A static cycling machine includes a support assembly and a drive assembly. A frame assembly is mounted on the support assembly. The frame assembly includes a seat tube assembly extending from the drive assembly, the seat tube assembly being adjustable in length. A down tube assembly extends from the drive assembly, the down tube assembly being adjustable in length. A handlebar assembly is mounted on the down tube assembly. A fork assembly is connected to the handlebar assembly and is adjustable in length. The seat tube, down tube, handlebar and fork assemblies are connected to each other such that at least the dimensions of the frame assembly can be adjusted by adjusting the lengths of the tube assemblies. A driven wheel assembly is operatively connected to the drive assembly so that work applied to the drive assembly can be transmitted to the wheel assembly. Actuators are operatively engaged with the frame assembly to adjust dimensions of the frame assembly.
1. Select start position
2. Record Actuator Positions
3. Cycling starts
4. Read power applied at Pedals
5. Adjust on verbal feedback
6. Read power applied at Pedals
   a. Improved?
      - Yes
      - No
         a. Adjust and read power
         b. Improved?
            - Yes
            - No
               a. Record actuator settings
STATIC CYCLING MACHINE

FIELD OF THE INVENTION

[0001] This invention relates to a static cycling machine. More particularly, this invention relates to a static cycling machine, a control system for a static cycling machine and a method for operation of a static cycling machine.

BACKGROUND OF THE INVENTION

[0002] Static cycling machines are a popular method of exercise for athletes at all levels, whether cyclists or not. A problem with such machines is that they generally can only be adjusted at a rudimentary level. As a result, users often use poorly adjusted machines. This results in inefficient exercise technique and can cause injury, particularly in upper level athletes.

[0003] Cyclists often require bicycles that are custom-fitted. Custom fitting a bicycle can be an expensive and tedious process.

SUMMARY OF THE INVENTION

[0004] According to a first aspect of the invention, there is provided a static cycling machine which comprises

[0005] a support assembly;
[0006] a drive assembly;
[0007] a frame assembly mounted on the support assembly, the frame assembly comprising
[0008] a seat tube assembly extending from the drive assembly, the seat tube assembly being adjustable in length;
[0009] a down tube assembly extending from the drive assembly, the down tube assembly being adjustable in length;
[0010] a handlebar assembly mounted on the down tube assembly; and
[0011] a fork assembly connected to the handlebar assembly and being adjustable in length, the seat tube, down tube, handlebar and fork assemblies being connected to each other such that at least the dimensions of the frame assembly can be adjusted by adjusting the lengths of the tube assemblies; and
[0012] a driven wheel assembly operatively connected to the drive assembly so that work applied to the drive assembly can be transmitted to the wheel assembly; and
[0013] actuators operatively engaged with the frame assembly to adjust dimensions of the frame assembly.

[0014] A top tube assembly may be connected between the seat tube assembly and the handlebar assembly and is adjustable in length. A seat assembly may be mounted on the seat tube assembly.

[0015] An actuator may be engaged with the seat tube assembly and an actuator may be engaged with the down tube assembly.

[0016] The fork assembly may include left and right fork assemblies and actuators may be engaged with respective fork assemblies.

[0017] The seat assembly may include a seat post assembly that is adjustable with respect to the seat tube assembly. An actuator may be engaged with and interposed between the seat post and seat tube assemblies.

[0018] The handlebar assembly may be pivotally mounted with respect to the top tube assembly, the down tube assembly and the fork assembly to permit the handlebar assembly to pivot in response to adjustment of the frame assembly.

[0019] An actuator may be engaged with the down tube assembly and the handlebar assembly to pivot the handlebar assembly.

[0020] The drive assembly may include a pair of independently operable crank and drive sprocket assemblies.

[0021] The drive assembly may include an intermediate sprocket and hub assembly that includes a pair of minor sprockets to take power from each of the crank and drive sprocket, assemblies and a major sprocket rotationally fixed with respect to the minor sprockets.

[0022] The driven wheel assembly may include a driven sprocket to take power from the major sprocket and a continuously variable transmission connected to the driven sprocket. Alternatively, the driven wheel assembly may include a driven sprocket set to take power from the major sprocket.

[0023] The driven wheel assembly may include a resistance wheel connected to the driven sprocket via the transmission. The resistance wheel may have vanes to provide air resistance as the wheel is rotated, each vane having peripheral edges that are directed away from a direction of movement of the vanes.

[0024] A fan cover assembly may cover the driven wheel assembly. The fan cover assembly may define a vent to direct a flow of air generated by the driven wheel assembly onto a user to cool the user.

[0025] The invention extends to a control system for the static cycling machine, the control system comprising

[0026] a controller operatively connected to each of the actuators to control operation of the actuators and thus the extent of adjustment of the frame assembly; and
[0027] a data storage medium operatively connected to the controller to store data related to the extent of adjustment of each actuator.

[0028] The control system may include a wireless communications module to permit the controller to communicate data to a wireless device.

[0029] The control system may include a wireless terminal configured to read data from the controller and to generate a suitable interface to permit an operator to adjust the frame assembly.

[0030] The controller may be configured to read user data from the actuators corresponding to an extent of adjustment of the frame assembly and to store said user data in the data storage medium.

