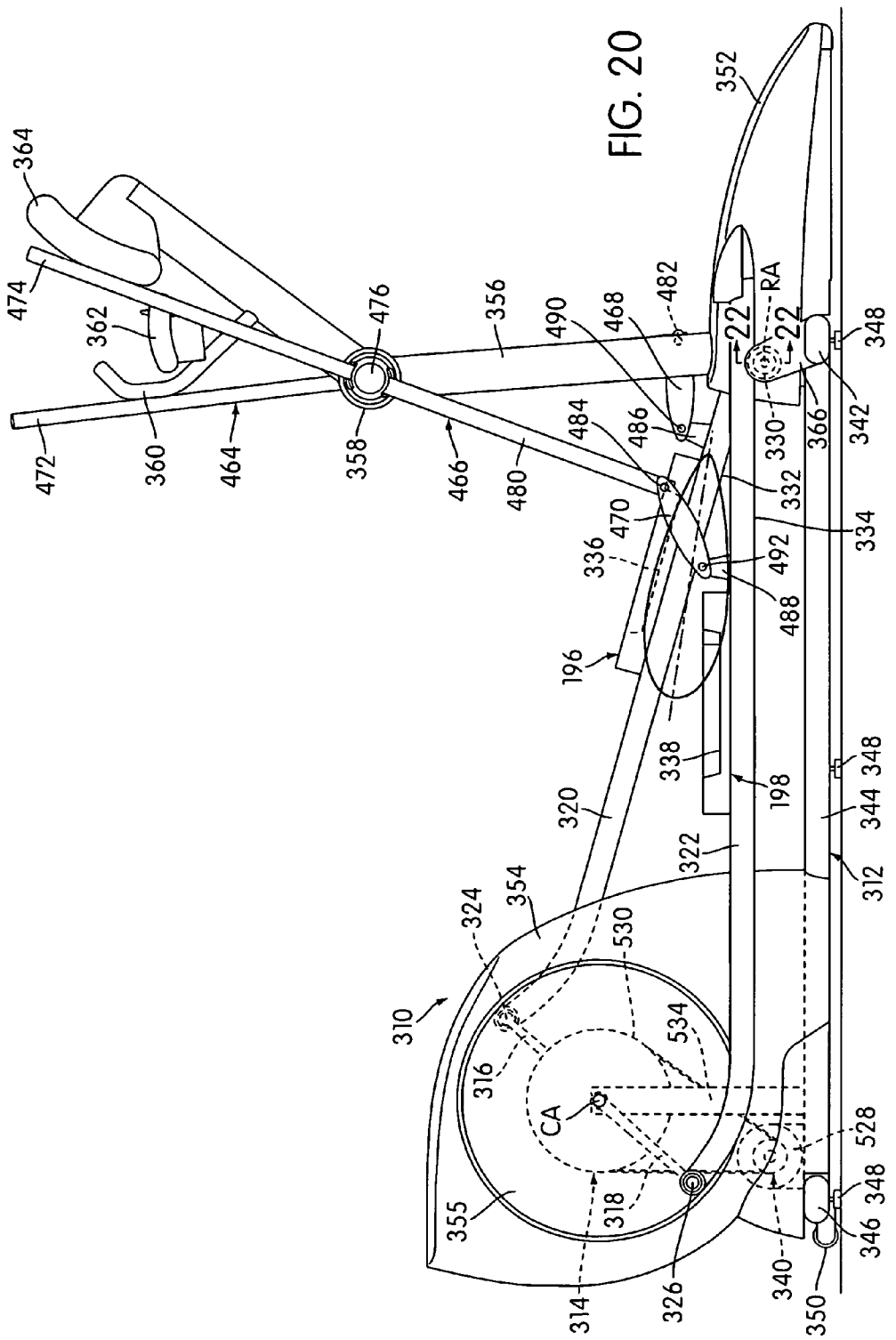
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FIG. 20

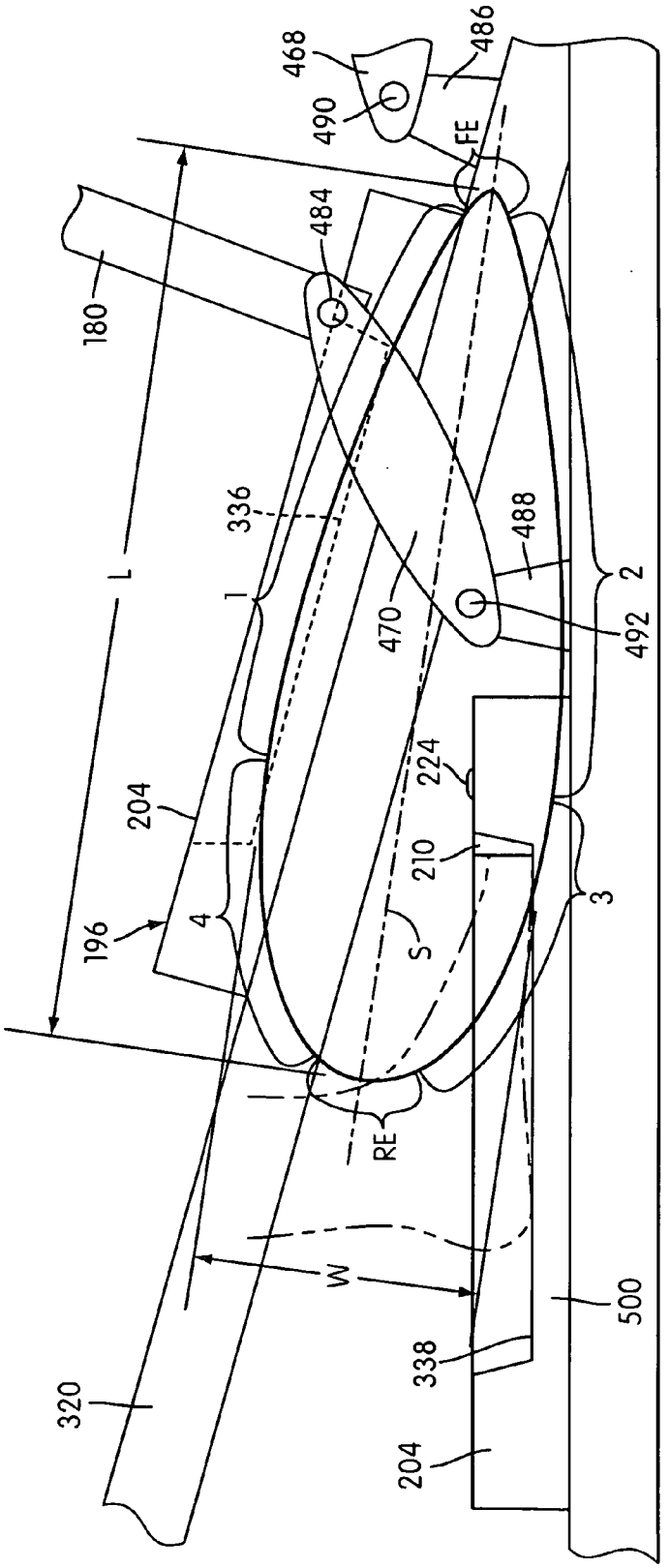
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FIG. 20A

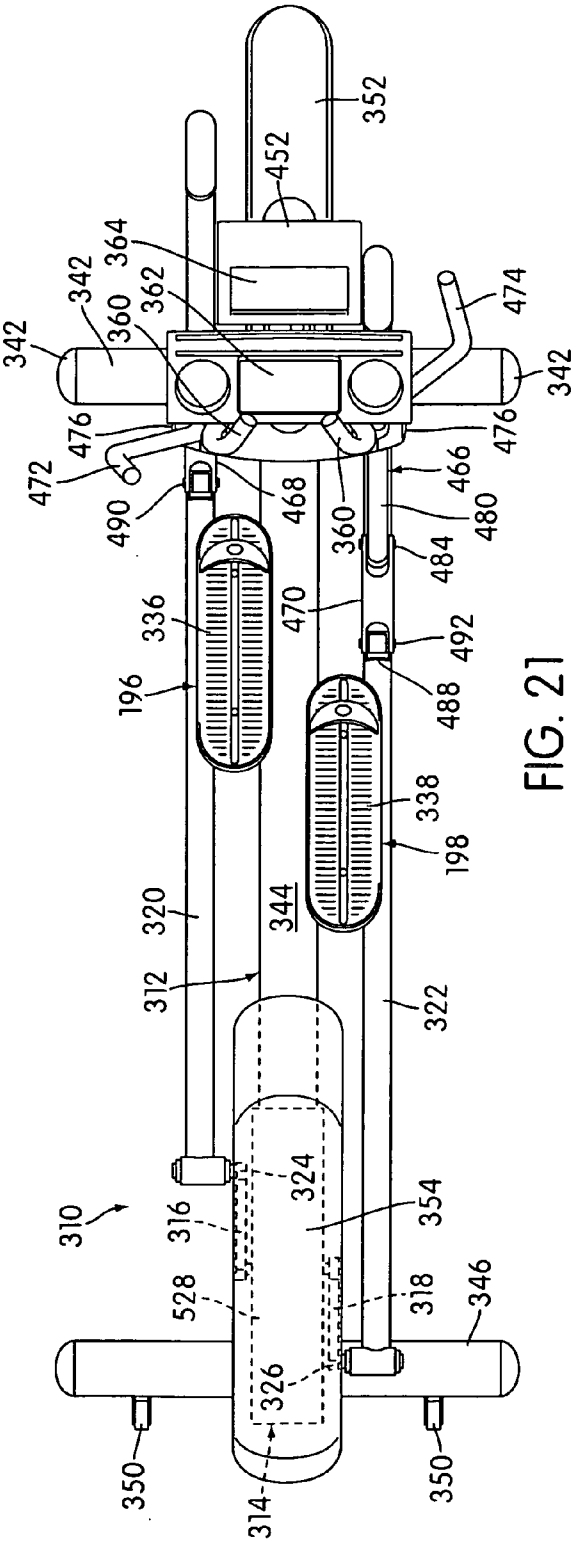
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FIG. 21

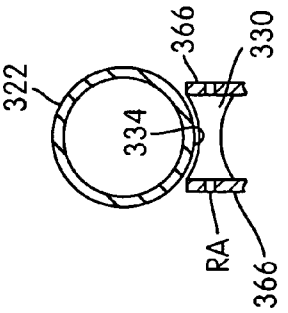
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FIG. 22

ELLIPTICAL EXERCISER

[0001] The present application claims priority to U.S. Provisional Application No. 60/697,989, filed Jul. 12, 2005, the entirety of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] Like most elliptical exercisers, the elliptical exerciser of U.S. Pat. No. 6,063,008 ("the '08 patent"), hereby incorporated by reference in its entirety, includes a frame arranged to be mounted in stable relation on a horizontal surface, a crank assembly rotatably mounted on a rearward portion of the frame including left and right cranks providing rotational connections with the rearward ends of the left and right pedal members, respectively.

