CHAIR EXERCISE APPARATUS

BACKGROUND OF THE DISCLOSURE

Field of the Disclosure

[0001] The present disclosure relates to an exercise apparatus used in Pilates type exercises. In particular, this disclosure relates to a new Pilates chair that has a number of unique innovations.

State of the Art

[0002] Exercise machines utilized in the performance of physical exercises originated by Joseph Pilates typically are often performed on a stationary apparatus called a reformer. Other exercises are conducted on a combo chair that has spring biased foot bar rests or bars on ends of arms which extend out from a pivot bar fixed to a bottom of the chair frame beneath the chair. One or two coil springs extend from beneath a rear of the chair or the chair seat to a point on each of the arms close to the foot rests.

[0003] Typically, a user presses against the foot bars or rests while either sitting on the chair or standing with both legs or one leg resting on the seat and the other pushing on the foot pad/bar at the ends of the arms. One such chair, called a combo chair, is disclosed in our US Patent No. 6,919,279. Spring tension is generally limited to the spring rate of typically one or at most two springs attached between the chair frame and each of the arms. One solution has been the anchor configuration set out in our US patent 6,919,279 which permits a rear end of each of the springs to be attached at three different heights at the rear of the combo chair. This has expanded the versatility of the Combo Chair but still limits the versatility of the combo chair to a relatively limited number of exercises without having to change out the coil springs. Thus there is a need for a more versatile chair that can provide a wider range of tensions between the chair seat and the foot support pads/bars at the ends of the arms that pivot from beneath the chair.

SUMMARY OF THE DISCLOSURE

[0004] One exemplary embodiment of a chair exercise apparatus in accordance with the present disclosure has a frame configured to rest on a horizontal surface, a seat

support fastened to an upper surface portion of the frame, a seat fastened to the seat support; and a pair of parallel arms each having a proximal end pivotally fastened to one of the frame or a portion of the seat support. Each arm is biased away from the frame toward the seat by a rotary arm torque unit. Each rotary arm torque unit includes a plurality of flat coil springs and each rotary arm torque unit is preferably fastened to the seat support which is rigidly fastened to or part of the frame.

[0005] Another embodiment of a chair exercise apparatus in accordance with the present disclosure includes a frame configured to rest on a horizontal surface, preferably an inverted Y shaped seat support merging with or into an upper surface portion of the frame, a seat connected to or fastened to an upper end of the seat support, a pair of parallel rotational arms each having a proximal end fastened to the frame and a foot support fastened to a distal end of each of the arms. Each arm is biased away from the frame toward the seat. Each arm is pivotally biased away from the frame by a rotary arm torque unit mounted beneath the seat.

[0006] Preferably each arm torque unit is mounted either to a portion of the frame or to a portion of the inverted Y shaped seat support. In this embodiment, the frame has a generally U shape with two parallel base portions and a mid portion spaced between the parallel base portions. Each rotary arm torque unit includes a plurality of flat coil springs. Each rotary arm torque unit is preferably fastened to the inverted y shaped seat support.

[0007] Each rotary arm torque unit preferably comprises a plurality of selectively engageable rotary springs fastened to a common axle rotatably carried by the frame. Each rotary arm torque unit includes a plurality of separately selectable flat coil springs engaging an axle supporting one of the arms. The rotary arm torque unit preferably includes a cassette housing carrying a plurality of flat coil springs in a cassette in the housing and a plurality of selectors for selecting one or more of the flat coil springs to engage the arm to which the rotary arm torque unit is attached. Each selector is configured to engage at least one of the plurality of flat coil springs. The cassette preferably includes a cassette comb having a plurality of spaced tines or partitions. This comb encloses and supports at least one of the plurality of flat coil springs between adjacent tines.

[0008] The rotary arm torque unit preferably has a cassette housing carrying a plurality of flat coil springs in a cassette in the housing and a plurality of selectors connected to the cassette housing for selecting one or more of the flat coil springs to engage the arm to which the rotary arm torque unit is attached.

[0009] An embodiment in accordance with the present disclosure may alternatively be viewed as a chair exercise apparatus that has a generally U shaped frame configured to rest on a horizontal surface, an inverted Y shaped seat support fastened to an upper surface portion of the U shaped frame, a seat fastened to a seat support portion of the inverted Y shaped seat support, and a pair of parallel arms each having a proximal end pivotally fastened to one of the frame or a diverging portion of the seat support. Each arm is biased away from the frame toward the seat by a rotary arm torque unit fastened below the seat to one of the frame or one of the diverging portions of the seat support. Each arm has a foot rest fastened to a distal end of the arm for a user to press his or her foot against while sitting or standing on the seat of the exercise apparatus.

[0010] An embodiment in accordance with the present disclosure may alternatively be viewed as a rotary arm torque unit for use in an exercise apparatus including a housing, a bearing supported rotary shaft in the housing for carrying an arm fastened to one end of the rotary shaft, and a cassette carried on the rotary shaft. This cassette has a plurality of flat coil springs therein each having a first end connected to the rotary shaft and a free second end engageable with the housing via one of a plurality of selectors carried by the housing.

[0011] One preferred embodiment of a rotary arm torque unit further includes a cassette comb carried in the housing separating at least two of the plurality of flat coil springs from each other. This cassette comb may be made of metal, a ceramic, or may preferably made of a polymeric material such as plastic. The cassette comb has a plurality of spaced apart tines or partitions to axially space apart at least two of the plurality of flat coil springs along the rotary shaft. One end of each of the flat coil springs is carried in an axial slot in the rotary axle. Preferably the free ends of two of the plurality of flat coil springs engage the housing to provide a preload the rotary arm torque unit. One preferred embodiment of the cassette has 7 flat coil springs.