[0031] The control system may include a wireless computational device that is configured to receive said user data from the controller and to generate output data based on the user data.

[0032] The computational device may be configured to generate a database relating users with data representing frame assembly dimensions. Furthermore, the computational device is configured to write user data for respective users to a data storage medium for use by said respective users.

[0033] The control system may include a reader for reading said data storage medium, the controller being configured to control operation of the actuators in response to data read from the storage medium such that the frame assembly is adjusted into a condition related to the user associated with the data storage medium.
The invention further extends to a method for using the static cycling machine, the method comprising the steps of:

- recording a user’s details;
- reading power applied at the drive assembly;
- adjusting the frame assembly with the actuators until a maximum power applied at the drive assembly is achieved;
- recording positional conditions of the actuators corresponding to said maximum power; and
- storing the user’s details together with the positional conditions in a database.

The method may include the steps of writing data relating to the user’s details and the positional conditions of the actuators to a data storage medium.

The method may include the steps of reading said data relating to the user’s details and the positional conditions of the actuators and adjusting the frame assembly in accordance with said data.

**BRIEF DESCRIPTION OF THE DRAWINGS**

FIG. 1 shows a right hand side view of one embodiment, in accordance with the invention, of a static cycling machine.

FIG. 2 shows a left hand side view of the static cycling machine.

FIG. 3 shows a right hand side view of the static cycling machine with a cowling assembly removed to display internal mechanisms.

FIG. 4 shows a left hand side view of the static cycling machine with a cowling assembly removed.

FIG. 5 shows an exploded view of the static cycling machine.

FIG. 6 shows a right hand side view of an embodiment of the static cycling machine, with the cowling assembly removed, incorporating sprocket gears on the driven wheel assembly.

FIG. 7 shows a left hand side view of the embodiment of FIG. 6.

FIG. 8 shows an exploded view of a drive frame assembly of the static cycling machine.

FIG. 9 shows an exploded view of a handlebar assembly of the static cycling machine.

FIG. 10 shows an exploded view of a left lower fork assembly of a support assembly of the static cycling machine.

FIG. 11 shows an exploded view of a right lower fork assembly of a support assembly of the static cycling machine.

FIG. 12 shows an exploded view of one of a pair of upper front fork assemblies of the static cycling machine.

FIG. 13 shows an exploded view of a left fork actuator assembly of the static cycling machine.

FIG. 14 shows an exploded view of a right fork actuator assembly of the static cycling machine.

FIG. 15 shows an exploded view of an outer part of a down tube assembly of the static cycling machine.

FIG. 16 shows an exploded view of an inner part of the down tube assembly.

FIG. 17 shows an exploded view of a top tube assembly of the static cycling machine.

FIG. 18 shows an exploded view of a seat post assembly of the static cycling machine.

FIG. 19 shows an exploded view of a seat tube assembly of the static cycling machine.

FIG. 20 shows a plan view of a base assembly of the static cycling machine.

FIG. 21 shows a three-dimensional view of the base assembly.

FIG. 22 shows a side view of a crank assembly of the static cycling machine.

FIG. 23 shows a three-dimensional view of the crank assembly.

FIG. 24 shows a top plan view of the crank assembly.

FIG. 25 shows an exploded view of the crank assembly.

FIG. 26 shows an exploded view of an intermediate hub assembly of the static cycling machine.

FIG. 27 shows an exploded view of a driven wheel assembly of the static cycling machine.

FIG. 28 shows an exploded view of a cowling assembly of the static cycling machine.

FIG. 29 shows a control system for the static cycling machine.

FIG. 30 shows a flow chart representing a method of using the cycling machine.

FIG. 31 shows a database generated by the method of FIG. 30.

**DETAILED DESCRIPTION OF THE DRAWINGS**

In FIGS. 1 and 2, reference numeral 10 generally indicates one embodiment of a static cycling machine, in accordance with the invention.

The cycling machine 10 includes a support assembly 12. A frame assembly 14 is mounted on the support assembly 12. A drive assembly 16 is mounted on the frame assembly 14. A driven wheel assembly 18 is mounted on the frame assembly 14. The wheel assembly 18 is operatively connected to the drive assembly 16 so that effort exerted at the drive assembly 16 is transmitted to the driven wheel assembly 18.

The frame assembly 14 includes a seat tube assembly 20. The seat tube assembly 20 is adjustable in length and a seat assembly 22 is mounted on one end of the seat tube assembly 20. An opposite end of the seat tube assembly 20 is fast with the drive assembly 16.

A down tube assembly 24 extends angularly with respect to the seat tube assembly in a manner conventional to bicycles. The down tube assembly 24 is adjustable in length. A handlebar assembly 26 is mounted on one end of the down tube assembly 24 and an opposite end of the down tube assembly 24 is fast with the drive assembly 16.

A top tube assembly 28 is connected between the seat tube assembly 20 and the handlebar assembly 26 such that the seat tube assembly 20, the down tube assembly 24 and the top tube assembly 28 are positioned in a manner similar to that of a conventional bicycle.

The top tube assembly 28 is also adjustable in length. The assemblies 20, 24, 26, and 28 are connected to each other in a pivotal manner so that at least the dimensions of the frame assembly 14 can be adjusted by adjusting the lengths of the assemblies 20, 24, 26 and 28.