[0003] The '008 patent elliptical exerciser also provides left and right rollers rotatably mounted on a forward portion of the frame. The left and right pedal members include downwardly facing surfaces which are rollingly supported on the left and right rollers, respectively. As a result of this construction, the forward ends of the left and right pedal members travel along one path during forward movement and a different path during rearward movement. This path configuration has been referred to in the prior art as a closed curved path. This closed curved path is distinguished from the reciprocating path most elliptical exercisers have.

[0004] A reciprocating path is known in the prior art as one in which the forward movement is along the same path as the rearward movement. Examples of elliptical exercisers having reciprocating paths are shown in U.S. Pat. No. 5,242,343 ("the '343 patent"), hereby incorporated by reference in its entirety. FIG. **4** of the '343 patent illustrates a typical elliptical exerciser having forward pedal member ends movable along arcuate reciprocating paths by means of pivotal connections with the lower ends of handle levers pivotally mounted on the frame. FIG. **5** of the '343 patent illustrates a typical elliptical exerciser having forward pedal member ends movable along straight reciprocating paths by means of rollers rotatably mounted on the forward ends of the pedal members which roll along straight tracks mounted on the frame.

[0005] Applicants have marketed and commercialized three versions of elliptical exercisers hat were similar in some respects to that disclosed in the '008 patent. The first version was designated Model 1700, the second version was designated Model 1720, and the third version was designated Model 1760. The three versions differed somewhat in the dimensions and relationship of the basic components provided.

[0006] For example, the Model 1700 provided a rear crank assembly with a crank radius of about 6.54", and a crank axis, indicated at CA in FIG. **1**, of about 9.33"above the floor. The crank radius is the distance between the crank axis, indicated at CA in FIG. **1**, and each rearward rotational axis defined by the pivots for the respective left or right pedal members. The roller assemblies provide a rolling axis, indicated at RA in FIG. **1**, spaced about 28.03" from the crank axis, indicated at CA in FIG. **1**, in a horizontal forward direction and about 1.64" in a vertical downward direction, and a roller radius of about 0.90". The forward distance between each of the parallel rotational axes of the crank assembly to the preferred position of the ball of the foot on the respective upper surface is about 18.50". The comparable dimensions for Model 1720 are a crank radius of about 7.125", a crank axis, indicated at CA in FIG. **1**, of about 15.25" above horizontal, a rolling axis, indicated at RA in FIG. **1**, of about 29.5" horizontally forward and about 9.00" vertically downward from the crank axis, indicated at CA in FIG. **1**, a roller radius of about 0.75" and forward distance of about 10". The comparable dimensions for Model 1760 are a crank radius of about 6.53", a crank axis, indicated at CA in FIG. **1**, of about 9.06" above horizontal, a rolling axis, indicated at RA in FIG. **1**, of about 28.92" horizontally forward and about 2.43" vertically downward from the crank axis, indicated at CA in FIG. **1**, a roller radius of about 0.90" and a forward distance of about 18.25".

[0007] While the marketing of the Model 1700, Model 1720 and Model 1760 achieved a modicum of success, the difference in the forward roller mount as compared with the reciprocating path type units provided a difference in operation and feel of the exerciser in use. The present invention stems, in part, from the inventors' recognition that the operating characteristics and feel of exercisers of the '008 patent type can be improved.

BRIEF SUMMARY OF THE INVENTION

[0008] The present invention provides several distinct and independently novel innovations over the known prior art.

[0009] For example, in accordance with the principles of one aspect of the present invention, an '008 patent type exerciser is provided with (1) a crank radius within an operative range of between 6" and 14", a preferred range of between 8" and 12", with a preferred example being approximately 10 inches, and (2) a crank axis, indicated at CA in FIG. **1**, spaced vertically above the floor within an operative range of between 15" and 23", a preferred range of between 17" and 21", with a preferred example being approximately 19.7". The rolling axis, indicated at RA in FIG. **1**, is (1) spaced horizontally forwardly from the crank axis, indicated at CA in FIG. **1**, within an operative range of between 52.25" and 68.25", a preferred range of between 56.25" and 64.25", with a preferred example being approximately 60.25", and (2) spaced vertically downwardly from the crank axis, indicated at CA in FIG. **1**, within an operative range of between 8.375" and 16.375", a preferred range of between 10.375" and 14.375", with a preferred example being approximately 12.375". The roller radius is within an operative range of between 0.125" and 3.0", a preferred range of between 0.31" and 1.30", with a preferred example being approximately 0.81". The forward distance from each rearward rotational axis to the fixed position on the upwardly facing surface of the respective pedal member where the ball of the foot is supported is (1) greater than one-half the length of the respective pedal member and (2) within an operative range of between 36.25" and 44.25", a preferred range of between 38.25" and 42.25", with a preferred example being approximately 40.25".

[0010] The improvement described above results in the each cyclical movement imparted to each pedal member to include: (1) a downward moving stroke wherein the ball of the user's foot moves forwardly along a first curved path merging into a relatively small generally arcuate end path and from the generally arcuate forward end path rearwardly along a second curved path symmetrical to first path with

respect to an axis of symmetry and (2) an upward return stroke wherein the ball of the user's foot moves rearwardly from second path rearwardly along a third curved path different from second path merging into a relatively large generally arcuate rearward end path and from the generally arcuate rearward end path forwardly along a fourth curved path symmetrical to the third path with respect to the aforesaid axis of symmetry. The axis of symmetry extends downwardly and forwardly and has an length between end paths which is generally equal to the distance between the parallel rotational axis provided by the cranks and at least three times greater than the width from a juncture between fourth and first curved paths to a juncture between third and second paths. The distance between the crank axis, indicated at CA in FIG. **1**, and the rolling axis, indicated at RA in FIG. **1**, is at least three times greater than the distance between the parallel rotational axes provided by the cranks.

[**0011**] Another aspect of the present invention stems from the one dimension and range, indicated above as embodying the principles of the present invention, which differ the most from the prior art commercial '008 type elliptical exercisers; namely, the horizontal length dimension between the crank axis, indicated at CA in FIG. **1**, and the rolling axis, indicated at RA in FIG. **1**. This increased dimension results in the other aspect of the present invention which is to position the foot supporting structures laterally close together an optimum distance of about 60 mm between the inner walls of the foot supporting structures. This increased length dimension also makes it possible to provide a generous fore and aft foot area between the fore and aft walls of the foot structures. The result as that when each foot supporting structure is at its rearmost position it is still forward of the casing housing the variable resistance assembly. Consequently, the foot supporting structures are not limited in lateral spacing by the width of the casing. A preferred arrangement leaves the entire space between the foot supporting structures free of interfering structure throughout their travel.

[**0012**] Another aspect of the present invention resides in providing a frame including a forward frame portion defining a rolling axis, indicated at RA in FIG. **1**, thereon and a separate rearward frame portion defining a crank axis, indicated at CA in FIG. **1**, thereon. The frame portions are mounted with respect to another for selective movement into one of a series of fixed operative positions wherein the horizontal distance between the crank axis, indicated at CA in FIG. **1**, and the rolling axis, indicated at RA in FIG. **1**, is disposed at a selected distance with a range of different distances. In one embodiment, the forward and rearward frame portions are telescopically interrelated.

[**0013**] Another aspect of the present invention is to provide various specific roller configurations and cooperating pedal member roller engaging surfaces.

[**0014**] Another aspect of the present invention is the provision of left and right handle levers pivoted to the frame intermediate ends thereof. The left and right handle levers have upper portions defining left and right handles to be manually gripped by the user and lower portions interconnected to the left and right pedal members by left and right links, respectively, pivotally connected at forward ends thereof to corresponding lower end portions of the left and right handle levers, respectively, and at rearward ends thereof to the left and right pedal members.

[**0015**] Still another aspect of the present invention is the provision of an '008 patent type elliptical exerciser in which each of the foot supporting structures include forward upstanding barrier structure disposed in a position to prevent the users foot from moving forwardly with respect to the respective upwardly facing surface. Each forward upstanding barrier structure is mounted on the respective pedal member for selective movement with respect to the foot engaging upwardly facing surface thereof into a selected forward fixed toe engaging operative position within a range of forward fixed toe engaging operative positions spaced different distances from the respective rearward rotational axis and/or a rearward 180° turned fixed heel engaging position within a range of rearward 180° turned fixed heel engaging positions with respect to the foot engaging upwardly turned surfaces of the respective pedal member spaced different distances from the respective rearward rotational axis.

BRIEF DESCRIPTION OF THE DRAWINGS

[**0016**] FIG. **1** is a side elevational view of an elliptical exerciser of the type represented by the '008 patent improved in accordance with the principles of the present invention;

[**0017**] FIG. **1**A is a fragmentary enlarged view of the portion of FIG. **1** which illustrates the path of the users foot movement with a typical users foot shown in dotted lines.

[**0018**] FIG. **2** is a top plan view of the exerciser shown in FIG. **1**;

[**0019**] FIGS. **3** through **14** are similar cross-sectional views of different cooperating components relating to the rolling support of the forward end of the pedal members;

[**0020**] FIG. **15** is a perspective view of a foot supporting assembly improvement constructed in accordance with the principles of the present invention;

[**0021**] FIG. **16** is an exploded view of the assembly shown in FIG. **16**;

[**0022**] FIG. **17** is a longitudinal sectional view of the assembly shown in FIG. **16**;

[**0023**] FIG. **18** is a view similar to FIG. **18** showing the parts after an initial movement to effect a longitudinal movement of the foot barrier structure;

[**0024**] FIG. **19** is a view similar to FIG. **18** showing the position of the parts after an initial movement to effect a 180° turning movement of the foot barrier structure;

[**0025**] FIG. **20** is a side elevational view of another embodiment of a elliptical exerciser of the type represented by the '008 patent improved in accordance with the principles of the present invention;

[**0026**] FIG. **20**A is a fragmentary enlarged view of the portion of FIG. **20** which illustrates the path of the users foot movement with a typical users foot shown in dotted lines;

[**0027**] FIG. **21** is a top plan view of the elliptical exerciser shown in FIG. **20**; and

[**0028**] FIG. **22** is an enlarged fragmentary sectional view taken along the line **22-22** of FIG. **20**.

DETAILED DESCRIPTION OF THE INVENTION

[0029] Referring now more particularly to the drawings, there is shown in FIG. **1** an elliptical exerciser, generally indicated at **10** embodying certain principles of the present invention. The exerciser **10** includes a frame, generally indicated at **12**, constructed and arranged to be stably supported on a horizontal surface. Mounted in a rearward position above the horizontal surface is a crank assembly, generally indicated at **14**, providing a crank axis, indicated at CA in FIG. **1**, fixed with respect to the frame **12**. The crank assembly **14** includes oppositely extending left and right cranks **16** and **18** providing parallel rotational axes spaced equidistantly from the crank axis, indicated at CA in FIG. **1**, and displaced 180° with respect to one another.