[0012] A kit for installing rotary torque units in a conventional Pilates chair exercise apparatus is also envisioned in this disclosure. A conventional chair exercise apparatus typically has a generally box shaped frame, a seat on the top of the frame and one rotary arm or a pair of rotary arms rotatably fastened to a bottom portion of the frame, and a plurality of elongated coil springs extending from beneath the seat to a distal portion of at least one of the arms to bias the rotary arm or arms upward toward the seat.

[0013] A kit for such a chair preferably includes a pair of rotary arm torque units and a left rotary arm and a right rotary arm each having a proximal end and a distal end. Each rotary arm torque unit includes a cassette housing configured to be fastened to the frame beneath the seat of the conventional Pilates chair. A bearing supported rotary shaft in the cassette housing is adapted to be fastened to the proximal end of one of the rotary arms.

[0014] The rotary arm torque unit includes a cassette carried on the rotary shaft in a cassette housing. This cassette has a plurality of flat coil springs therein each having a first end connected to the rotary shaft and a free second end engageable with the cassette housing via one of a plurality of selectors carried by the cassette housing. Preferably the rotary arm torque unit includes a cassette comb carried in the cassette housing axially separating one or more of the plurality of flat coil springs from each other. The cassette comb is preferably made of a polymeric material such as plastic. The cassette comb has a plurality of spaced apart tines or partitions to axially space apart one or more of the plurality of flat coil springs along the rotary shaft. The free ends of one or preferably two of the plurality of flat coil springs engage the cassette housing to preload the rotary arm torque unit.

BRIEF DESCRIPTION OF THE DRAWING

[0015] These and other features and advantages of embodiments of the present disclosure will become more apparent from a reading of the following detailed description when taken in conjunction with the drawings.

[0016] FIG. **1** is a front view of a chair exercise apparatus in accordance with the present disclosure having exemplary hand support posts beside and extending above the seat.

[0017] FIG. **2** is a rear perspective view of the chair exercise apparatus shown in FIG. **1**.

[0018] FIG. **3** is a separate rear perspective view of the floor support frame for the exercise apparatus shown in FIGS. **1** and **2**.

[0019] FIG. **4** is separate perspective view of the inverted Y shaped seat post member for the exercise apparatus shown in FIGS. **1** and **2**.

[0020] FIG. **5** is a separate front side view of one of the flat coil spring torque units removed from the chair exercise apparatus in accordance with the present disclosure.

[0021] FIG. **6** is a separate rear side perspective view of the other coil spring torque unit of the exercise apparatus similar to that shown in FIG. **5**.

[0022] FIG. **7** is a slightly tilted rear perspective view of the torque unit shown in FIG. **6**.

[0023] FIG. **8** is a partially exploded perspective view of a coil spring cassette in one of the torque units shown in FIGS. **5**-**7**.

[0024] FIG. **9** is a schematic representation of engagement of the coil spring cassette with the torque selector buttons in accordance with the present disclosure.

[0025] FIG. **10** is a front perspective view of another embodiment of a chair exercise apparatus in accordance with the present disclosure.

[0026] FIG. **11** is a perspective view of one of the torque modules removed from the chair exercise apparatus shown in FIG. **10**.

[0027] FIG **12** is a side view of the torque module shown in FIG. **11** with its side covers removed.

[0028] FIG. **13** is an opposite side view of the torque module shown in FIG. **12**.

[0029] FIG. **14** is an exploded view of the torque module shown in FIG. **12**.

DETAILED DESCRIPTION

[0030] One exemplary embodiment of a chair exercise apparatus **100** in accordance with the present disclosure is shown in a front view in FIG. **1**. A rear perspective view of the chair **100** is shown in FIG. **2**. The chair **100** has a generally U shaped bottom

frame member **104**, an inverted Y seat support member **106** fastened to the U shaped bottom frame member **104**, a seat **108** fastened to the seat support member **106**, an optional pair of handle support posts **102** removably mounted adjacent the seat **108**, a pair of elongated parallel arm members **112** each having a proximal end joined to an axle **118** beneath the Y seat support member **106** and extending outward and upward from beneath the inverted Y seat support member **106** and a spaced pair of rotary arm torque units **110** fastened to the bottom frame member **104** each independently biasing one of the arm members **112** upward toward the seat **108**.

[0031] A rear perspective view of the chair exercise apparatus **100** is shown in FIG. **2**. Each elongated arm **112** has a distal end **114** to which is fastened a foot support or rest **116** and a proximal end **118** rigidly fastened to one end **120** of a torque unit axle **122**. The chair exercise apparatus **100** has two arm torque units **110** mounted beneath the seat **108** and connected to the bottom frame member 104 and aligned on a common axis such that a user sitting on the seat 108 can place his or her feet on the side by side foot support rests **116** to perform basic Pilates chair exercises by pressing down on the foot support rests **116** to rotate the arms **112** downward away from the position shown in FIGS. **1** and **2** against spring resistance provided by the arm torque units **110** as further explained below.

[0032] Floor support for the chair exercise apparatus **100** is provided by the seat **108**, the bottom frame member **104** and the inverted Y shaped seat support member **106**. A separate rear perspective view of the bottom frame member **104** is shown in FIG. **3**. This bottom frame member **104** is a generally U shaped rigid body having spaced parallel leg portions **124** extending parallel from a mid portion **126**. The U shaped bottom frame member **104** is designed to rest on a flat support surface such as a floor. Extending between and arched above the leg portions **124** is an arm torque unit support member **128**. Together the bottom frame member **104** and arm torque unit support member **128** may be formed as a single sheet metal or cast body, preferably made of steel, aluminum or a high strength polymer material, or may be separate castings or parts suitably fastened together to form a rigid structure.