A front fork assembly 30 is connected between the support assembly 12 and the handlebar assembly 26, the front fork assembly 30 being adjustable in length. In particular, the front fork assembly 30 includes a left fork assembly 34 and a right fork assembly 36, each of which are adjustable in length.
Actuators engage the frame assembly 14 and are operable to adjust dimensions of the frame assembly 14.

The support assembly 12 includes a base assembly 36. An example of the base assembly 38 is shown in detail in FIGS. 20 and 21. The base assembly 38 includes a base plate 40. A pair of wheels or casters 42 is mounted on the base plate 40. Thus, movement of the cycling machine 10 is facilitated. Brackets 44 are fast with the plate 40 to permit the plate 40 to be secured in position.

The drive assembly 16 includes a drive frame assembly 46. An example of the drive frame assembly 46 is shown in detail in FIGS. 5 and 8. The assembly 46 includes a crank hub case 48. A rear brace 60 has one end fast with the base plate 40 with, a suitable foot plate 52 and an opposite end fast with the case 48. A front brace 54 has one end fast with the base plate 40 with a suitable foot plate 58 and an opposite end fast with the case 48. A tubular seat pole 58 of the seat tube assembly is fast with and extends operatively upwardly from the case 48.

A rear vertical support 60 is fast with and interposed between the seat pole 58 and the foot plate 52.

Control and sensing circuitry is arranged in a housing 61 mounted on the rear and front braces 50, 54 with suitable brackets 62.

The drive assembly 16 includes a crank assembly 64 fitted to crank case 48. Detail of the crank assembly 64 is shown in FIGS. 22 to 25. The crank assembly 64 includes a pair of power crank and sprocket assemblies 66.1, 66.2 mounted on the left and right hand sides of the drive frame assembly 46, respectively. The assemblies 66.1 and 66.2 include power cranks 68.1 and 68.2, respectively. The power cranks 68.1 and 68.2 are connected to left and right drive sprockets 70.1 and 70.2, respectively, via clutch mechanisms 71.1 and 71.2 interposed between the cranks 68.1 and 68.2, respectively and adapters 72.1 and 72.2, respectively. The drive sprockets 70.1 and 70.2 are connected to the crank case 48 with roller bearings 73.1 and 73.2, respectively.

Thus, the assemblies 66 are configured to operate independently of each other. As a result, a user is encouraged to apply positive effort to each power crank continuously to maintain a conventional pedaling action. Sensor mounts 74.1, 74.2 are interposed between the adaptors 72.1, 72.2 and the cranks 70.1 and 70.2, respectively. Sensors, not shown here, are arranged on the mounts 74 to generate signals corresponding to the effort applied to the respective cranks 68.1 and 68.2.

Such an arrangement is particularly suited for training cyclists and other athletes. It is envisaged that the invention covers embodiments in which the crank assembly 64 is a single mechanism in which the power cranks are connected to each other for a more conventional training application.

Applicant has found that suitable components of the crank assembly 64 are those supplied by Quark Technology Inc., for power measurement and those known as "Power-Crank" for the assemblies 66.

Other components which constitute the crank assembly, but which are not specifically described can readily be ascertained from FIG. 25.

The drive assembly 16 further includes an intermediate sprocket and hub assembly 76 mounted on the front brace 54. Detail of the assembly 76 is shown in FIG. 26. The assembly 76 includes a mounting bracket 78. A shaft housing 61 is fast with the bracket 78. A left roller bearing 80.1 and a right roller bearing 80.2 are fitted into the housing 81. A drive member in the form of a left minor sprocket 88 is fast with the left roller bearing 80.1.

An adaptor 82 is fast with the right roller bearing 80.2. Drive members in the form of a major sprocket 84 and a right minor sprocket 90 are both fast with the adaptor 82.

A flexible drive member in the form of a left primary drive chain interconnects the left drive sprocket 70.1 and the left minor sprocket 88. A further flexible drive member in the form of a right primary drive chain interconnects the right drive sprocket 70.2 and the right minor sprocket 90. Therefore, operation of either of the assemblies 66.1 or 66.2 results in rotation of the major sprocket 84, allowing specific training or technique assessment.

The support assembly 12 includes a left lower fork assembly 92 and a right lower fork assembly 94. Positioning of these assemblies 92, 94 is shown in detail in FIG. 5. Detail of the left lower fork assembly 92 is shown in FIG. 10, while detail of the right lower fork assembly 94 is shown in FIG. 11. The driven wheel assembly 18 is supported above the base assembly 38 by the fork assemblies 92, 94.

The left lower fork assembly 92 includes a foot plate 96 fast with the base plate 40. A tubular fork 98 is fast with the foot plate 96. A bracket 100 is mounted on an upper end of the fork 98 for mounting the left fork assembly 34. A braking mechanism in the form of a disk brake caliper 101 is mounted on the fork 98 with a bracket 102. A resistance wheel axle mount 104 is fast with the fork 98.

The right lower fork assembly 94 includes a foot plate 106 fast with the base plate 40. A tubular fork 108 is fast with the foot plate 96. A bracket 110 is mounted on an upper end of the fork 108 for mounting the right fork assembly 36. A resistance wheel axle mount 112 is fast with the fork 108.