[0030] The crank assembly **14** provides a rearward mounting assembly for left and right pedal members **20** and **22** having rear portions connected, as at **24** and **26**, with the left and right cranks **16** and **18** respectively for rotational movement about the respective rotational axis thereof. The left and right pedal members **20** and **22** are supported by a forward mounting assembly in the form of left and right rollers **28** and **30** mounted on the frame **12** for rotation about a single rolling axis, indicated at RA in FIG. **1**, parallel with respect to the crank axis, indicated at CA in FIG. **1**, in a forward position above the horizontal surface a distance less than the distance of the crank axis, indicated at CA in FIG. **1**, above the horizontal surface.

[0031] The left and right pedal members **20** and **22** have straight downwardly facing surfaces **32** and **34** respectively at forward end portions thereof rollingly supported on the left and right rollers **28** and **30** respectively. The left and right pedal members **20** and **22** also have upwardly facing surfaces **36** and **38** between the forward and rearward ends thereto. Each upwardly facing surface **36** or **38** is disposed in an operatively fixed position with respect to the respective pedal members **20** or **22** to support the ball of a user's foot so as to enable a user to apply repeated generally elliptical cyclical movements to the left and right pedal members **20** and **22**.

[0032] The exerciser **10** also includes a selectively variable resistance assembly, generally indicated at **40**, constructed and arranged to provide a selected resistance within a range of resistances to the cyclical movements of the left and right pedal members **20** and **22**.

[0033] In one embodiment, each crank **16** or **18** has (1) a crank radius within a range of between 6" and 14", a more preferred range of between 8" and 12", with a preferred example being approximately 10 inches, and (2) a crank axis, indicated at CA in FIG. **1**, spaced vertically above the floor within a range of between 15" and 23", a preferred range of between 17" and 21", with a preferred example being approximately 19.7". The rolling axis, indicated at RA in FIG. **1**, is (1) spaced horizontally forwardly from the crank axis, indicated at CA in FIG. **1**, within a range of between 52.25" and 68.25", a preferred range of between 56.25" and 64.25", with a preferred example being approximately 60.25", and (2) spaced vertically downwardly from the crank axis, indicated at CA in FIG. **1**, within a range of between 8.375" and 16.375", a preferred range of between 10.375" and 14.375", with a preferred example being approximately 13.125". Each roller **28** or **30** has a roller radius within a range of between 0.125" and 3.0", a preferred range of between 0.31" and 1.30", with a preferred example being approximately 0.81". The forward distance from each rearward rotational axis to the fixed position on the upwardly facing surface of the respective pedal member **20** or **22** where the ball of the foot is supported is (1) greater than one-half the length of the respective pedal member and (2) within a range of between 36.25" and 44.25", a preferred range of between 38.25" and 42.25", with a preferred example being approximately 40.25".

[0034] With the construction described above, each cyclical movement includes (1) a downward moving stroke wherein the ball of the user's foot moves forwardly along a first curved path, indicated at **1** in FIG. **1**A, which merges into a relatively small generally arcuate end path, indicated at FE in FIG. **1**A, and from the generally arcuate forward end path FE rearwardly along a second curved path, indicated at **2** in FIG. **1**A, symmetrical to the first path **1** with respect to an axis of symmetry, indicated at **2** in FIG. **1**A, and (2) an upward return stroke wherein the ball of the user's foot moves rearwardly from the second path **2** rearwardly along a third curved path, indicated at **3** in FIG. **1**A, different from the second path **2**, and which merges into a relatively large generally arcuate rearward end path, indicated at RE in FIG. **1**A, and from the generally arcuate rearward end path RE forwardly along a fourth curved path, indicated at **4** in FIG. **1**A, symmetrical to the third path **3**, with respect to the aforesaid axis of symmetry S. FIGS. **1** and **1**A both illustrate the generally elliptical or teardrop shape of the path of movement of the ball of the user's foot during each cycle.

[0035] It will be noted that the axis of symmetry extends downwardly and forwardly and has a length, indicated at L in FIG. **1**A, between the end paths FE and RE which is generally equal to the distance between the parallel rotational axes provided by the cranks **16** and **18** and at least three times greater than the width, indicated at W in FIG. **1**A, from a juncture between the fourth and first curved paths **4** and **1** to a juncture between the third and second paths **3** and **2**. The distance between the crank axis, indicated at CA in FIG. **1**, and the rolling axis, indicated at RA in FIG. **1**, in one embodiment, is at least three times greater than the distance between the parallel rotational axes **24** and **26** provided by the cranks **16** and **18**.

[0036] As best shown in FIG. **1**, the frame **12** of the elliptical exerciser **10** includes a forward frame portion **42** defining the rolling axis, indicated at RA in FIG. **1**, thereon and a separate rearward frame portion **44** defining the crank axis, indicated at CA in FIG. **1**, thereon. The frame portions **42** and **44** are, in one embodiment, in the form of central hollow members mounted in telescopic relation with respect to another for selective movement into one of a series of operative positions wherein the horizontal distance between the crank axis, indicated at CA in FIG. **1**, and the rolling axis, indicated at RA in FIG. **1**, is disposed at a selected distance within a range of different distances as previously indicated.

[0037] As best shown in FIG. **1**, in one embodiment, each of the pedal members **20** and **22** has a straight relatively short rearward section and a straight relatively long forward section providing the straight roller engaging downward surfaces. This angle configuration is like the configuration embodied in the Model 1720. It is within the contemplation of the present invention to form each of the pedal members

20 and 22 straight throughout its longitudinal extent, like the configuration embodied in the Model 1700 and Model 1760.

[0038] Referring now more particularly to FIGS. 3 through 14, there is illustrated therein various configurations of the roller and cooperating roller engaging surface of the forward mounting assembly for each of the left and right pedal members 20 and 22.

[0039] Each of the pedal members 20 and 22 are illustrated in FIGS. 1 and 2 as being of hollow rectangular tubular construction having a rectangular cross-sectional configuration elongated in the horizontal direction so as to present planar downwardly facing roller engaging surfaces 32 and 34. The rollers 28 and 30 are shown as having a cylindrical pedal member supporting surfaces. Each roller 28 or 30 could be provided with spaced end flanges which extend upwardly on opposite sides of the pedal member as provided in the Model 1720.

[0040] Each of the different configurations shown in FIGS. 3 through 14 illustrate a different pedal member with overall configurations like the pedal members 20 and 22 , but with different cross-sectional configurations and hence different roller engaging surfaces, and different roller constructions cooperating therewith.

[0041] FIG. 3 shows a pedal member 42 of solid rectangular bar cross-sectional configuration formed with parallel, relatively closely spaced grooves 44 of concavely downwardly arcuate cross-section formed therein. A pair of correspondingly spaced parallel rollers 46 are provided with convexly arcuate peripheral surfaces 48 to rollingly engage within the grooves 44.

[0042] FIGS. 4 and 5 illustrate a pedal member 50 of inverted channel shape in cross-section providing a central downwardly facing planar roller engaging surface 52 and two flanges 54 extending downwardly at right angles on opposite sides thereof. The central downwardly facing surface 52 is rollingly supported by a roller 56 similar in peripheral configuration to each of the rollers 46.

[0043] In FIG. 4, inner surfaces 58 of the flanges 54 are rollingly engaged with a pair of smaller rollers 60 rotatably supported about spaced vertical axes. The rollers 60 provide lateral stability to the pedal member 50.

[0044] In FIG. 5, outer surfaces 62 of the flanges 54 are rollingly engaged with a pair of smaller rollers 64 rotatably supported about spaced parallel vertical axes.

[0045] FIG. 6 illustrates the principle of utilizing additional vertical axis rollers to provide lateral stability as in FIGS. 4 and 5, to a pedal member 66 having a construction and cross-sectional configuration like either of the pedal members 20 or 22. As shown, the pedal member 66 provides a planar downwardly facing surface 68 rollingly supported by roller 70. The pedal member 66 also provides two oppositely facing side surfaces 72 disposed on opposite sides thereof which are rollingly engaged by a pair of rollers 74 rotatable about parallel vertical axes.

[0046] The rollers 48, 56 and 70, shown in FIGS. 3-6, like the rollers 28 and 30 shown in FIGS. 1 and 2, can conveniently cooperate with depending structure 76 fixed to the associated pedal member and extending below the periphery of the associated roller to limit upward movement of the pedal member with respect to the roller and thus provide the pedal member with vertical stability. It will be understood, however, that since the weight of the user is always acting to keep the pedal members in roller engagement an upwardly limiting structure 76 is not essential.

[0047] FIGS. 7 and 8 illustrate pedal members 78 of hollow round cross-sectional configurations.

[0048] FIG. 7 illustrates a single roller 80 rollingly supporting the lower arcuate surface of the round tubular pedal member 78. The roller 80 has a concavely arcuately grooved exterior periphery 82 configured and sized to roll in substantial mating engagement with the lower arcuate exterior peripheral surface of the round tubular pedal member 78.

[0049] FIG. 8 illustrates a pair of rollers 80 with their rotational axes disposed at right angles with respect to one another, intersecting vertically below the axis of the round cross-section of the pedal member 78. Each of the rollers 84 are shown as being of a construction similar to the rollers 48, 56 and 70 although they may be constructed similar to the rollers 82. The axis about which each pair of rollers 84 turns is different, however, the effective rolling axis, indicated at RA in FIG. 1, is the same as the rolling axis, indicated at RA in FIG. 1, of the single roller 80.

[0050] FIG. 9 illustrates the same rollers 84 rollingly supporting a pedal member 86. The rollers rollingly engage with outer perpendicularly related V-shaped surfaces 88 of the pedal member 86 formed in the lower wall of an otherwise hollow rectangular cross-sectional configuration.

[0051] FIGS. 10 through 14 disclose pedal members that are similar to pedal member 86 in that each is of hollow rectangular cross-sectional configuration with a lower wall of modified configuration.

[0052] FIG. 10 illustrates a pedal member 90 in which the lower wall is concavo-convex with a roller engaging arcuately convex surface 92. A single roller 94 rollingly supports the pedal member 90 which has concavely arcuate double frustroconical periphery 96 similar in configuration to the peripheries 82 of the rollers 80 in rolling engagement with the surface 92.

[0053] FIG. 11 illustrates a pedal member 98 in which the lower wall is formed with a pair of parallel indentations defining a pair of parallel downwardly facing surfaces of arcuately concave cross-sectional configuration within downwardly facing planar surfaces 102. A single roller 104 rollingly supports the pedal member 98. The periphery of the rollers 104 includes cylindrical surfaces 106 rollingly engaging planar surfaces 102 and spaced apart annular ridges 108 formed therein having exterior surfaces 108 of arcuately convex cross-sectional configurations rollingly engaging the concavely arcuate surfaces 100.