[0033] FIG. **4** is a separate perspective view of the seat support member **106**. Inverted Y shaped support member **106** has a generally tubular seat post portion **130** that has an upper end receiving the seat **108**. The lower end of the seat post portion

130 splits into two diverging portions **132**. These diverging portions **132** each cover and fasten to the arm torque unit support member **128** of the bottom frame member **104**. Each of the Y shaped support member **106** and the bottom frame member **104** could be formed of a suitable steel, aluminum casting, sheet metal or structural polymeric material. The seat **108** may further be covered by any suitable cushioning material such as a covered foam pad.

[0034] Each arm torque unit **110** includes a torque axle **122** that has one end **120** rigidly connected to the proximal end **118** of the elongated arm **112**. Each torque axle **122** is bearing or bushing supported and carried within a flat rotary spring torque cassette housing or cage **134** that is in turn fastened to the arm torque unit support member **128** which is part of the bottom frame member **104**.

[0035] A separate side view of one of the arm torque units **110** removed from the apparatus **100** is shown in FIG. **5**. The arm torque unit **110** has a somewhat rectangular box cassette cage **134** which supports axle **122** for rotation between two journal bearings or bushings **136**. An exemplary cassette **138** including 7 flat coil springs **146** is rotatably supported within the cassette cage **134** shown in FIG. **5**. This embodiment is merely exemplary. A different number of flat coil springs **146** could alternatively be provided.

[0036] In this exemplary embodiment of the apparatus **100**, there are two flat coil springs **146** that are always engaged between the cassette housing or cage **134** and one of the axles **122**, as will become more clearly explained below. These two springs **146** provide a baseline tension or torque on each of the elongated arms **112**. This baseline torque on each of the elongated arms **112** is needed to maintain the arms **112** biased and raised toward the seat **108** as is shown in FIGS. **1** and **2** when no other flat coil springs **146** are engaged. The remaining 5 flat coil springs **146** in each cassette **138** may be selectively engaged and/or disengaged between the cassette housing **134** and the axle **122** to provide different levels of torque or resistance against rotation of the elongated arms **112**.

[0037] Each cassette **138** is made up of 7 flat coil springs **146** and 6 spring separator plates **148** that are held together in a stack by four cassette bolts **142** and a plurality of spacer tubes **144**. A set of 4 spacer tubes **144** is placed on each of the separator plates 148 so as to separate each of the springs **146** on the cassette bolts **142**. An

end plate 150 completes the assembly of a cassette **138**. Referring now to FIG. **8**, a partially exploded view of a cassette **138** is shown prior to installation on an axle **122**.

[0038] Each spring **146**, its separator plate **148** and 4 spacers tubes **144** are assembled sequentially onto the four bolts **142** and onto the axle **122**. The partially assembled cassette **138** can be assembled onto the axle **122** and finally the end plate **150** is fastened to the threaded ends of the four bolts **142**. Note that in FIG. **8**, the end plate **150** has a central hole **151** for receiving the distal end of the axle **122**. This central hole **151** has a radial tab **153** which engages into the slot **156** in the axle **122** when the end plate **150** is installed on and fastened to the four bolts **142**.

[0039] Each coil spring **146** has an inner tabbed end **152** and an outer tabbed end **154**. The inner tabbed ends **152** slide into an axial slot **156** in the axle **122**. The partially assembled cassette **138**, minus the end plate **150**, can be slid onto the axle **122** with the tabbed inner ends **152** of each spring **146** inside the slot **156** in the axle **122**. The end plate **150** can be installed with the proximal end of the axle **122** passing into the hole **151** in the end plate **150**. However, the end plate **150** must be rotated a few degrees to permit a tab **153** on the end plate **150** protruding into the hole **151** to enter the slot **156** while aligning the ends of the bolts **142** with the corresponding bolt holes in the end plate **150**.

[0040] This rotation of the end plate **150** sets a preload on all of the flat coil springs **146** through the axle **122** as shown in FIG. **8**. This rotation of the end plate **150** during assembly causes each outer tabbed end **154** of each spring **146** to engage against one of the bolts **142** as is also shown in the schematic view of FIG. **9**, setting this preload torque on rotation of the axle **122** when the axle **122** is connected to the proximal end **118** of the arm **112**. The assembled cassette **138** may optionally include one or more guide bolt/spacer assemblies **149** which can be used to compensate for non-planar contraction and expansion of the springs **146**.

[0041] The assembled cassette **138** on an axle **122** is then installed in the cassette cage **134** and the outer bearing or bushing **136** installed in the cage **134** to complete the assembly of the axle **122** into the cage **134** shown in FIG. **5**. The distal end **120** of the axle **122** can then be fixed or fastened to the proximal end **118** of the elongated arm **112** through one of the bearings or bushings **136** in the cassette cage **134**.

[0042] Also installed in the cassette housing or cage **134** are five spring loaded selectors **158**. Each selector **158** is slidably supported in a channel **155** in the cassette housing or cage **134** and has a selector shaft **160** which extends parallel to the channel **155**. This selector shaft **160** is best seen in the opposite perspective view of the torque unit **110** shown in FIG. **6**. Each selector shaft **160** is oriented adjacent a pivot finger **162** that pivots about a bolt 164 pinned into the cassette housing or cage **134**. Each pivot finger **162** corresponds to one spring **146** in the cassette **138** and has a distal end 166 oriented adjacent one of the outer tabbed ends **154** of a coil spring **146**. When no springs **146** are selected, only the two springs **146** nearest the elongated arm **112** are engaged with the arm **112**. In this condition, the entire cassette **138** is free to rotate within the cassette housing or cage **134** with the axle **122** as the arm **112** is rotated downward from that shown in FIGS. **1** and **2**.