The driven wheel assembly 18 includes a resistance wheel 114. In this particular embodiment, the resistance wheel 114 is in the form of a fan wheel. The wheel 114 includes a vane fastening arrangement in the form of a pair of spaced, vane fastening rings assemblies 116. A plurality of vanes 118 are fastened between the rings 116 to generate suitable wind resistance when the wheel 114 is rotated. Each ring assembly includes an outer ring 120 and an inner ring 122, the vanes 116 extending outwardly in a radial fashion from the inner ring 122 to the outer ring 120.

Each vane 118 is generally rectangular with major peripheral edges 124 directed away from a direction of movement of the vanes 118. Applicant has found that this configuration results in a significant reduction in noise levels and an increase in wind resistance when compared with flat vanes and those used on conventional exercise equipment.

A fan drive ring 132 is fast with a right inner ring 122.2 with a suitable fastening arrangement. In this embodiment, the fastening arrangement is in the form of ring halves 128 that interconnect the drive ring 132 and the right inner ring 122.2.

A hub 126 is fast with the fan drive ring 132 so that rotation of the hub 126 is conveyed to the resistance wheel 114.

A drive member in the form of a driven sprocket 134 is arranged on the hub 126. A flexible drive element in the form of a drive chain interconnects the sprocket 84 and the sprocket 134. It will thus be appreciated that rotation of either of the power cranks 68, independently of the other, results in rotation of the resistance wheel.
[0101] A continuously variable transmission mechanism 138 is fast with the hub to provide a continuously variable gearing effect. An example of a suitable mechanism is that supplied under the brand NuVinci®.

[0102] As shown in FIGS. 6 and 7, an alternative embodiment of the static cycling machine includes a cog set 140 of a number of differently dimensioned sprockets instead of the mechanism 138. With reference to the preceding Figures, like reference numerals refer to like parts unless otherwise specified.

[0103] FIGS. 6 and 7 also show an alternative resistance wheel 123. The wheel 123 includes a circular mounting plate 125 mounted on the cog set 140. A plurality of vanes 127 are fast with the plate 125 and extend from the plate 125 in a radial manner. Each vane 125 has one peripheral major edge that faces a direction of movement and an opposed major peripheral edge facing away from the direction of movement.

[0104] Reverting to the other Figures, a brake in the form of a disk brake 130 is mounted on a left inner ring 122.1 to be engaged by the caliper 101.

[0105] The front fork assembly 30 includes left and right upper front fork assemblies 142, one of which is shown in FIG. 12. Each assembly 142 includes a fork adjustment member 144 and a fork connecting bracket 146 for connecting the fork assemblies 142 to the handlebar assembly 26.

[0106] The front fork assembly 30 includes a left fork actuating member 148 (FIG. 13) and a right fork actuating member 150 (FIG. 14).

[0107] A left fork adjustment member 144.1 is telescopically mounted on the left fork actuating member 148 through a guide and damper assembly 149 mounted on the left fork actuating member 148 configured to dampen relative movement between the member 148 and the member 144.1. A bottom joint 152 connects to the bracket 100. A left fork actuator 154 is engaged with the members 144.1 and 148 to adjust an overall length of the left upper front fork assembly.

[0108] A right fork adjustment member 144.2 is telescopically mounted on the right fork actuating member 150 through a guide and damper assembly 151 configured to dampen relative movement between the member 150 and the member 144.2. A bottom joint 156 connects to the bracket 110. A right fork actuator 158 is engaged with the members 144.2 and 150 to adjust an overall length of the left upper front fork assembly.

[0109] The down tube assembly 24 is shown in detail in FIGS. 15 and 16. The down tube assembly 24 has an inner down tube 160 (FIG. 16). The inner down tube 160 has a joint 162 that is fast with the crank hub case 48.

[0110] The down tube assembly 24 has an outer down tube 164 (FIG. 15). The outer down tube 164 has a bottom tube guide 166 at one end through which the inner down tube 160 is received to be telescopically mounted to the outer down tube 164. The bottom tube guide 166 incorporates a damper arrangement 165 that includes a damper pad and pressure plate to dampen relative movement between the inner and outer down tubes.

[0111] A pivotal connecting arrangement in the form of a top yoke 168 is mounted at an opposite end of the tube 164 to connect the outer down tube to the handlebar assembly 26. An actuator mounting bracket 170 is fast with the outer down tube 164.

[0112] An actuator 172 interconnects the inner down tube 160 and the bracket 170 so that an overall length of the down tube assembly 24 can be adjusted on operation of the actuator 172.

[0113] The seat tube assembly 20 (FIG. 19) includes a seat tube 174 that is telescopically mounted on the seat pole 58. A top guide joint 176 is mounted on an operatively upper end of the seat tube 174. A dampering arrangement 175 is arranged in the joint 176 to dampen relative movement of the seat tube 174 and the seat post 184. A seat tube actuator bracket 178 is fast with the seat tube 174.

[0114] An actuator 180 interconnects the top guide joint 176 and the seat pole 58 so that an overall length of the seat tube assembly 20 can be adjusted on operation of the actuator 180. A demaricated size indication plate 181 is fast with the seat tube 174 and co-operates with the seat pole 58 to provide a visual indication of the overall length of the seat tube assembly 20.