[0054] FIG. 12 illustrates a pedal member 110 having a lower wall with only a central indentation therein defining a single downwardly facing surface 112 of concavely arcuate cross-sectional configuration centrally located within planar surface 114. A single roller 116 rollingly supports the pedal member 110. The roller 116 includes a cylindrical peripheral surface 118 rollingly engaging the planar surface 114 and a central annual ridge defining a surface 120 of convexly arcuate cross-section configurations rollingly engaging the concavely arcuate surfaces 112.

[0055] FIGS. **13** and **14** illustrate two different pedal members **122** and **124** which are slight variations of the pedal member **110**. The pedal members **122** and **124** are rollingly supported by rollers **126** and **128** which are slight variations of the roller **116**.

[0056] The variation shown in FIG. **13** is essentially a reversal of the configuration shown in FIG. **12**. The reversal shows a central projection **130** with opposite sides defined by planar surfaces **132**. The projection **130** has a convexly arcuate downwardly facing cross-sectional configuration. An annular groove **134** in the central portion of the roller **126** with opposite sides defined by cylindrical surfaces **136**. The annular groove has a mating concavely arcuate cross-sectional configuration.

[0057] The variation of FIG. **14** is like that of FIG. **13** except for the cross-sectional configuration of the mating projection and annual groove. FIG. **14** illustrates the lower wall of the pedal member **124** with a central projection **138** having planar surfaces **140** on opposite sides thereof and the roller **128** with a central annular groove **142** having cylindrical surfaces **144** on opposite sides thereof. As shown, the mating cross-sections of the projection and groove are of block configuration or squared U-shaped configuration.

[0058] It can be seen that in the above embodiments of the cooperating pedal members and rollers, the rollingly supported cooperating relationship remains uneffected by any telescopic adjusting movements made between the forward and rearward frame portions **42** and **44**. The primary effect is simply to change the distance between the crank axis, indicated at CA in FIG. **1**, and the rolling axis, indicated at RA in FIG. **1**.

[0059] The movement of the frame portions **42** and **44** into different positions correspondingly changes the longitudinal position of the elliptical path and the shape of the symmetrical curves thereof slightly. Once the frame members **42** and **44** are in a selected operative fixed position, they can be locked therein by any suitable means, such a threaded knob member **146** threaded into the outer tubular rearward frame member **44** to lockingly engage the inner forward tubular frame member **42**.

[0060] As shown, the rearward end of the forward frame member **42** telescopically fits within the forward end of the rearward frame member **44**. The rearward end of the rearward frame member **44** has a rearward cross frame member **148** fixed thereto by any suitable means, such as fasteners or the like. The cross-frame member **148** extends laterally outwardly on opposite sides of the centrally disposed rearward frame member **44** and has floor engaging caps **150** on the outer ends thereof.

[0061] The forward frame member **42** extends forwardly from the rearward frame member **44** and has its midsection bent into an upwardly extending curve from which a forward end portion extends upwardly at a substantial upright vertical inclination. The upper extremity of the forward frame member **42** preferably has an instrument panel **152** fixed thereon. The instrument panel **152** can be of any known construction.

[0062] The rearward cross frame member **148** provides lateral stability to the rearward end of the exerciser **10** during use. The forward end is laterally stabilized by a forward cross frame member **154** having floor engaging end caps **156**. The cross frame member **154** is fixedly secured in floor engaging position to the bent intermediate section of the forward frame member **42** by any suitable means, such as brackets **158** welded therebetween.

[0063] Since the rollers **28** and **30** are supported on the frame **10** in laterally outwardly spaced relation to the centrally located forward frame member **42**, one embodiment provides the roller support on the forward cross frame member **154**. As shown, left and right pairs of parallel steel plates or comparably configured brackets **160** and **162** are welded at their lower ends to the upper surface of the forward cross frame member **154** at appropriate lateral positions. It will be understood that all of the rollers shown in FIGS. **3-14** can be rotatably mounted on the forward cross frame member **154** in similar locations by similar appropriate brackets or plates.

[0064] In one embodiment, the elliptical exerciser **10** can be provided with left and right handle assembles like any of those exercisers of the Stamina and LifeGear units previously mentioned. That is, they may constitute telescopic handle assemblies pivoted to the forward ends of the pedal members like the Stamina Model 1720, they may simply be fixed to the frame, like the Stamina Models 1700 and 1760 and the LifeGear "Transorbit" or fixed to the forward ends of the pedal members like the LifeGear "Transmotion."

[0065] In one embodiment there is provided improved left and right handle assemblies which include left and right pivoted handle levers **164** and **166** and left and right connecting links **168** and **170**, operatively associated with the left and right pedal members **20** and **22**, respectively.

[0066] As shown, the left and right pivoted handle levers **164** and **166** includes upper portions defining left and right handles **172** and **174**, respectively, positioned to be gripped by the left and right hands of the user. Intermediate midpoints of the left and right handle levers **164** and **166** are pivoted to upper end portions of the forward frame member **42** by a laterally extending shaft structure **176** providing a handle pivotal axis extending through the frame member **42** below the instrument panel **152**.

[0067] The left and right handle levers **164** and **166** have left and right lower portions **178** and **180** extending downwardly from the shaft structure **176**. The lower ends of the left and right handle lever lower portions **178** and **180** are pivoted to the bifurcated forward ends of the left and right connecting links **168** and **170**, respectively, as indicated at **182** and **184**.

[0068] As best shown in FIG. **1**, the bifurcated rearward ends of the left and right connecting links **168** and **170** are pivotally connected to the respective left and right pedal members **20** and **22**. As shown, the pivotal connection provides for the selective pivotal connection in a selected one of a plurality of different positions. This selectivity allows the user to vary the fore and aft position of movement of the handles **172** and **174** with respect to the pedal members **20** and **22** to better suit the particular individual user. As shown, left and right brackets **186** and **188**, each having multiple longitudinally spaced pin receiving openings, are fixedly mounted on the upper surface of the left and right pedal members **20** and **22**, respectively, at intermediate positions spaced rearwardly of the forward ends thereof. The bifurcated rear ends of the left and right connecting links **168**

and **170** are fitted with left and right pivot pins **190** and **192**, capable of being pivotally engaged within any one of the pin receiving openings in the left and right brackets **186** and **188**.

[**0069**] It is within the contemplation of the present invention to provide the upwardly facing foot supporting surfaces **36** and **38** by the upwardly facing surfaces of the left and right pedal members **20** and **22** themselves. However, in one embodiment, the surfaces **36** and **38** are provided by separate foot supporting structural units fixed on the upper surface of the pedal members. These foot supporting structural units are in the form of left and right adjustable foot supporting platform assemblies, indicated generally at **196** and **198**.

[**0070**] As best shown in FIGS. **1** and **2**, the distance that the rolling axis, indicated at RA in FIG. **1**, is spaced forwardly from the crank axis, indicated at CA in FIG. **1**, makes it possible to make the foot supporting structures **196** and **198** with ample fore and aft area to accommodate significant adjustment for a wide range of foot sizes.

[**0071**] The assemblies **196** and **198** are identical except for being side by side mirror images of one another so that a description of one will suffice to give an understanding of the construction and operation of both.

[**0072**] Referring now more particularly to FIGS. **15-19**, each foot supporting assembly **196** or **198** includes a foot supporting platform structure **200** providing an upwardly facing platform surface configuration **202** of a shape to receive a foot of the user. As shown, the surface configuration **202** provides a series of parallel ridges or longitudinally-spaced teeth.

[**0073**] The surface configuration **202** is peripherally defined by an upstanding structure **204** which extends along an inner side periphery and around the forward and rearward peripheral ends of the surface **202** so as to allow the outer side of the surface **202** to be open for easier access to the user.

[**0074**] Extending longitudinally within the platform structure **200** is a slot **206** which extends vertically through the platform structure **200**. The under surface of the platform structure **200** is recessed marginally on opposite sides of the slot **206** and formed with a series of downwardly projecting longitudinally-spaced transverse ridges or teeth **208**.

[**0075**] Disposed above the surface **202** is an upstanding barrier structure **210**. As shown, the barrier structure **210** includes an arcuately-shaped foot engaging surface **212** and a central depending portion **214** slidably mounted within the slot **206**. Extending vertically through the barrier structure **210** is a fastener element **216**.

[**0076**] The fastener element **216** also extends vertically through a lower adjustment member **218** having a series of upwardly facing longitudinally-spaced teeth **220** configured and positioned to mesh with the downwardly facing teeth **208** of the platform structure **200**.

[**0077**] Fixed, as by a nut **222**, on the upper end of the fastener element **216** is a pusher member **224** configured and positioned to move vertically within an upwardly opening recess in the barrier member **210**. A compression coil spring **226** is disposed within the barrier member recess in surrounding relation with the fastener element **216** and in engaged relation between the barrier member **210** and the pusher member **224**.

[**0078**] As best shown in FIG. **17**, the spring **226** normally biases the barrier member **210** downwardly into a selected fixed operative position with respect to the platform **210** with the depending portion **214**, thereof disposed within the slot **206**. The spring **226** also biases the lower member **218** upwardly so that the upwardly facing teeth **220** thereon meshingly engage the downwardly facing teeth **208** of the platform structure **200**.

[**0079**] The spring arrangement enables the barrier structure **21** to be moved relative to the platform structure **200** (1) longitudinally into a selected toe engaging operative position within a range of toe engaging operative positions and (2), rotationally and longitudinally between a toe engaging position or a 180° turned heel engaging position.

[**0080**] As best shown in FIG. **18**, the toe engaging position of the barrier structure is one in which the arcuately-shaped foot engaging surface **212** of the barrier member **210** faces rearwardly in a position to be engaged by a toe structure of the user so as to prevent forward movement of the user's foot therebeyond. In this toe engaging orientation, the user can selectively move the barrier structure **210** into a selected toe engaging operative position by a combined downward manual push and longitudinal movement. The longitudinal movement of the barrier structure **210** is possible after the down push of the pushing member **224** because the teeth **220** of the lower adjustment member **218** are disposed out of meshing relation to the teeth **208** of the platform **200**.

[**0081**] As best shown in FIG. **19**, a combined vertically upward and rotational movement of the barrier member **210** enable the barrier member to be moved into a 180° turned heel engaging position. This movement is allowed because the upward movement of the barrier structure **210** against the spring bias moves the depending portion **214** of the barrier structure **210** out of the slot **206** enabling rotational movement to take place whereas, in the selected fixed operative position, the positioning of the depending portion **214** of the barrier structure **210** within the slot **206** normally prevents rotational movement.