[0043] FIG. **9** shows a schematic representation of operation of the torque selection mechanism in the exemplary embodiment of the chair exercise apparatus **100**. In the left most image, the pivot finger **162** is disengaged with the cassette **138** and thus the cassette **138** is free to rotate with the axle **122** as the arm **112** is rotated downward. In the middle image, the selector **158** is depressed which pushes the selector shaft **160** downward, riding downward on an inclined surface of the finger **162** above the pivot bolt **164**, which in turn rotates the finger **162** clockwise. The right image shows the selector shaft **160** pushed down past the corner of the inclined surface of the finger **162**, fully engaging the distal end **166** of the finger **162** with the tabbed end **154** of a spring 146. Now, when the user steps on the foot rest **116** at the distal end of the arm **112**, the outer tabbed end **154** of the flat coil spring **146** is constrained against the distal end **166** of the finger **162** and that particular coil spring **146** must contract during arm **112** rotation. This exerts additional torque on the arm **112**, thus increasing the resistance felt by a user depressing the arm **112**. When a user depresses the selector 158 again, selector spring tension causes the selector **158** to return or rise to the left image position, disengaging the distal end **166** of the finger **162** from the tabbed outer end of the coil spring **146**.

[0044] Referring back to FIGS. **5**, **6** and FIGS. **1** and **2**, the selectors **158** each have different lengths corresponding to positions along the sloped or slanted portion of the diverging portion **132** of the seat support member **106** such that when the torque unit

110 is installed in the frame **104** each selector **158** extends up from the diverging portion **132** by approximately the same amount.

[0045] Another exemplary embodiment of a chair exercise apparatus **200** in accordance with the present disclosure is shown in a front perspective view in FIG. **10**. The chair **200** has a generally U shaped bottom frame member **204**, an inverted Y seat support member **206** fastened to the U shaped bottom frame member **204**, and a seat **208** fastened to the seat support member **206**. An optional pair of handle support posts **102** as in the first embodiment described above may be removably mounted to the apparatus **200** adjacent the seat **208**.

[0046] The chair exercise apparatus **200** has a pair of elongated parallel arm members **212** each having a proximal end joined to an axle **222** beneath the Y seat support member **206** and extending outward and upward from beneath the inverted Y seat support member **206** and a spaced pair of rotary arm torque units **210** fastened to the bottom frame member **204** via the inverted Y support member **206**, each independently biasing one of the arm members **212** upward toward the seat **208**.

[0047] Each elongated arm **212** has a distal end **214** to which is fastened a foot support pedal or rest **216** and a proximal end **218** rigidly fastened to one end of a torque unit axle **222**. The chair exercise apparatus **200** has two arm torque units **210** mounted beneath the seat **208** and connected to the bottom frame member **204** via divergent portions 232 of the inverted Y seat support member **206** and aligned on a common axis such that a user sitting on the seat **206** can place his or her feet on the side by side foot support rests **216** to perform basic Pilates chair exercises by pressing down on the foot support rests **216** to rotate the arms **212** downward away from the position shown in FIG. **10** against spring resistance provided by the arm torque units **210**. Each of the foot support pedals or rests **216** preferably extends laterally from the arm **212** to which it is attached and may be straight, bent or curved as is shown in FIG. **10**. This curved or bent shape provides a unique gripping surface and shape for a user to grasp in certain exercises wherein the user grasps the rest **216** with his/her hand rather than a foot.

[0048] Floor support for the chair exercise apparatus **200** is provided by the seat **208**, the bottom frame member **204** and the inverted Y shaped seat support member **206**.

This bottom frame member **204** is preferably a generally U shaped rigid body having spaced parallel leg portions **224** extending from a mid portion **226** of the frame member **204**. The U shaped bottom frame member **204** is designed to rest on a flat support surface such as a floor.

[0049] Inverted Y shaped support member **206** has a generally tubular seat post portion **230** that has an upper end receiving the seat **208**. The lower end of the seat post portion **230** splits into two diverging portions **232**. These diverging portions **232** each cover and fasten to a rotary arm torque unit **210** and rigidly join or are fastened to the bottom frame member **204**. As in the first embodiment **100**, the Y shaped support member **206** and the bottom frame member **204** could be formed of a suitable steel, aluminum casting, sheet metal or structural polymeric material. The seat **208** may further be covered by any suitable cushioning material such as a covered foam pad.

[0050] Each arm torque unit **210** includes a torque axle **222** that has one end rigidly connected to the proximal end **218** of one of the elongated arms **212**. A separate perspective view of one of the arm torque units **210** is shown in FIG. **11**. The front and rear sides of the torque unit **210** has fastened to it a plastic or metal cover **215** which keeps dirt and dust out of the inner workings of the rotary arm torque unit **210**. In the FIGS. **12-14** that follow, these covers **215** are removed for clarity in explanation.

[0051] Each torque axle **222** is bearing or bushing supported and carried within a flat rotary spring torque cassette housing or cage **234** that is in turn preferably rigidly fastened to the bottom frame member **204** via a portion of one of the diverging portions **232** of the inverted Y shaped support member **206**. The arm torque units **210** are essentially the same as those described above with reference to the exercise chair **100** except for the structure of the cassette **238**.

[0052] A separate side view of one of the arm torque units **210** removed from the chair exercise apparatus **200** is shown in FIG. **12**. An opposite side view of the arm torque unit **210** is shown in FIG. **13**. Finally, an exploded view of the arm torque unit **210** is shown in FIG. **14** so that the internal components can be easily identified in the discussion that follows.

[0053] The arm torque unit **210** has a somewhat rectangular box shaped cassette cage or housing **234** which supports axle **222** for rotation between two journal bearings or bushings **236**. An exemplary cassette **238** including a stack of 7 flat clock coil springs **146** is rotatably supported within the cassette housing **234** as shown in FIGS **12** and **13**. This embodiment **200** is merely exemplary. A different number of flat coil springs **146** could alternatively be provided.