[0115] The seat assembly 22 includes a seat post assembly 182 (FIG. 18). The post assembly 182 includes a seat post 184, a lower end of which is received through the top guide joint 176 of the seat tube assembly 20 so that the post 184 is telescopically mounted on the seat pole 58.

[0116] A seat adjustment base plate 186 is mounted on an operatively upper end of the post 184. The base plate 186 defines a channel 188. A seat mounting block 190 is received in the channel 188 to be operatively horizontally displaceable relative to the base plate 186. A slide rod 192 is positioned in the channel 188. The seat mounting block 190 has a pair of guide formations 194, each defining a guide passage 196. The slide rod 192 is received through the guide passages 196 so that the seat mounting block 190 can slide relative to the base plate 186. The base plate 186 defines a pair of opposed elongate slots 198. A pair of fasteners 200 is received through the slots 198 and through openings 201 in the block 190 to secure the block 190 in a selected position.

[0117] A seat clamping assembly 202 is arranged on the block 190 to fasten a seat 204 to the block 190. The seat clamping assembly 202 is configured so that the seat 204 can be pivoted into a desired orientation.

[0118] An actuator 206 interconnects the base plate 186 and the actuator mounting bracket 170 so that the seat post 184 can be adjusted relative to the seat tube 174.

[0119] The top tube assembly 28 is shown in detail in FIG. 17. The assembly 28 includes an outer top tube 208. A pivotal connector in the form of a front yoke 210 is mounted on a front end of the tube 208. An inner top tube 212 is received in the outer top tube 208 in a telescopic fashion. The inner top tube is received through a guide and damper assembly 214. The guide and damper assembly 214 includes a guide member 216 which is fast with the outer top tube 208. The guide member 216 defines a damper member 218 in which a damper washer insert is received. A damper washer 220 is fast with the inner top tube 212 to engage the washer insert when the top tube assembly 28 is in a retracted condition.

[0120] A size indicator in the form of a demaricated size indication plate 224 is mounted on each side of the inner top tube 212. The plate 224 co-operates with the outer top tube 208 to provide a visual indication of the overall length of the top tube assembly 28.

[0121] A pivotal connector in the form of a yoke, such as a clevis yoke 226 is mounted on a rear end of the inner top tube
so that the inner top tube can be connected to a complementary connecting formation in the form of a yoke 227 on the seat tube 174.

The handlebar assembly 26 is shown in detail in FIG. 9. The handlebar assembly includes a head portion that includes a head joint 228. The head joint 228 defines a channel 230. A head stem 232 is received in the channel 230. A sliding guide arrangement in the form of a slide rod 234 is positioned in the channel 230. The head stem 232 defines a passage 235, the slide rod 234 being received through the passage 236 so that the head stem 232 can slide relative to the head joint 228. A locking arrangement includes a pair of opposed slots 258 defined in the head stem 232 and opening into the channel 230. A pair of fasteners is received through the slots 238 and through complementary openings 240 defined in the head stem 232. Thus, the head stem 232 can be locked in position relative to the head joint 228. A handlebar stem 242 is clamped to a spigot 244 of the head stem 232 and handlebars 246 are fast with the handlebar stem 242.

The head joint 228 defines a transverse mounting formation 246. A left fork connecting bracket 146.1 is pivotally connected to a left side of the mounting formation 246 and a right fork connecting bracket 146.2 is pivotally connected to a right side of the mounting formation 246. It follows that actuation of the left and right fork actuators 148, 150 adjusts a height of the handlebars 248.

The head joint 228 defines an opening 250 so that the top yoke 168 of the outer down tube 164 is pivotally connected to the head joint 228 allowing pivotal movement of the head joint 228 with respect to the down tube assembly 24.

The head joint 228 defines a lug 252. The lug 252 defines an opening 254 so that an actuator 256 pivotally interconnects the head joint 228 and the actuator mounting bracket 170.

The head joint 228 defines a further opening 258 so that the front yoke 210 of the outer top tube 208 is pivotally connected with the head joint 228.

The static cycling machine 10 includes a cover assembly in the form of a cowling assembly 260, shown in detail in FIG. 28. The cowling assembly 260 includes a pair of side covers 262 that cover the various working components of the machine 10, both for safety and aesthetics.

The cowling assembly 260 also includes a fan cover 264 that covers the driven wheel assembly 266. The fan cover 264 defines a vent 266 that is configured so that air flow generated by the vanes 118 is directed on to a user to cool the user.

Each of the actuators is a linear actuator incorporating a stepper motor, the actuators are infinitely adjustable between predetermined ranges.

The static cycling machine 10 includes a control system, an example of which is indicated at 270 in FIG. 29. The actuators described above are numbered accordingly in FIG. 29 for the sake of convenience and clarity. The control system 270 includes a controller 272 that is operatively connected to each of the actuators to control operation of the actuators. The actuators incorporate stepper motors with feedback generation so that a positional condition of each actuator can be signaled to the controller 272 and stored either dynamically or stastically in a database 274.