[**0082**] The selectively operable variable resistance assembly **40** is shown somewhat schematically in FIGS. **1** and **2**. The assembly **40** can be of any known construction and operation. The assembly **40** is shown as embodying an electrically operated unit **228**; although it will be understood that other units including frictional-operated and fan-operated units can be utilized.

[**0083**] The electrical unit **228** of the assembly **40** is shown in FIG. **1** as being positioned on the frame **44**. The variable resistance assembly **40** also includes a belt and pulley system **230** driven by the crank assembly **14**. The entire variable resistance assembly **40** including the electrical unit **228** and belt and pulley system **230** is housed within a casing **232** which also houses support structure **234** for the crank assembly **14**. The configuration and position of the casing **232** and the distance which the rolling axis, indicated at RA in FIG. **1**, is spaced forwardly form the crank axis, indicated at CA in FIG. **1**, makes it possible to position the foot supporting structure **196** and **198** so that when each foot

supporting structure **196** and **198** is at its rearmost it is spaced forwardly by the casing. With this relationship established the lateral width between the foot supporting structures **96** and **198** can be moved close together into an optimum spacing, as, for example, 60 mm between the lateral extent of the peripheral walls **204**. As can be seen from FIG. **2**, this optimum distance is less than the width or widest lateral dimension of the casing **232**. In one embodiment, as shown, the lateral space between the foot supporting structures **196** and **198** free of interfering structure in every position of movement of the pedal members **20** and **22**.

[**0084**] Referring now more particularly to FIGS. **20-22** of the drawings, there is shown in FIG. **20** another elliptical exerciser, generally indicated at **310**. The exerciser **310** includes a frame, generally indicated at **312**, constructed and arranged to be stably supported on a horizontal surface. Mounted in a rearward position above the horizontal surface is a crank assembly, generally indicated at **314**, providing a crank axis, indicated at CA in FIG. **20**, fixed with respect to the frame **312**. The crank assembly **314** includes oppositely extending left and right cranks **316** and **318** providing parallel rotational axes spaced equidistantly from the crank axis, indicated at CA in FIG. **20**, and displaced 180° with respect to one another.

[**0085**] The crank assembly **314** provides a rearward mounting assembly for left and right pedal members **320** and **322** having rear portions connected, as at **324** and **326**, with the left and right cranks **316** and **318**, respectively, for rotational movement about the respective rotational axis thereof. The left and right pedal members **320** and **322** are supported by a forward mounting assembly in the form of left and right rollers **328** and **330** mounted on the frame **312** for rotation about a single rolling axis, indicated at RA in FIG. **20**, parallel with respect to the crank axis, indicated at CA in FIG. **20**, in a forward position above the horizontal surface a distance less than the distance of the crank axis, indicated at CA in FIG. **20**, above the horizontal surface.

[**0086**] The left and right pedal members **320** and **322** have straight downwardly facing surfaces **332** and **334**, respectively, at forward end portions thereof rollingly supported on the left and right rollers **328** and **330**, respectively. The left and right pedal members **320** and **322** also have upwardly facing surfaces **336** and **338** between the forward and rearward ends thereto. Each upwardly facing surface **336** or **338** is disposed in an operatively fixed position with respect to the respective pedal members **320** or **322** to support the ball of a user's foot so as to enable a user to apply repeated generally elliptical cyclical movements to the left and right pedal members **320** and **322**.

[**0087**] The exerciser **310** also includes a selectively variable resistance assembly, generally indicated at **340**, constructed and arranged to provide a selected resistance within a range of resistances to the cyclical movements of the left and right pedal members **320** and **322**.

[**0088**] Each crank **316** or **318** has (1) a crank radius within a range of between 6" and 14", a preferred range of between 8" and 12", with a preferred example being approximately 10 inches, and (2) a crank axis, indicated at CA in FIG. **20**, spaced vertically above the floor within a range of between 15" and 23", a preferred range of between 17" and 21", with a preferred example being approximately 19.7". The rolling axis, indicated at RA in FIG. **20**, is (1) spaced horizontally forwardly from the crank axis, indicated at CA in FIG. **20**, within a range of between 52.25" and 68.25", a preferred range of between 56.25" and 64.25", with a preferred example being approximately 60.25", and (2) spaced vertically downwardly from the crank axis, indicated at CA in FIG. **20**, within a range of between 8.375" and 16.375", a preferred range of between 10.375" and 14.375", with a preferred example being approximately 13.125". Each roller **328** or **330** has a roller radius within a range of between 0.125" and 3.0", a preferred range of between 0.31" and 1.30", with a preferred example being approximately 0.81". The forward distance from each rearward rotational axis to the fixed position on the upwardly facing surface of the respective pedal member **320** or **322** where the ball of the foot is supported is (1) greater than one-half the length of the respective pedal member and (2) within a range of between 36.25" and 44.25", a preferred range of between 38.25" and 42.25", with a preferred example being approximately 40.25".

[**0089**] With the construction described above, each cyclical movement includes (1) a downward moving stroke wherein the ball of the user's foot moves forwardly along a first curved path, indicated at **1** in FIG. **20**A, which merges into a relatively small generally arcuate end path, indicated at FE in FIG. **20**A, and from the generally arcuate forward end path FE rearwardly along a second curved path, indicated at **2** in FIG. **20**A, symmetrical to the first path **1** with respect to an axis of symmetry, indicated at S in FIG. **20**A, and (2) an upward return stroke wherein the ball of the user's foot moves rearwardly from the second path **2** rearwardly along a third curved path, indicated at **3** in FIG. **20**A, different from the second path **2**, and which merges into a relatively large generally arcuate rearward end path, indicated at RE in FIG. **20**A, and from the generally arcuate rearward end path RE forwardly along a fourth curved path, indicated at **4** in FIG. **20**A, symmetrical to the third path **3**, with respect to the aforesaid axis of symmetry S. FIGS. **20** and **20**A both illustrate the generally elliptical or teardrop shape of the path of movement of the ball of the user's foot during each cycle.

[**0090**] It will be noted that the axis of symmetry extends downwardly and forwardly and has a length, indicated at L in FIG. **20**A, between the end paths FE and RE which is generally equal to the distance between the parallel rotational axes provided by the cranks **316** and **318** and at least three times greater than the width, indicated at W in FIG. **20**A, from a juncture between the fourth and first curved paths **4** and **1** to a juncture between the third and second paths **3** and **2**. The distance between the crank axis, indicated at CA in FIG. **20**, and the rolling axis, indicated at RA in FIG. **20**, is at least three times greater than the distance between the parallel rotational axes **324** and **326** provided by the cranks **316** and **318**.

[**0091**] As best shown in FIG. **20**, the frame **312** of the elliptical exerciser **310** includes a forward transversely extending cross frame member **342**, a longitudinally extending central frame member and a rearward transversely extending cross frame **346**. The cross frame members **342** and **346** are suitably fixed to the central frame member **344** as by welding or the like. All are provided with floor engaging leveling pads **348**. Fixed to the rearward cross member **346** is a pair of rearwardly extending rollers **350**.

The rollers **350** serve to render the exerciser **310** rollingly portable by tipping the forward end upwardly to engage the rollers **350** on the floor.

[**0092**] The frame **312** includes a forward decorative housing **352** which is fixed to the central portion of the cross frame member **342** in covering relation to the forward end of the central frame member **344** and extends forwardly therefrom. The crank assembly **314** is partially covered by a rearward housing **354** fixed to the rearward end of the central frame member **344** and central portion of the rearward cross frame member **346**. The rearward housing **354** extends upwardly from the frame members **344** and **346** in covering relation to the crank assembly **314**, but is open at its sides to accommodate the movement of the cranks **316** and **318**. Preferably, covering disks **355** are rotatably carried by the shaft defining the crank axis CA. The covering disks **55** are aperture to accommodate the shaft connectors **324** and **326** and rotate during the operation of the exerciser **310**.

[**0093**] The frame **312** also includes a forward upright frame member **356** which is fixed, as by welding or the like, to the juncture between the forward cross member **342** and central frame member **344**. As best shown in FIG. **20**, the upright frame member **356** extends vertically upwardly from the frame members **342** and **344** and then at a midportion, indicated at **358**, slants upwardly and forwardly. Fixed to the upper slanted portion of the upright frame member **354** is a pair of fixed handle bars **360** which extend rearwardly and outwardly. Fixed across the midportion of the handle bars **360** is a first instrument panel **362**. A second instrument panel **364** is fixed to the upper free end of the upright frame member **356**.

[**0094**] As best shown in FIG. **20**, in one embodiment, each of the pedal members **320** and **322** has a straight relatively short rearward section and a straight relatively long forward section providing the straight roller engaging downward surfaces. This angle configuration is like the configuration embodied in the Model 1720. It is contemplated that, in one embodiment, each of the pedal members **320** and **322** may be formed straight throughout its longitudinal extent, like the configuration embodied in the Model 1700 and Model 1760.

[**0095**] Each of the pedal members **320** and **322** are illustrated in FIGS. **20-22** as being of hollow tubular construction having a cylindrical cross-sectional configuration so as to present an arcuate downwardly facing roller engaging surface **332** or **334**. The rollers **328** and **330** are shown in FIG. **22** as having an arcuate, concave pedal member supporting surface. Each roller **328** or **330** is mounted on a respective side of the forward frame portion **342** by a pair of brackets **366**.

[**0096**] In one embodiment, the elliptical exerciser **310** can be provided with left and movable right handle assemblies like any of those exercisers of the Stamina and LifeGear units previously mentioned. That is, they may constitute telescopic handle assemblies pivoted to the forward ends of the pedal members like the Stamina Model 1720, they may simply be fixed to the frame, like the Stamina Models 1700 and 1760 and the LifeGear "Transorbit" or fixed to the forward ends of the pedal members like the LifeGear "Transmotion."

[**0097**] In one embodiment, the invention provides improved left and right handle assemblies which include left and right pivoted handle levers **464** and **466** and left and right connecting links **468** and **470**, operatively associated with the left and right pedal members **320** and **322**, respectively.

[**0098**] As shown, the left and right pivoted handle levers **464** and **466** include upper portions defining left and right handles **472** and **474**, respectively, positioned to be gripped by the left and right hands of the user. Intermediate midpoints of the left and right handle levers **464** and **466** are pivoted to the end portion of the upright frame member **356** by a laterally extending shaft structure **476** providing a handle pivotal axis extending through the frame member **356** below the instrument panel **452**.

[**0099**] The left and right handle levers **464** and **466** have left and right lower portions **478** and **480** extending downwardly from the shaft structure **476**. The lower ends of the left and right handle lever lower portions **478** and **480** are pivoted to the bifurcated forward ends of the left and right connecting links **468** and **470**, respectively, as indicated at **482** and **484**.