[0054] In this exemplary embodiment of the chair exercise apparatus **200**, two flat coil springs **146** are always engaged between the cassette housing or cage **234** and the axle **222**, as will become more clearly explained below. These two springs **146** provide a baseline tension or torque on each of the elongated arms **212**. This baseline torque on each of the elongated arms **212** is needed to maintain the arms **212** biased and raised toward the seat **208** as is shown in FIGS. **10** when no other flat coil springs **146** are engaged. The remaining 5 flat coil springs **146** in each cassette **238** may be selectively engaged and/or disengaged between the cassette housing **234** and the axle **222** to provide different levels of torque or resistance against rotation of the elongated arms **212.**

[0055] Each cassette **238** is made up of two flat coil springs **146**, and five coil springs **146** that are held together and carried in an axial stack within a cassette comb **244**. This cassette comb **244** has a plurality of spaced apart tines or partitions **245**. Each partition separates one of the springs **146** from an adjacent spring **146**, except for the pair of preload springs **146**, which are carried together in the cassette **238**. This cassette comb **244** may be a 3D printed metal or nonmetal comb structure. It may alternatively be a rigid polymeric or plastic molded part. This cassette comb **244** takes the place of the separator plates **148**, bolts **142**, end plate **150** and plurality of spacer tubes **144** in the first embodiment **110**. This cassette comb **244** separates each of the five springs **146** and the pair of preload springs **146** as in the first embodiment **110**.

[0056] Each coil spring **146** has an inner tabbed end **152** and an outer tabbed end **154**. The inner tabbed ends **152** slide into an axial slot **256** in the axle **222**. The partially assembled cassette **238** can be slid onto the axle **222** with the tabbed inner ends **252** of each spring **146** inside the slot **256** in the axle **222**. Assembly of the

cassette **238** into the cassette housing **234** is basically the same as described above with reference to FIG. **5** and **9**.

[0057] During assembly, the axle rotation with respect to the cassette comb **244** imparts a desired preload on all springs **146**. Then a key **270** (shown in FIG. **14**) is inserted to lock the axle **222** together with the cassette comb **244**. The assembled cassette **238** on an axle **222** is then installed in the cassette cage or housing **234** and the outer bearing or bushing **236** is installed in the cassette cage or housing **234** to complete the assembly of the axle **222** into the cassette cage or housing **234** as is shown in FIG. **12**.

[0058] Also installed in the cassette housing or cage **234** are five spring loaded selectors **258**, like in the first embodiment **110**. Each selector **258** is slidably supported in a channel **255** in the cassette housing or cage **234** and has a selector shaft **260** which extends parallel to the channel **255**. This selector shaft **260** is best seen in the exploded view of the arm torque unit **210** shown in FIG. **14**. Each selector shaft **260** is oriented adjacent a pivot finger **162** that pivots about a bolt **264** pinned into the cassette housing or cage **234**. Each pivot finger **162** corresponds to one spring **146** in the cassette **238** and has a distal end **166** oriented adjacent one of the outer tabbed ends **154** of a coil spring **146**. When no springs **146** are selected, only the two springs **146** nearest the elongated arm **212** are engaged with the arm **212**. In this condition, the entire cassette **238** is free to rotate within the cassette housing or cage **234** with the axle **222** as the arm **212** is rotated downward from that shown in FIG. **10**.

[0059] FIG. **9** shows a schematic representation of operation of the torque selection mechanism in the two exemplary embodiments of the chair exercise apparatus **100** and **200**. In the left most image, the pivot finger **162** is disengaged with the cassette **138** (or **238**) and thus the cassette **138** (or **238**) is free to rotate with the axle **122** (or **222**) as the arm **112** (or **212**) is rotated downward. In the middle image, the selector **158** (or **258**) is depressed which pushes the selector shaft **160** (or **260**) downward, riding downward on an inclined surface of the finger **162** above the pivot bolt **164**, which in turn rotates the finger **162** clockwise. The right image shows the selector shaft **160** pushed down past the corner of the inclined surface of the finger **162**, fully engaging the distal end **166** of the finger **162** with the tabbed end **154** of a spring

146. Now, when the user steps on the foot rest **116** (or **216**) at the distal end of the arm **112** (or **212**), the outer tabbed end **154** of the flat coil spring **146** is constrained against the distal end **166** of the finger **162** and that particular coil spring **146** must contract during arm **112** or **212** rotation. This exerts additional torque on the arm **112** or **212**, thus increasing the resistance felt by a user depressing the arm **112** or **212**. When a user depresses the selector **158** again, selector spring tension causes the selector **158** to return or rise to the left image position, disengaging the distal end **166** of the finger **162** from the tabbed outer end of the coil spring **146**.

[0060] Referring back to FIGS. **5**, **6** and FIGS. **1** and **2**, the selectors **158** (or **258**) each have different lengths corresponding to positions along the sloped or slanted portion of the diverging portion **132** (or **232**) of the seat support member **106** (or **206**) such that when the torque unit **110** (or **210**) is installed in the frame **104** (or **204**) each selector **158** extends up from the diverging portion **132** (or **232**) by approximately the same amount.

[0061] A kit for installing one or more rotary arm torque units **210** in a conventional Pilates chair exercise apparatus is also envisioned in this disclosure. A conventional chair exercise apparatus typically has a generally box shaped frame, a seat on the top of the frame and one or a pair of rotary arms rotatably fastened to a bottom portion of the frame, each having a foot pad or bar fastened to its distal end, and a plurality of elongated coil springs extending from beneath the seat to at least one of the arms to bias the rotary arm or arms upward toward the seat.