It will be appreciated that adjusting a length of one of the assemblies will result in corresponding adjustment in length of at least one other assembly. The controller 272 is programmed so that an adjustment in length of any one of the assemblies is carried out in a compound fashion by incrementally altering the lengths of the other assemblies. For example, where it is desired to extend a height of the handlebar assembly 26 relative to the seat assembly 22, the actuators 154, 158 and 172 co-operate to achieve the height adjustment. It follows that said adjustment can occur incrementally and sequentially in each of the actuators 164, 158 and 172. Furthermore, the actuator 256 can be operated to adjust a tilt of the handlebar assembly 26 to suit the cyclist. During that adjustment process, the top tube assembly 28 is capable of pivoting to accommodate relative movement of the assemblies due to the manner in which it is mounted to the handlebar assembly 26 and the seat tube assembly 20. Also, the top tube assembly 28 is capable of extension or retraction to accommodate that relative movement. It will readily be appreciated that a similar process is followed when a height of the seat assembly 22 is adjusted relative to the handlebar assembly 26.

The actuators include potentiometers, the resistance value associated with the potentiometers varying according to an extent of adjustment of the actuators. The Controller 272 reads the variation in resistance to obtain a value associated with an extent of adjustment of the actuators.

The actuators have internal limit switches, generally indicated at 276 to limit the extent of adjustment of the actuators. In addition, the controller 272 is programmed to cut power to a particular actuator, if the extent of adjustment of that actuator exceeds a predetermined value.

The controller 272 is located in the control circuitry housing 61 described earlier. The control circuitry includes a wireless communications module 278 to permit the controller 272 to communicate wirelessly with various devices.

Such devices can include a handheld wireless device 280 in the form of an application-specific handheld terminal or a personal digital assistant (PDA). The device 280 is configured to receive data from the controller 272 representing the positional condition of each of the actuators. Alternatively, the controller 272 can be configured to generate data representing the lengths of the various adjustable assemblies, calculated from the positional conditions of the associated actuators. That data can then be communicated to the terminal 280 so that an operator can readily assess the condition of the machine 10.

The device 280 can be configured to generate an interface for use by an operator to permit the operator to control the actuators in a number of different ways. In one embodiment, the device can be configured to actuate each of the actuators individually, in another embodiment, the device can be configured to generate an interface that allows the operator to select a particular position of one of the assemblies. In that embodiment, when the operator selects the particular position, the controller is configured to sequentially and incrementally adjust the associated actuators until a positional condition of the associated actuators corresponding to the desired position of the target assembly is reached.

In this regard, it will be appreciated that relative positions of the seat 204 and handlebar 248 correspond in a predictable manner with positional conditions of the various actuators. It follows that the controller 272 can be programmed with a suitable algorithm relating the relative position of the seat 204 and handlebar 248 to positional conditions of the various actuators. Furthermore, one of the actuators 250 is capable of adjusting an angular position of the handle-
bars 248 to accommodate adjustment of relative linear positions of the handlebars 248 and the seat 204.

The actuators are configured to provide infinite adjustment within a particular range. It follows that overall dimensions of the frame assembly 14 are infinitely adjustable over a particular range. As a result the frame assembly 14 can simulate any bicycle frame geometry across a particular range. It follows that the machine 10 is suited for assessing cyclists or athletes for frame customization.

The machine 10 facilitates customization because the actuators are operable while the cyclist operates the machine. In one application, therefore, the cyclist pedals while a trainer or fitter obtains verbal feedback as to which settings are most comfortable. Those settings are recorded manually using the various size indication plates. Instead, the controller 272 can record the positional conditions of the actuators corresponding to the most comfortable settings in the database 274 for later recall.

The control system 270 includes a computational device such as a laptop computer 286 or a PC that is configured to communicate with the controller 272 via the communication module 278. The device 286 can include one or more databases for storing data, relating to the use of the machine 10. For example, the device 286 can store cyclist identification data, and, related to each cyclist, data related to the fork assembly length, down tube assembly length, top tube assembly length, seat tube assembly length, and seat post assembly length.

One example of a method of collecting that data is set out in the flowchart shown in FIG. 30. A cyclist to be assessed is seated on the machine. Details of the cyclist are recorded. At 290, the actuators are adjusted so that the frame assembly and fork assembly are adjusted into a condition estimated to be suitable for the cyclist. At 292 the actuator positions are recorded. Pedaling is initiated at 294. Power applied to the left and right hand power cranks is read at 296.

The cyclist provides verbal feedback and the actuators are adjusted accordingly at 298. Power applied to the left and right hand cranks is read again at 300. The power applied at 300 is compared to the power applied at 296 at 302. If there has been an improvement the actuators can be adjusted again at 298 and steps 300 and 302 repeated. If there has not been an improvement, the operator makes an intuitive adjustment and reads the power again. At 304 a query is made as to whether or not the power has improved. If yes, the actuator settings can be recorded.

It will be appreciated that the method shown in FIG. 30 can be automated to a large degree to generate optimized data related to the various lengths and associated with the particular cyclist.

It will also be appreciated that the method can be used to generate a relational database. An example of a simple relational database in accordance with the invention is shown in FIG. 31. As can be seen, the relational database associates respective cyclist data components 314 with data components 316 related to optimized fork assembly length, down tube assembly length, top tube assembly length, seat tube assembly length, and seat post assembly length. Each of the optimized lengths is associated with respective sets of data components 318 representing positional conditions of the actuators.