[**0100**] As best shown in FIG. **20**, the bifurcated rearward ends of the left and right connecting links **468** and **470** are pivotally connected to the respective left and right pedal members **320** and **322**. As shown, left and right brackets **486** and **488** are fixedly mounted on the upper surface of the left and right pedal members **320** and **322**, respectively, at intermediate positions spaced rearwardly of the forward ends thereof. The bifurcated rear ends of the left and right connecting links **468** and **470** are fitted with left and right pivot pins **490** and **492**, pivotally engaged within a cooperative pin receiving opening in the left and right brackets **486** and **488**.

[**0101**] In one embodiment, the upwardly facing foot supporting surfaces **336** and **338** are provided by the upwardly facing surfaces of the left and right pedal members **320** and **322** themselves. However, the surfaces **336** and **338** may be provided by separate foot supporting structural units fixed on the upper surface of the pedal members. These foot supporting structural units are in the form of left and right adjustable foot supporting platform assemblies, indicated generally at **196** and **198**, as previously described.

[**0102**] The selectively operable variable resistance assembly **340** is shown somewhat schematically in FIGS. **20** and **21**. The assembly **340** can be of any well known construction and operation. The assembly **340** is shown as embodying an electrically operated unit **528**; although it will be understood that other units including frictional-operated and fan-operated units can be utilized.

[**0103**] The electrical unit **528** of the assembly **340** is shown in FIG. **20** as being positioned on the frame **344** within the housing **354**. The variable resistance assembly **340** also includes a belt and pulley system **530** driven by the crank assembly **314**. The entire variable resistance assembly **340** including the electrical unit **528** and belt and pulley system **530** is disposed within the housing **354** which also houses support structure **534** for the crank assembly **314**. The configuration and position of the housing **354** and the distance which the rolling axis, indicated at RA in FIG. **20**, is spaced forwardly form the crank axis, indicated at CA in FIG. **20**, makes it possible to position the foot supporting structure **196** and **198** so that when each foot supporting structure **196** and **198** is at its rearmost it is spaced forwardly by the casing.

[0104] The spacing of the foot supporting structures in the exerciser **310** is the same as in exerciser **10** of the previous embodiment, except it is the housing **354** which enters into the relationship rather than the casing **232**.

What is claimed is:

1. An elliptical exerciser comprising:

a frame constructed and arranged to be stably supported on a horizontal surface,

a crank assembly providing a crank axis fixed with respect to said frame in a rearward position above the horizontal surface,

said crank assembly including oppositely extending left and right cranks providing parallel rotational axis spaced equidistantly from said crank axis and displaced approximately 180° with respect to one another,

left and right pedal members having rear portions connected with said left and right cranks respectively for rotational movement about the respective rotational axis thereof,

left and right rollers mounted on said frame for rotation about a single rolling axis parallel with respect to said crank axis in a forward position above the horizontal surface a distance less than the distance of said crank axis above said horizontal surface,

said left and right pedal members having generally downwardly facing surfaces at forward end portions thereof rollingly supported on said left and right rollers respectively,

said left and right pedal members providing left and right foot supporting structures defining generally upwardly facing surfaces between the forward and rearward ends of said pedal members, each being in an operatively fixed position with respect to the respective pedal member to support the ball of a user's foot so as to enable a user to apply repeated generally elliptical cyclical movements to said left and right pedal members, and

a selectively variable resistance assembly constructed and arranged to provide a selected resistance within a range of resistances to the cyclical movements of said left and right pedal members,

each crank having a crank radius within an operative range of between 6" and 14",

said crank axis being spaced above said horizontal surface within an operative range of between 15" and 23",

said rolling axis being spaced horizontally forwardly from the crank axis within an operative range of between 52.25" and 68.25," and spaced vertically downwardly from the crank axis within an operative range of between 8.375" and 16.375."

2. An elliptical exerciser as defined in claim 1, wherein said rollers are of equal radius within an operative range of 0.125" and 3.0", the forward distance from each rearward rotational axis to the fixed position on the upwardly facing surface of the respective pedal member where the ball of the foot is supported being greater than one half the length of the respective pedal member and within an operative range of between 36.25" and 44.25".

3. An elliptical exerciser as defined in claim 2, wherein each cyclical movement includes (1) a downward moving stroke wherein the ball of the user's foot moves forwardly along a first curved path merging into a relatively small generally arcuate end path and from said generally arcuate forward end path rearwardly along a second curved path symmetrical to said first path with respect to an axis of symmetry and (2) an upward return stroke wherein the ball of the user's foot moves rearwardly from said second path rearwardly along a third curved path different from said second path merging into a relatively large generally arcuate rearward end path and from said generally arcuate rearward end path forwardly along a fourth curved path symmetrical to said third path with respect to the aforesaid axis of symmetry,

said axis of symmetry extending downwardly and forwardly and having a length between said end paths which is generally equal to the distance between the parallel rotational axes provided by said cranks and at least three times greater than the width from a juncture between said fourth and first curved paths to a juncture between said third and second curved paths, the distance between said crank axis and said rolling axis being at least three times greater than the distance between the parallel rotational axes provided by said cranks.

4. An elliptical exerciser as defined in claim 3, wherein said selectively variable resistance assembly is driven by said crank assembly and is housed within a casing, said left and right foot supporting structures being disposed forwardly of said casing throughout the movements thereof and spaced laterally apart an optimum distance.

5. An elliptical exerciser as defined in claim 4, wherein said frame inc forward frame portion defining said rolling axis thereon and a separate rearward frame portion defining said crank axis thereon, said frame portions being mounted with respect to another for selective movement into one of a series of fixed operative positions wherein the horizontal distance between said crank axis and said rolling axis is disposed at a selected distance within a range of different distances.

6. An elliptical exerciser as defined in claim 5, wherein each foot supporting structure includes upstanding barrier structure configured to prevent the users foot from moving forwardly with respect to the respective upwardly facing surface when in a toe engaging operative position, each upstanding barrier structure being mounted on the respective pedal member for selective movement with respect to the respective upwardly facing surface into a selected toe engaging operative position within a range of toe engaging operative positions spaced different distances from the respective parallel rotational axis.

7. An elliptical exerciser as defined in claim 6, wherein each upstanding barrier structure is mounted for movement into an oppositely facing longitudinally spaced heel engaging position.

8. An elliptical exerciser as defined in claim 7, wherein said left and right pedal members have left and right handle levers respectively associated therewith, said left and right hand levers having (1) upper end portions defining left and right handles respectively to be gripped by left and right hands respectively of a user, (2) mid-portions pivotally mounted on said frame about a common transverse pivotal axis, and (3) lower portions disposed below said mid-

portions, and left and right connecting links pivoted at forward ends thereof to the lower portions of said left and right handle levers respectively and at rearward ends thereof to intermediate portions of said left and right pedal members respectively.

9. An elliptical exerciser as defined in claim 4, wherein said left and right foot supporting structures include inner foot retaining walls, the lateral spacing of said left and right foot supporting structures being approximately 60 mm between said inner walls.

10. An elliptical exerciser as defined in claim 9, wherein said optimum lateral spacing is less than the widest lateral dimension of said casing.

11. An elliptical exerciser as defined in claim 10, wherein the lateral space between said foot supporting structures is devoid of interfering structure in any position of movement of said pedal members.

12. An elliptical exerciser as defined in claim 2, wherein said rollers have a radius within a preferred range of 0.31" and 1.30", the forward distance from each rearward rotational axis to the fixed position on the upwardly facing surface of the respective pedal member where the ball of the foot is supported being within a preferred range of between 38.25" and 42.25".

13. An elliptical exerciser as defined in claim 12, wherein said rollers have a radius of approximately 0.81", the forward distance from each rearward rotational axis to the fixed position on the upwardly facing surface of the respective pedal member where the ball of the foot is supported being approximately 40.25".

14. An elliptical exerciser as defined in claim 1, wherein each crank has a crank radius within a preferred range of between 8" and 12", said crank axis being spaced above said horizontal surface within a preferred range of between 17" and 21", said rolling axis being spaced horizontally forwardly from the crank axis within a preferred range of between 56.25" and 64.25" and spaced vertically downwardly from the crank axis within a preferred range of between 10.375" and 14.375".

15. An elliptical exerciser as defined in claim 14, wherein each crank has a crank radius of approximately 10", said crank axis being spaced above said horizontal surface approximately 19.7", said rolling axis being spaced horizontally. forwardly from the crank axis approximately 60.25" and spaced vertically downwardly from the crank axis approximately 12.375".

16. An elliptical exerciser as defined in claim 1, wherein said frame includes a forward frame portion defining said rolling axis thereon and a separate rearward frame portion defining said crank axis thereon, said frame portions being mounted with respect to another for selective movement into one of a series of operative positions wherein the horizontal distance between said crank axis and said rolling axis is disposed at a selected distance within a range of different distances.

17. An elliptical exerciser as defined in claim 16, wherein said forward and rearward frame portions are telescopically interrelated.

18. An elliptical exerciser as defined in claim 1, wherein each foot supporting structure includes upstanding barrier structure configured to prevent the users foot from moving forwardly with respect to the respective upwardly facing surface when in a toe engaging operative position, each upstanding barrier structure being mounted on the respective pedal member for selective movement with respect to the respective upwardly facing surface into a selected toe engaging operative position within a range of toe engaging operative positions spaced different distances from the respective parallel rotational axis.

19. An elliptical exerciser as defined in claim 18, wherein each upstanding barrier structure is mounted for movement with respect to the associated upwardly facing surface into an oppositely facing heel engaging position.

20. An elliptical exerciser as defined in claim 19, wherein each foot engaging structure includes a platform defining the respective upwardly facing surface.

21. An elliptical exerciser as defined in claim 20, wherein each platform has a periphery open at an outer side with an upstanding structure extending throughout the remainder thereof.

22. An elliptical exerciser as defined in claim 21, wherein each platform is formed with a longitudinal slot extending through the respective upwardly facing surface and a series of longitudinally spaced downwardly facing teeth on opposite sides of said slot, each upstanding barrier structure comprising a barrier assembly including a curved upper barrier member extending on opposite sides of said slot above the respective upwardly facing surface and having a portion slidable in said slot, a central fastener member slidably mounted in said upper barrier member and extending downwardly therefrom through said slot, a lower member extending on opposite sides of said slot connected with said fastener member, said lower member including a series of longitudinally spaced upwardly facing teeth configured to interengage with said downwardly facing teeth to establish the fixed relationship, a pusher member fixed to an upper end of said fastener member above said barrier member and a spring acting between said pusher member and said barrier member so as to resiliently bias the teeth of said lower member upwardly into interengaging relation with the teeth of said platform and the lower portion of said barrier member into confined sliding relation within said slot, said spring bias enabling: (1) a combined downward manual push and longitudinal movement on said pusher member to effect longitudinal movement of said barrier member with the lower portion thereof in sliding relation to said slot and the teeth of said lower member disengaged from the teeth of said platform, and (2) a combined vertical and rotational movement of said barrier member to effect rotational movement of the barrier member into and out of the 180° turned positioning thereof.