[0062] A kit for such a chair in accordance with the present disclosure includes a pair of rotary arm torque units **210** and a left rotary arm such as arm **212** and a right rotary arm such as arm **212** each having a proximal end **218** and a distal end **214** and may include a foot bar **216**. Each rotary arm torque unit **210** in the kit includes a cassette housing **234** configured to be fastened to the frame beneath the seat of the Pilates chair. It is to be understood that this housing **234** would most likely have a different external box shape than that shown so as to match with the contours of the conventional Pilates chair exercise apparatus to which it is being installed.

[0063] A bearing supported rotary shaft such as shaft **222** in the cassette housing **234** is adapted to be fastened to the proximal end **218** of one of the rotary arms **212**. The rotary arm torque unit **210** includes a cassette **238** carried on the rotary shaft

222. This cassette **238** has a plurality of flat coil springs **146** therein each having a first end connected to the rotary shaft **222** and a free second end engageable with the cassette housing **234** via one of a plurality of selectors such as selectors **258** carried by the cassette housing **234** (although each likely having a different shape than that shown in this disclosure).

[0064] Preferably the rotary arm torque unit **210** in such a kit includes a cassette comb **244** carried in the cassette housing **234** axially separating each one or two of the plurality of flat coil springs **146** from each other. The cassette comb **244** is preferably made of a polymeric material such as plastic. The cassette comb **244** has a plurality of spaced apart tines or partitions **246** to axially space apart at least two of the plurality of flat coil springs **146** along the rotary shaft **222**. The free ends of one or preferably two of the plurality of flat coil springs **146** in the rotary arm torque unit **210** engage the cassette housing **234** to preload the rotary arm torque unit **210**.

[0065] Turning now to FIGS. **15** and **16**, one exemplary embodiment of a chair exercise apparatus **200** having exemplary hinged hand support posts **280** is shown. In FIG. **15**, the chair **200** is shown with the support posts **280** in an operable position each extended alongside the seat **208**. In the rear perspective view of FIG. **16**, the support posts **280** are shown in a storage position folded down beneath the seat **208**.

[0066] Each support post member **280** for a chair exercise apparatus **200** in accordance with the present disclosure may be hinged and moveable from a retracted storage position as shown in FIG. **16** beneath the chair exercise apparatus seat **208** to an operable position alongside the seat **208** of the exercise apparatus **200** and preferably includes a mounting bracket **282** configured to be fastened to part a frame of the chair exercise apparatus **200**. The support post member **280** preferably has a long leg **284** and a short leg **286**. Preferably the short leg **286** extends at an angle from the long leg **284** and is hinged to a cross member **288** of the mounting bracket **282**.

[0067] This mounting bracket **288** is fastened to either the frame **204** and/or the seat support **206** immediately beneath the seat **208**. The support post member **280** preferably has a handle **290** fastened to a distal end of the hinged post member **280**. The long leg **284** of the hinged support post member **280** preferably has a first portion **292** telescopically carried within a second portion **294** and the short leg **286** extends

at a right angle from a proximal end of the long leg **284**. The handle **290** is preferably removably fastened to a distal end of the first portion **292** of the long leg **284** of the hinged post member **280**.

[0068] The short leg **286** of the hinged post member **280** preferably has a locking member **296** engageable with the cross member **288** of the mounting bracket **282** to releasably hold the short leg **286** parallel to the cross member **288** in an operating position when the hinged post member **280** is fastened to the chair exercise apparatus **200**.

[0069] An exemplary embodiment of a chair exercise apparatus **200** in accordance with the present disclosure, shown in FIGS. **15** and **16** has a frame **204** configured to rest on a horizontal surface such as a floor. The chair exercise apparatus **200** includes an inverted Y shaped seat support **206** fastened to an upper surface portion of the frame **204**, a seat **208** fastened to an upper end **230** of the inverted Y shaped seat support **206**, a pair of parallel arms **212** each having a proximal end pivotally fastened to the frame **204** and a foot support or pedal **216** fastened to a distal end **214** of each of the parallel arms **212**. Each arm **212** is biased away from the frame **204** toward the seat **208**.

[0070] A pair of hinged support post members **280** are each preferably removably fastened to a mounting bracket **288** attached to the upper portion **230** of the inverted Y shaped seat support **206**. Each hinged support post member **280** is movable from a storage position below the seat **208** as shown in FIG. **16** to an operable position extending upward alongside the seat **208** as is shown in FIG. **15**. Each hinged support post member **280** has a long leg **284** and a short leg **286**. The short leg **286** extends at a right angle from the long leg **284**. The short leg **286** is hinged at hinge **298** to a cross member **296** of the mounting bracket **282**.

[0071] In FIG. **16**, the mounting bracket **282** is clearly shown which has square tube cross member **288** that is fixed to an angle bracket portion **300** which may be inserted and fastened between and fixed between the upper portion **230** of the inverted Y shaped seat support **206** and the seat **208**. Optionally a pair of lateral support posts **302** may also be provided between the cross member **288** and the seat **208** to provide additional rigidity to the sides of the seat **208.**

[0072] Each of the support post members **280** has a locking knob **296** on the short leg **286** spaced from the hinge **298** that engages a complementary fitting **306** on the cross member **288** to securely fasten the short leg **286** parallel to the cross member **288** when the support members **280** are in the operable position as shown in FIG. **15**. This locking knob **296** may threadably engage a complementary threaded fitting **306** or engage a detent in the cross member **288** to fasten the short leg **286** in position. The long leg **284** preferably has a first portion **292** telescopically received in a tubular second portion **294**.

[0073] These first and second portions **292** and **294** may be fitted with appropriate fittings **312** to set the length of the support post **280** as desired. A locking knob **314** is preferably provided on the long leg **284** to fix the desired length of the long leg **284** when the support post member **280** is raised to and locked in the operable position shown in FIG. **15**.