Once the relational database has been generated, it can be used to write data relating to respective cyclists to data storage media personalized for the respective cyclists. That data would include identification data representing the cyclist and at least data related to fork assembly length, down tube assembly length, top tube assembly length, seat tube assembly length, and seat post assembly length optimized for the card holder. Other data may include extent of handlebar tilts and any other conditional data related to the machine 10 which can be effected by the positional conditions of the actuators. For example, the data can be written to a card with a data carrier.

The machine 10 may include a data reader 310 for reading the data from the data storage media. A reader interface 312 writes the data to the controller 272. Where the data storage media is a card, the data reader 310 is a card reader.

The controller 272 is configured to process the data from the data storage media and to generate control signals so that the actuators assume conditions that result in the various assemblies assuming lengths optimized for the particular cyclist.

In one application, the static cycling machine 10 is used to select a suitable frame for a cyclist. Once the cyclist has the data storage medium, it can be presented at any bicycle dealer so that optimized frame dimensions can be extracted.

In one example, the controller 272 can be connected to an actuator 320 for applying the disk brake 130. The controller 272 can be programmed with a set of instructions so that the disk brake 130 is applied to increase or decrease resistance to cycling experience by the cyclist. The set of instructions can be configured so that the cyclist experiences a simulation of a particular route. Furthermore, the set of instructions can be written to the controller by the computational device 256. The computational device 286 can be configured to generate an image for the cyclist that represents the particular route. To facilitate this and in order to enhance the functionality of the machine 10, the machine 10 can include an electronic odometer that generates a signal representing an equivalent distance covered by the cyclist. Thus, the computational device can be configured so that various characteristics of a selected route can be accurately simulated.

Competitive cyclists generally train with bicycles that are particularly suited to their specific requirements. Such bicycles are either carefully adjusted or have been custom made for the cyclist. As a result, competitive cyclists are hesitant to train on conventional static cycling machines out of a fear of injury. Such machines can generally only be adjusted in a rudimentary manner. Experienced cyclists who decide to change a riding position such as seat height do so gradually often over many months. Typical static cycling machines have 25 mm adjustments in seat height, for example. Such a change could easily result in injury. Furthermore, it is often just too time-consuming and frustrating to attempt to adjust such machines before training. With the present invention, a cyclist can swipe the card and begin cycling as soon as the machine has adjusted itself into a condition optimized for the cyclist.

Competitive cyclists are often required to travel around the world to attend various competitions. As a result they often find themselves in hotels with gymnasiums. Flow-
ever, these gymnasiums are generally fitted with conventional cycling machines and cyclists are hesitant to use such machines. The machine 10 provides a means whereby competitive cyclists can train in conditions that closely simulate their competitive bicycles. It is not only competitive cyclists who find themselves in such a position. Cycling has become a very popular pastime among businessmen, professionals and others who attend gymnasiums when away from home. The machine 10 provides a training apparatus that can closely simulate their bicycles so that training regimes can be maintained.

At present, especially equipped training centres are used to fit competitive cyclists to cycle frames and to carry out the associated testing. Such fitting and testing can be prohibitively expensive and time-consuming. It will readily be appreciated that the machine 10 provides a means whereby such expense and time is saved. Because the frame assembly has components common to those of conventional and even a large number of specialized bicycles, it is possible to use the data generated by the controller 272 for fitting such bicycles to cyclists. Such bicycles could include competitive road bicycles, off-road bicycle, such as BMX bicycles and downhill racers and track bicycles.

Static cycling machines are a popular method of exercise for athletes at all levels, whether cyclists or riot. An example of their popularity is their growing use in what is called “spinning.” That activity usually involves a number of users each positioned on a cycling machine being directed by an instructor on a similar cycling machine. Generally, spinning machines only have very rudimentary adjustment mechanisms. These can be both difficult and tedious to adjust, particularly considering that many different users could use a particular machine in just one day. As a result, the users often don’t bother to adjust the machines properly. Even when they do make adjustments, those adjustments are usually just an estimation of the proper settings. The machine 10 can be used to address this problem. For example, in one application, the machine 10 could be used as a spinning machine. In that application, the embodiment of the drive assembly described above could be replaced with a more conventional drive assembly. It will be appreciated that the wireless capability of the machine 10 and the controller 272 would allow each gym member to have both the machine 10 and a route or routine specifically customized for that member. Furthermore, the data storage medium, for example a swipe card, could be used to facilitate alteration of the frame dimensions and even the routine to accommodate a new member.

It will be appreciated that the frame assembly 14 is analogous to that of a conventional bicycle. As a result, a cycling experience can be achieved that is similar to that of a conventional bicycle. This is enhanced by the pivotal adjustability of the handlebar assembly.

In this specification, the term “cyclist” is not intended to refer only to those whose primary sporting activity is cycling. Rather, the word is intended to cover all who incorporate cycling into their training schedules. These could include runners, football and rugby players, and a host of others.

Throughout the specification, including the claims, where the context permits, the term “comprising” and variants thereof such as “comprise” or “comprises” are to be interpreted as including the stated integer or integers without necessarily excluding any other integers.

It is to be understood that the terminology employed above is for the purpose of description and should not be regarded as limiting. The described embodiments are intended to be illustrative of the invention, without limiting the scope thereof. The invention is capable of being practised with various modifications and additions as will readily occur to those skilled in the art.