23. An elliptical exerciser comprising:

a frame constructed and arranged to be stably supported on a horizontal surface,

a crank assembly providing a crank axis fixed with respect to said frame in a rearward position above the horizontal surface,

said crank assembly including oppositely extending left and right cranks providing parallel rotational axis spaced equidistantly from said crank axis and displaced approximately 180° with respect to one another,

left and right pedal members having rear portions connected with said left and right cranks respectively for rotational movement about the respective rotational axis thereof,

left and right rollers mounted on said frame for rotation about a rolling axis parallel with respect to said crank axis in a forward position above the horizontal surface a distance less than the distance of said crank axis above said horizontal surface,

said left and right pedal members having generally downwardly facing surfaces at forward end portions thereof rollingly supported on said left and right rollers respectively,

said left and right pedal members providing left and right foot supporting structures defining generally upwardly facing surfaces between the forward and rearward ends of said pedal members, each being in an operatively fixed position with respect to the respective pedal member to support the ball of a user's foot so as to enable a user to apply repeated generally elliptical cyclical movements to said left and right pedal members, and

a selectively variable resistance assembly constructed and arranged to provide a selected resistance within a range of resistances to the cyclical movements of said left and right pedal members,

each cyclical movement including (1) a downward moving stroke wherein the ball of the user's foot moves forwardly along a first curved path merging into a relatively small generally arcuate end path and from said generally arcuate forward end path rearwardly along a second curved path symmetrical to said first path with respect to an axis of symmetry and (2) an upward return stroke wherein the ball of the user's foot moves rearwardly from said second path rearwardly along a third curved path different from said second path merging into a relatively large generally arcuate rearward end path and from said generally arcuate rearward end path forwardly along a fourth curved path symmetrical to said third path with respect to the aforesaid axis of symmetry,

said axis of symmetry extending downwardly and forwardly and having a length between said end paths which is generally equal to the distance between the parallel rotational axes provided by said cranks and at least three times greater than the width from a juncture between said fourth and first curved paths to a juncture between said third and second paths, the distance between said crank axis and said rolling axis, being at least three times greater than the distance between the parallel rotational axes provided by said cranks.

24. An elliptical exerciser comprising:

a frame constructed and arranged to be stably supported on a horizontal surface,

a crank assembly providing a crank axis fixed with respect to said frame in a rearward position above the horizontal surface,

said crank assembly including oppositely extending left and right cranks providing parallel rotational axis spaced equidistantly from said crank axis and displaced approximately 180° with respect to one another,

left and right pedal members having rear portions connected with said left and right cranks respectively for rotational movement about the respective rotational axis thereof,

left and right rollers mounted on said frame for rotation about a rolling axis parallel with respect to said crank axis in a forward position above the horizontal surface a distance less than the distance of said crank axis above said horizontal surface,

said left and right pedal members having generally downwardly facing surfaces at forward end portions thereof rollingly supported on said left and right rollers respectively,

said left and right pedal members providing left and right foot supporting structures defining generally upwardly facing surfaces between the forward and rearward ends of said pedal members, each being in an operatively fixed position with respect to the respective pedal member to support the ball of a user's foot so as to enable a user to apply repeated generally elliptical cyclical movements to said left and right pedal members, and

a selectively variable resistance assembly driven by said crank assembly constructed and arranged to provide a selected resistance within a range of resistances to the cyclical movements of said left and right pedal members,

a casing housing said variable resistance assembly

said left and right foot supporting structures being disposed forwardly of said casing throughout the movements thereof and spaced laterally apart an optimum distance.

25. An elliptical exerciser as defined in claim 24, wherein said left and right foot supporting structures include inner foot retaining walls, the lateral spacing of said left and right foot supporting structures being approximately 60 mm between said inner walls.

26. An elliptical exerciser as defined in claim 25, wherein said optimum lateral spacing is less than the widest lateral dimension of said casing.

27. An elliptical exerciser as defined in claim 26, wherein the lateral space between said foot supporting structures is devoid of interfering structure in any position of movement of said pedal members.

28. An elliptical exerciser comprising:

a frame constructed and arranged to be stably supported on a horizontal surface,

a crank assembly providing a crank axis fixed with respect to said frame in a position above the horizontal surface,

said crank assembly including oppositely extending left and right cranks providing parallel rotational axis spaced equidistantly from said crank axis and displaced approximately 180° with respect to one another,

left and right pedal members having first end portions connected with said left and right cranks respectively for rotational movement about the respective rotational axis thereof,

left and right rollers mounted on said frame for rotation about a rolling axis parallel with respect to said crank axis in a position above the horizontal surface a distance less than the distance of said crank axis above said horizontal surface,

said left and right pedal members having generally downwardly facing surfaces at second end portions thereof rollingly supported on said left and right rollers respectively,

said left and right pedal members providing left and right foot supporting structures defining generally upwardly facing surfaces between the forward and rearward ends of said pedal members, each being in an operatively fixed position with respect to the respective pedal member to support the ball of a user's foot so as to enable a user to apply repeated generally elliptical cyclical movements to said left and right pedal members, and

a selectively variable resistance assembly constructed and arranged to provide a selected resistance within a range of resistances to the cyclical movements of said left and right pedal members,

said frame including a forward frame portion defining said rolling axis thereon and a separate rearward frame portion defining said crank axis thereon, said frame portions being mounted with respect to another for selective movement into one of a series of operative positions wherein the horizontal distance between said crank axis and said rolling axis is disposed at a selected distance within a range of different distances.

29. An elliptical exerciser as defined in claim 28, wherein said forward and rearward frame portions are telescopically interrelated.

30. An elliptical exerciser comprising:

a frame constructed and arranged to be stably supported on a horizontal surface,

a crank assembly providing a crank axis fixed with respect to said frame in a position above the horizontal surface,

said crank assembly including oppositely extending left and right cranks providing parallel rotational axis spaced equidistantly from said crank axis and displaced approximately 180° with respect to one another,

left and right pedal members having first portions connected with said left and right cranks respectively for rotational movement about the respective rotational axis thereof,

left and right rollers mounted on said frame for rotation about a rolling axis parallel with respect to said crank axis in a position above the horizontal surface a distance less than the distance of said crank axis above said horizontal surface,

said left and right pedal members having generally downwardly facing surfaces at second end portions thereof rollingly supported on said left and right rollers respectively,

said left and right pedal members providing left and right foot supporting structures defining generally upwardly facing surfaces between the forward and rearward ends of said pedal members, each being in an operatively fixed position with respect to the respective pedal member to support the ball of a user's foot so as to enable a user to apply repeated generally elliptical cyclical movements to said left and right pedal members, and

a selectively variable resistance assembly constructed and arranged to provide a selected resistance within a range of resistances to the cyclical movements of said left and right pedal members,

said left and right pedal member have left and right handle levers respectively associated therewith, said left and right hand levers having (1) upper handle portions respectively to be gripped by left and right hands respectively of a user, (2) mid-portions pivotally mounted on said frame about a common transverse pivotal axis, and (3) lower portions disposed below said mid-portions, and left and right connecting links pivoted at forward ends thereof to the lower portions of said left and right handle levers respectively and at rearward ends thereof to intermediate portions of said left and right pedal members respectively.

31. An elliptical exerciser as defined in claim 30, wherein each connecting link is selectively adjustably pivoted to the lower end portion of the respective handle lever and to the respective pedal member so as to selectively vary the fore and aft position of movement of the respective handle portion.

32. An exerciser comprising:

a frame constructed and arranged to be stably supported on a horizontal surface;

an exercising mechanism on said frame including left and right pedal assemblies constructed and arranged to enable a user to apply thereto repeated generally elliptical cyclical movements providing exercise to the user;

each of said pedal assemblies including a generally upwardly facing foot supporting surface and an upstanding barrier structure constructed and arranged when in a toe engaging operative position to be engaged by a toe area of a user to prevent forward movement of the users foot therebeyond;

said barrier structure being incorporated within the respective pedal assembly so as to be selectively movable with respect to the respective foot supporting surface into a selected toe engaging operative position within a range of toe engaging operative positions.

33. An exerciser as defined in claim 32, wherein said exercising mechanism includes a rearward crank mounting assembly and a forward mounting assembly for said left and right pedal assemblies constructed and arranged to cause said left and right pedal assemblies to undergo repeated generally elliptical cyclical movements.

34. An exerciser as defined in claim 33, wherein said crank mounting assembly provides a crank axis fixed with respect to said frame in a rearward position above the horizontal surface, said crank mounting assembly including oppositely extending left and right cranks providing parallel rotational axis spaced equidistantly from said crank axis and displaced 180° with respect to one another, said left and right pedal members having rear portions connected with said left and right cranks respectively for rotational movement about the respective rotational axis thereof,

said forward mounting assembly comprising left and right rollers mounted on said frame for rotation about a rolling axis parallel with respect to said crank axis in a forward position above the horizontal surface a distance less than the distance of said crank axis above

said horizontal surface, said left and right pedal members having straight downwardly facing surfaces at forward end portions thereof rollingly supported on said left and right rollers respectively, and a selectively variable resistance assembly constructed and arranged to provide a selected resistance within a range of resistances to the cyclical movements of said left and right pedal members.

35. An exercise as defined in claim 34, wherein each cyclical movement includes: (1) a downward moving stroke wherein the ball of the user's foot moves forwardly along a first curved path merging into a relatively small generally arcuate end path and from said generally arcuate forward end path rearwardly along a second curved path symmetrical to said first path with respect to an axis of symmetry and (2) an upward return stroke wherein the ball of the user's foot moves rearwardly from said second path rearwardly along a third curved path different from said second path merging into a relatively large generally arcuate rearward end path and from said generally arcuate rearward end path forwardly along a fourth curved path symmetrical to said third path with respect to the aforesaid axis of symmetry.

36. An exerciser as defined in claim 32, wherein each of said barrier structures is incorporated within the respective pedal assembly for combined 180° rotational and longitudinal movements into a rearward heel engaging operative position wherein the barrier structure is operable to be engaged by a heel area of a users foot to prevent rearward movement therebeyond.

37. An exerciser as defined in claim 36, wherein each foot engaging structure includes a platform having a periphery open at an outer side thereof and having structure extending upwardly along a remaining portion of the periphery thereof including an inner side thereof.

38. An exerciser as defined in claim 37, wherein each peripheral structure extends continuously from the inner side thereof upwardly along front and rear ends of the periphery of each platform.