[0074] Many changes may be made to the exercise apparatus of this disclosure. For example, the torque unit cage or housing **134** or **234** may be made of plastic, metal or composite structure and may be a cast or molded body. The selectors **158** or **258** may all be the same height or of different heights depending on where on the inverted Y seat support member **106** or **206** they are located. Further, the inverted Y seat support member **106** or **206** may be other than a Y shape. The lower portion, for example, may have a more or less angled shape or horizontal orientation and thus the selectors **158** and **258** could be differently structured than as specifically shown. What is shown are simply two exemplary embodiments. The seat **108** and **208** and the foot rests **116** and **216** may have different shapes than as currently depicted. These pairs of foot rests **116** and **216** may be ganged together to operate the arms **112** as a single arm rather than two as shown. Such an arrangement could be accomplished by a U shaped sleeve over the foot rests **116** or a rod threaded through the foot rests **116**, for example.

[0075] The optional handle supports **102** fastened to the sides of the seat **108** or **208** may be telescopically extendable and collapsible, or may be hinged, an example of which is shown in FIGS. **15** and **16**, so as to be readily retracted or placed out of the way for easy storage when not needed. Throughout the disclosure the term “fastened” is used when describing the joinder between the seat, the seat support

member, and the frame. It is to be understood that other means of joinder between frame and support elements may be utilized such as merging via welding or forming as a unitary connection as in a single molded body, for example.

[0076] In the embodiments described, there are 7 sets of springs **146** within each cassette **138** and **238**. Many other embodiments are envisioned each having different numbers of springs **146**. The flat coil springs **146** may be interrelated or connected such that depression of one selector **158** or **258** may retract other selectors so as to limit the number of springs that can be engaged at any one time. Furthermore, the rotary arm torque unit **210** may be configured to be utilized in place of conventional springs in a conventional Pilates chair exercise apparatus. In such an alternative implementation, the selectors **258** and the cassette cage or housing **234** would preferably be shaped differently in accordance with the frame configuration of such a conventional Pilates chair exercise apparatus.

[0077] Accordingly, all such alternatives, variations and modifications are intended to be encompassed within the scope of and as defined by the following claims.

CLAIMS

What is claimed is:

1. A chair exercise apparatus comprising:

a frame configured to rest on a horizontal surface;

an inverted Y shaped seat support fastened to an upper surface portion of the frame;

a seat fastened to an upper end of the inverted Y shaped seat support; and

a pair of parallel arms each having a proximal end fastened to the frame and a foot support fastened to a distal end of each of the parallel arms, wherein each arm is biased away from the frame toward the seat.

2. The chair exercise apparatus according to claim 1 wherein each arm is pivotally biased away from the frame by a rotary arm torque unit mounted beneath the seat.

3. The chair exercise apparatus according to claim 1 wherein the frame has a generally U shape with two parallel base portions.

4. The chair exercise apparatus according to claim 3 wherein the frame further comprises a mid portion spaced between the two parallel base portions.

5. The chair exercise apparatus according to claim 2 wherein each rotary arm torque unit includes a plurality of flat coil springs.

6. The chair exercise apparatus according to claim 2 wherein each rotary arm torque unit is fastened to the inverted y shaped seat support.

7. The chair exercise apparatus according to claim 2 wherein each rotary arm torque unit comprises a plurality of selectively engageable rotary springs fastened to a common axle rotatably carried by the frame.

8. The chair exercise apparatus according to claim 2 wherein each rotary arm torque unit includes a plurality of separately selectable flat coil springs engaging an axle supporting one of the arms.

9. The chair exercise apparatus according to claim 2 wherein the rotary arm torque unit comprises a cassette housing carrying a plurality of flat coil springs in a cassette in the cassette housing and a plurality of selectors for selecting one or more of the flat coil springs to engage the arm to which the rotary arm torque unit is attached.

10. The chair exercise apparatus according to claim 9 wherein each selector is configured to engage one of the plurality of flat coil springs.

11. The chair exercise apparatus according to claim 9 wherein the cassette comprises a cassette comb having a plurality of spaced apart tines or partitions supporting at least one of the plurality of flat coil springs therebetween.

12. A chair exercise apparatus comprising:
a frame configured to rest on a horizontal surface;
a seat support fastened to an upper surface portion of the frame;
a seat fastened to the seat support; and
a pair of parallel arms each having a proximal end fastened to one of the frame or a portion of the seat support, wherein each arm is biased away from the frame toward the seat.

13. The chair exercise apparatus according to claim 12 wherein each arm is pivotally biased away from the frame by a rotary arm torque unit.

14. The chair exercise apparatus according to claim 12 wherein the frame is a generally U shaped frame having parallel base portions and a mid portion spaced between the parallel base portions.

15. The chair exercise apparatus according to claim 13 wherein each rotary arm torque unit includes a plurality of flat coil springs.

16. The chair exercise apparatus according to claim 13 wherein each rotary arm torque unit is fastened to at least one of the seat support or the frame.

17. The chair exercise apparatus according to claim 13 wherein each rotary arm torque unit comprises a plurality of selectively engageable rotary springs fastened to a common axle rotatably carried by the frame.

18. The chair exercise apparatus according to claim 13 wherein each rotary arm torque unit includes a plurality of separately selectable flat coil springs engaging an axle supporting one of the arms.

19. The chair exercise apparatus according to claim 13 wherein the rotary arm torque unit comprises a cassette housing carrying a plurality of flat coil springs in a cassette in the housing and a plurality of selectors connected to the cassette housing for selecting one or more of the flat coil springs to engage the arm to which the rotary arm torque unit is attached.