1. A static cycling machine which comprises
   a support assembly;
   a drive assembly;
   a frame assembly mounted on the support assembly, the frame assembly comprising
   a seat tube assembly extending from the drive assembly,
   the seat tube assembly being adjustable in length;
   a down tube assembly extending from the drive assembly,
   the down tube assembly being adjustable in length;
   a handlebar assembly mounted on the down tube assembly;
   and
   a fork assembly connected to the handlebar assembly
   and being adjustable in length, the seat tube, down tube, handlebar and fork assemblies being connected to each other such that at least the dimensions, of the frame assembly can be adjusted by adjusting the lengths of the tube assemblies; and
   a driven wheel assembly operatively connected to the drive assembly so that work applied to the drive assembly can be transmitted to the wheel assembly; and
   actuators operatively engaged with the frame assembly to adjust dimensions of the frame assembly.

2. A static cycling machine as claimed in claim 1, in which a top tube assembly is connected between the seat tube assembly and the handlebar assembly and is adjustable in length.

3. A static cycling machine as claimed in claim 1, in which a seat assembly is mounted on the seat tube assembly.

4. A static cycling machine as claimed in claim 3, in which an actuator is engaged with the seat tube assembly and an actuator is engaged with the down tube assembly.

5. A static cycling machine as claimed in claim 3, in which the fork assembly includes left and right fork assemblies and actuators are engaged with respective fork assemblies.

6. A static cycling machine as claimed in claim 3, in which the seat assembly includes a seat post assembly that is adjustable with respect to the seat tube assembly, an actuator being engaged with and interposed between the seat post and seat tube assemblies.

7. A static cycling machine as claimed in claim 3, in which the handlebar assembly is pivotally mounted with respect to the top tube assembly, the down tube assembly and the fork assembly to permit the handlebar assembly to pivot in response to adjustment of the frame assembly.

8. A static cycling machine as claimed in claim 7, in which an actuator is engaged with the down tube assembly and the handlebar assembly to pivot the handlebar assembly.

9. A static cycling machine as claimed in claim 3, in which the drive assembly includes a pair of independently operable crank and drive sprocket assemblies.

10. A static cycling machine as claimed in claim 9, in which the drive assembly includes an intermediate sprocket and hub assembly that includes a pair of minor sprockets to take power from each of the crank and drive sprocket assemblies and a major sprocket rotationally fixed with respect to the minor sprockets.
11. A static cycling machine as claimed in claim 10, in which the driven wheel assembly includes a driven sprocket to take power from the major sprocket and a continuously variable transmission connected to the driven sprocket.

12. A static cycling machine as claimed in claim 10, in which the driven wheel assembly includes a driven sprocket set to take power from the major sprocket.

13. A static cycling machine as claimed in claim 11, in which the driven wheel assembly includes a resistance wheel connected to the driven sprocket via the transmission, the resistance wheel having vanes to provide air resistance as the wheel is rotated, each vane having peripheral edges that are directed away from a direction of movement of the vanes.

14. A static cycling machine as claimed in claim 1, which includes a fan cover assembly for covering the driven wheel assembly, the fan cover assembly defining a vent to direct a flow of air generated by the driven wheel assembly on to a user to cool the user.

15. A control system for a static cycling machine as claimed in claim 1, the control system comprising
   a controller operatively connected to each of the actuators to control operation of the actuators and thus the extent of adjustment of the frame assembly; and
   a data storage medium operatively connected to the controller to store data related to the extent of adjustment of each actuator.

16. A control system as claimed in claim 15, which includes a wireless communications module to permit the controller to communicate data to a wireless device.

17. A control system as claimed in claim 16, in which the control system includes a wireless terminal configured to read data from the controller and to generate a suitable interface to permit an operator to adjust the frame assembly.

18. A control system as claimed in claim 16, in which the controller is configured to read user data from the actuators corresponding to an extent of adjustment of the frame assembly and to store said user data in the data storage medium.

19. A control system as claimed in claim 16, which includes a wireless computational device that is configured to receive said user data from the controller and to generate output data based on the user data.

20. A control system as claimed in claim 19 in which the computational device is configured to generate a database relating users with data representing frame assembly dimensions.

21. A control system as claimed in claim 20, in which the computational device is configured to write user data for respective users to a data storage medium for use by said respective users.

22. A control system as claimed in claim 21 which includes a reader for reading said data storage medium, the controller being configured to control operation of the actuators in response to data read from the storage medium such that the frame assembly is adjusted into a condition related to the user associated with the data storage medium.

23. A method for using the static cycling machine of claim 1, the method comprising the steps of:
   recording a user’s details;
   reading power applied at the drive assembly;
   adjusting the frame assembly with the actuators until a maximum power applied at the drive assembly is achieved;
   recording positional conditions of the actuators corresponding to said maximum power; and
   storing the user’s details together with the positional conditions in a database.

24. A method as claimed in claim 23, which includes the steps of writing data relating to the user’s details and the positional conditions of the actuators to a data storage medium.

25. A method as claimed in claim 24, which includes the steps of reading said data relating to the user’s details and the positional conditions of the actuators and adjusting the frame assembly, in accordance with said data.