39. An exerciser as defined in claim 38, wherein each platform is formed with a longitudinal slot and a series of longitudinally spaced downwardly facing teeth on opposite sides of said slot, each upstanding barrier structure comprising a barrier assembly including a curved upper barrier member extending on opposite sides of said slot and having a portion slidable in said slot, a central fastener member slidably mounted in said upper barrier member and extending downwardly therefrom through said slot, a lower member extending on opposite sides of said slot connected with said fastener member, said lower member including a series of longitudinally spaced upwardly facing teeth configured to interengage with said downwardly facing teeth to establish said retained relationship, a pusher member fixed to an upper end of said fastener member above said barrier member and a spring acting between said pusher member and said barrier member so as to resiliently bias the teeth of said lower member upwardly into interengaging relation with the teeth of said platform and the lower portion of said barrier member into confined sliding relation within said slot, said spring bias enabling: (1) a combined downward manual push and longitudinal movement on said pusher member to effect longitudinal movement of said barrier member with the lower portion thereof in sliding relation to said slot and the teeth of said lower member disengaged from the teeth of said platform, and (2) a combined vertical and rotational movement of said barrier member to effect rotational movement of the barrier member into and out of oppositely facing positioning thereof.

40. An exerciser comprising:

a frame constructed and arranged to be stably supported on a horizontal surface;

an exercising mechanism on said frame including left and right pedal assemblies constructed and arranged to enable a user to apply thereto repeated generally elliptical cyclical movements providing exercise to the user;

each of said pedal assemblies including a generally upwardly facing foot supporting surface and an upstanding barrier structure constructed and arranged in a forward position to be forwardly engaged by a toe area of a user and in a rearward position to be rearwardly engaged by a heel area of a user, each barrier structure being incorporated within the respective pedal assembly so as to be movable between said forward and rearward positions by a combination of 180° rotational and longitudinal movements.

41. An exerciser as defined in claim 40, wherein each foot engaging structure includes a platform having a periphery open at an outer side thereof and having structure extending upwardly along a remaining portion of the periphery thereof including an inner side thereof.

42. An exerciser as defined in claim 41, wherein each peripheral structure extends continuously from the inner side thereof upwardly along front and rear ends of the periphery of each platform.

43. An exerciser as defined in claim 42, wherein each platform is formed with a longitudinal slot and a series of longitudinally spaced downwardly facing teeth on opposite sides of said slot, each upstanding barrier structure comprising a barrier assembly including a curved upper barrier member extending on opposite sides of said slot and having a portion slidable in said slot, a central fastener member slidably mounted in said upper barrier member and extending downwardly therefrom through said slot, a lower member extending on opposite sides of said slot connected with said fastener member, said lower member including a series of longitudinally spaced upwardly facing teeth configured to interengage with said downwardly facing teeth to establish said retained relationship, a pusher member fixed to an upper end of said fastener member above said barrier member and a spring acting between said pusher member and said barrier member so as to resiliently bias the teeth of said lower member upwardly into interengaging relation with the teeth of said platform and the lower portion of said barrier member into confined sliding relation within said slot, said spring bias enabling: (1) a combined downward manual push and longitudinal movement on said pusher member to effect longitudinal movement of said barrier member with the lower portion thereof in sliding relation to said slot and the teeth of said lower member disengaged from the teeth of said platform, and (2) a combined vertical and rotational movement of said barrier member to effect rotational movement of the barrier member into and out of oppositely facing positioning thereof.

44. An elliptical exerciser comprising:

a frame constructed and arranged to be stably supported on a horizontal surface,

a crank assembly providing a crank axis fixed with respect to said frame in a position above the horizontal surface,

said crank assembly including oppositely extending left and right cranks providing parallel rotational axis spaced equidistantly from said crank axis and displaced about 180° with respect to one another,

left and right pedal members having first end portions connected with said left and right cranks respectively for rotational movement about the respective rotational axis thereof,

left and right rollers mounted on said frame for rotation about a rolling axis parallel with respect to said crank axis in a position above the horizontal surface a distance less than the distance of said crank axis above said horizontal surface,

said left and right pedal members having generally downwardly facing surfaces at second end portions thereof rollingly supported on said left and right rollers respectively,

said left and right pedal members providing left and right foot supporting structures defining generally upwardly facing surfaces between the forward and rearward ends of said pedal members, each being in an operatively fixed position with respect to the respective pedal member to support the ball of a user's foot so as to enable a user to apply repeated generally elliptical cyclical movements to said left and right pedal members, and

a selectively variable resistance assembly constructed and arranged to provide a selected resistance within a range of resistances to the cyclical movements of said left and right pedal members,

each of said downwardly facing surfaces including laterally spaced planar portions having a differently shaped intermediate portion therebetween,

each of said rollers including laterally spaced cylindrical surfaces rollingly mating with the laterally spaced planar surfaces of a respective downwardly facing surface and a differently shaped intermediate portion therebetween rollingly mating with the differently shaped intermediate portion of a respective downwardly facing surface,

said differently shaped intermediate portions including projections and recesses.

45. An elliptical exerciser as defined in claim 44, wherein the cross-sectional configuration of each projection and cooperating recess is of arcuate shape.

46. An elliptical exerciser as defined in claim 45, wherein the cross-sectional configuration of each projection and cooperating recess is of rectangular shape.

47. An elliptical exerciser as defined in claim 46, wherein each projection and cooperating recess comprises parallel projections and cooperating parallel recesses.

48. An elliptical exerciser as defined in claim 44, wherein said projections are formed as elongated intermediate portions of said downwardly facing surfaces and said recesses are formed as annular intermediate portions of said rollers.

49. An elliptical exerciser as defined in claim 44, wherein said projections are formed as annular intermediate portions of said rollers and said recesses are formed as elongated intermediate portions of said downwardly facing surfaces.

50. An elliptical exerciser comprising:

a frame constructed and arranged to be stably supported on a horizontal surface,

a crank assembly providing a crank axis fixed with respect to said frame in a rearward position above the horizontal surface,

said crank assembly including oppositely extending left and right cranks providing parallel rotational axis spaced equidistantly from said crank axis and displaced about 180° with respect to one another,

left and right pedal members having first end portions connected with said left and right cranks respectively for rotational movement about the respective rotational axis thereof,

left and right rollers mounted on said frame for rotation about a rolling axis parallel with respect to said crank axis in a position above the horizontal surface a distance less than the distance of said crank axis above said horizontal surface,

said left and right pedal members having generally downwardly facing surfaces at second end portions thereof rollingly supported on said left and right rollers respectively,

said left and right pedal members providing left and right foot supporting structures defining generally upwardly facing surfaces between the forward and rearward ends of said pedal members, each being in an operatively fixed position with respect to the respective pedal member to support the ball of a user's foot so as to enable a user to apply repeated generally elliptical cyclical movements to said left and right pedal members, and

a selectively variable resistance assembly constructed and arranged to provide a selected resistance within a range of resistances to the cyclical movements of said left and right pedal members,

said downwardly facing surfaces being planar intermediate horizontal surfaces having vertical surfaces on opposite sides thereof,

said rollers including rollers rollingly contacting said horizontal surfaces and rollers rollingly contacting said vertical surfaces.

51. An elliptical exerciser as defined in claim 50, wherein said vertical surfaces face toward one another.

52. An elliptical exerciser as defined in claim 50, wherein said vertical surfaces face away from one another.

53. An elliptical exerciser comprising:

a frame constructed and arranged to be stably supported on a horizontal surface,

a crank assembly providing a crank axis fixed with respect to said frame in a position above the horizontal surface,

said crank assembly including oppositely extending left and right cranks providing parallel rotational axis spaced equidistantly from said crank axis and displaced about 180° with respect to one another,

left and right pedal members having first end portions connected with said left and right cranks respectively for rotational movement about the respective rotational axis thereof,

left and right rollers mounted on said frame for rotation about a rolling axis parallel with respect to said crank axis in a position above the horizontal surface a distance less than the distance of said crank axis above said horizontal surface,

said left and right pedal members having generally downwardly facing surfaces at second end portions thereof rollingly supported on said left and right rollers respectively,

said left and right pedal members providing left and right foot supporting structures defining generally upwardly facing surfaces between the forward and rearward ends of said pedal members, each being in an operatively fixed position with respect to the respective pedal member to support the ball of a user's foot so as to enable a user to apply repeated generally elliptical cyclical movements to said left and right pedal members, and

a selectively variable resistance assembly constructed and arranged to provide a selected resistance within a range of resistances to the cyclical movements of said left and right pedal members,

said downwardly facing surfaces including side portions extending downwardly and inwardly toward a lower central portion, said rollers including a roller rollingly engaging each of said side portions.

54. An elliptical exerciser as defined in claim 53, wherein said side portions are convexly arcuate in cross-section.

55. An elliptical exerciser as defined in claim 53, wherein said side portions are straight in cross-section.

56. An elliptical exerciser comprising:

a frame constructed and arranged to be stably supported on a horizontal surface,

a crank assembly providing a crank axis fixed with respect to said frame in a position above the horizontal surface,

said crank assembly including oppositely extending left and right cranks providing parallel rotational axis spaced equidistantly from said crank axis and displaced about 180° with respect to one another,

left and right pedal members having first end portions connected with said left and right cranks respectively for rotational movement about the respective rotational axis thereof,

left and right rollers mounted on said frame for rotation about a rolling axis parallel with respect to said crank axis in a position above the horizontal surface a distance less than the distance of said crank axis above said horizontal surface,

said left and right pedal members having generally downwardly facing surfaces at second end portions thereof rollingly supported on said left and right rollers respectively,

said left and right pedal members providing left and right foot supporting structures defining generally upwardly facing surfaces between the forward and rearward ends of said pedal members, each being in an operatively fixed position with respect to the respective pedal member to support the ball of a user's foot so as to enable a user to apply repeated generally elliptical cyclical movements to said left and right pedal members, and

a selectively variable resistance assembly constructed and arranged to provide a selected resistance within a range of resistances to the cyclical movements of said left and right pedal members,

each of said pedal members being formed as a tube,

each respective downwardly facing surfaces comprising an arcuate segment of a cylindrical periphery of a tube,

said arcuate segments having roller surfaces in rolling engagement therewith.

57. An elliptical exerciser as defined in claim 56, wherein each arcuate segment has a pair of rollers with perpendicular roller axes in rolling engagement therewith.

58. An elliptical exerciser as defined in claim 56, wherein each roller in rolling engagement with an arcuate segment has a grooved peripheral surface rollingly mating therewith.

59. An elliptical exerciser as defined in claim 24, wherein said casing is a housing having open sides to accommodate the movement of said left and right cranks, said open sides being substantially closed by disks which rotate about the crank axis by the movement of the cranks.

60. An exerciser as defined in claim 28, wherein said frame includes rearwardly extending rollers on a rearward end thereof position to engage the floor when the forward end of the frame is tilted upwardly so as to render the frame rollingly portable.

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