20. A chair exercise apparatus comprising:

a frame configured to rest on a horizontal surface;

a seat support merging into an upper surface portion of the frame;

a seat fastened to a seat support portion of the seat support; and

a pair of parallel arms each having a proximal end fastened to one of the frame or a portion of the seat support, wherein each arm is biased away from the frame toward the seat by a rotary arm torque unit fastened below the seat to one of the frame or a portion of the seat support, and wherein each rotary arm torque unit carries a cassette having a plurality of flat coil springs each selectively engageable with the arm to which the rotary arm torque unit is connected.

21. A rotary arm torque unit for use in an exercise apparatus, the rotary arm torque unit comprising:

a housing;

a bearing supported rotary shaft in the housing for carrying an arm fastened to one end of the rotary shaft; and

a cassette carried on the rotary shaft, the cassette having a plurality of flat coil springs therein each having a first end connected to the rotary shaft and a free second end engageable with the housing via one of a plurality of selectors carried by the housing.

22. The rotary arm torque unit according to claim 21 further comprising a cassette comb carried in the housing separating at least two of the plurality of flat coil springs from each other.

23. The rotary arm torque unit according to claim 22 wherein the cassette comb is made of a polymeric material.

24. The rotary arm torque unit according to claim 22 wherein the cassette comb has a plurality of spaced apart tines to axially space apart at least two of the plurality of flat coil springs along the rotary shaft.

25. The rotary arm torque unit according to claim 24 wherein the free ends of two of the plurality of flat coil springs engage the housing to preload the rotary arm torque unit.

26. The rotary arm torque unit according to claim 25 wherein the cassette has 7 flat coil springs.

27. A kit for installing rotary torque units in a chair exercise apparatus having a frame and seat, the kit comprising:

a pair of rotary arm torque units; and

a left rotary arm and a right rotary arm each having a proximal end and a distal end;

wherein each rotary arm torque unit comprises:

a cassette housing configured to be fastened to the frame beneath the seat of the chair exercise apparatus;

a bearing supported rotary shaft in the cassette housing adapted to be fastened to the proximal end of one of the rotary arms; and

a cassette carried on the bearing supported rotary shaft, the cassette having a plurality of flat coil springs therein each having a first end connected to the rotary shaft and a free second end engageable with the cassette housing via one of a plurality of selectors carried by the cassette housing.

28. The kit according to claim 27 further comprising a cassette comb carried in the cassette housing separating at least two of the plurality of flat coil springs from each other.

29. The kit according to claim 28 wherein the cassette comb is made of a polymeric material.

30. The kit according to claim 28 wherein the cassette comb has a plurality of spaced apart tines to axially space apart at least two of the plurality of flat coil springs along the rotary shaft.

31. The kit according to claim 30 wherein the free ends of two of the plurality of flat coil springs engage the cassette housing to preload the rotary arm torque unit.

32. The kit according to claim 31 wherein the cassette has 7 flat coil springs.

33. A support post member for a chair exercise apparatus comprising:

a mounting bracket configured to be fastened to a frame of the chair exercise apparatus; and

a hinged post member having a long leg and a short leg, the short leg extending at an angle from the long leg, the short leg hinged to a cross member of the mounting bracket.

34. The support post member according to claim 33 further comprising a handle fastened to a distal end of the hinged post member.

35. The support post member according to claim 33 wherein the long leg of the hinged post member has a first portion telescopically carried within a second portion and the short leg extends at a right angle from a proximal end of the long leg.

36. The support post member according to claim 35 further comprising a handle fastened to a distal end of the first portion of the long leg of the hinged post member.

37. The support post member according to claim 33 wherein the short leg of the hinged post member has a locking member engageable with the cross member of the mounting bracket to releasably hold the short leg parallel to the cross member in an operating position when the hinged post member is fastened to the chair exercise apparatus.

38. The support post member according to claim 35 wherein the short leg of the hinged post member has a locking member engageable with the cross member of the mounting bracket to releasably hold the short leg parallel to the cross member in an operating position when the hinged post member is fastened to the chair exercise apparatus.

39. A chair exercise apparatus comprising:

a frame configured to rest on a horizontal surface;

an inverted Y shaped seat support fastened to an upper surface portion of the frame;

a seat fastened to an upper end of the inverted Y shaped seat support;

a pair of parallel arms each having a proximal end fastened to the frame and a foot support fastened to a distal end of each of the parallel arms, wherein each arm is biased away from the frame toward the seat; and.

a pair of hinged support post members each fastened to a mounting bracket attached to the inverted Y shaped seat support, wherein each support post member is movable from a storage position below the seat to an operable position extending upward alongside the seat, wherein each hinged support post member has a long

leg and a short leg, the short leg extending at an angle from the long leg, the short leg hinged to a cross member of the mounting bracket.

40. The chair exercise apparatus according to claim 39 wherein each arm is pivotally biased away from the frame by a rotary arm torque unit mounted beneath the seat.

41. The chair exercise apparatus according to claim 39 further comprising a handle fastened to a distal end of each hinged support post member.

42. The chair exercise apparatus according to claim 39 wherein the long leg of each hinged support post member has a first portion telescopically carried within a second portion and the short leg extends at a right angle from a proximal end of the long leg.

43. The chair exercise apparatus according to claim 42 further comprising a handle fastened to a distal end of the first portion of the long leg of each hinged support post member.

44. The chair exercise apparatus according to claim 39 wherein the short leg of each hinged support post member has a locking member engageable with the cross member of the mounting bracket to releasably hold the short leg parallel to the cross member in the operable position.

45. The chair exercise apparatus according to claim 42 wherein the short leg of each hinged support post member has a locking member engageable with the cross member of the mounting bracket to releasably hold the short leg parallel to the cross member in an operating position.