**ABSTRACT**

An exercise device, method of making the device and a method and system for interaction with an exercise device, in which removable, variable weight may be provided in a housing of the device. Two rotatable handles may be provided in the housing, permitting various hand orientations during exercise. The removable weight may be provided near the center of the exercise device, with the handles substantially outboard the weight. Weight may thus be efficiently added or removed in a central area of the housing between the handles.
FIG. 14

1440

ATTACH UPPER HOUSING 10 WITH WEIGHT SELECTION ASSEMBLY 100 TO LOWER HOUSING 20

1470

ATTACH UPPER HOUSING 10 WITH WEIGHT SELECTION ASSEMBLY 100 TO LOWER HOUSING 20

1460

INSERT WEIGHT SELECTION ASSEMBLY 100 THROUGH OPENING 106A OF UPPER HOUSING 10

1450

INSERT HANDLE ASSEMBLIES 40 INTO CORRESPONDING OPENINGS 15 OF LOWER HOUSING 20

1410

FORM UPPER HOUSING 10

1420

FORM LOWER HOUSING 20

1430

FORM WEIGHT SELECTION ASSEMBLY 100

1440

FORM HANDLE ASSEMBLIES 40
EXERCISE DEVICE, METHOD OF FABRICATING EXERCISE DEVICE, AND METHOD AND SYSTEM FOR INTERACTION WITH AN EXERCISE DEVICE

DOMESTIC PRIORITY STATEMENT

[0001] This application claims domestic priority under 35 U.S.C. $120 to U.S. Provisional Application Ser. No. 60/483,633 to Mills et al., filed Jul. 1, 2003 in the United States Patent & Trademark Office, the disclosure of which is incorporated herein in its entirety by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention generally relates to an exercise device, a method of fabricating the device, and a method and system for interaction with an exercise device.

[0004] 2. Description of Related Art

[0005] Today, dumbbells may be generally recognized as the most efficient of strength training devices. They allow extreme flexibility in patterns of movement and allow the athlete to perform a real world training regimen unlike, for example, bungee cord exercises. Therapists prefer dumbbells because dumbbells may reflect everyday movements and the flexibility of a dumbbell may allow the patient to train around joint and muscle trauma. People that train with dumbbells may enjoy productive gains not available with other training modalities because dumbbells generally require balance and involve synergistic muscle groups to contract during the lift. The necessity to balance the dumbbells and coordinate movement of each hand may stress the muscular and nervous system unlike any machine exercise. With machines, a portion of the athlete’s musculature can actually relax due to the absence of fully balanced coordination, i.e. one side can push harder than the other.

[0006] There are two basic forms of dumbbells: fixed or “pro-style”, and adjustable dumbbells. Fixed dumbbells are individually compact, but are typically sold in sets which typically may be stored on a rack that is bulky and cumbersome. Adjustable dumbbells have historically incorporated plates and locking collars secured to the ends of an extended handle.

[0007] Adjustable dumbbells may be the most space and cost efficient exercise equipment. However, adjustable dumbbells may have some drawbacks. One drawback may be the time it takes to change or adjust both dumbbells. Removing and replacing the locking collars and plates may be time consuming, and can be a potential safety hazard if the collars are not securely tightened. Some exercises such as bench presses, inclines and shoulder work typically begin and end with the dumbbells resting on the knees of the user. However, this may be unwieldy and painful if the ends of the dumbbells are not relatively flat.

[0008] Various adjustable dumbbells have been developed heretofore. U.S. Pat. No. 4,743,017 to Jaeger, U.S. Pat. No. 4,529,198 to Hettick and U.S. Pat. No. 6,083,144 to Towley, III et al. are representative of the prior art in this regard. Each of these patents, however, addresses only certain aspects of an adjustable dumbbell, such as releasability, interlocking of the weights, etc. Moreover, the exercise devices in each of these references may involve a relatively cumbersome operation to add and/or subtract weight and/or may be somewhat bulky and cumbersome to store.

SUMMARY OF THE INVENTION

[0009] An exemplary embodiment of the present invention may be directed to an exercise device. The exercise device may include a housing and a pair of rotatable handle assemblies. Each rotating handle assembly of the pair may be arranged on either side of the housing. The housing may be adapted to hold a removable weight therein so that the removable weight is centrally located in the exercise device.

[0010] Another exemplary embodiment of the present invention may be directed to an exercise device. The exercise device may include an upper housing and a lower housing. The lower housing may include a central cavity for insertion of one or more removable weights. Each of the upper and lower housings may further include a frame and a pair of outer openings, one opening at each side of the central cavity. The device may include a pair of rotating handle assemblies provided in corresponding outer openings, and a weight selection assembly for selecting a desired amount of weight for insertion in the central cavity.

[0011] Another exemplary embodiment of the present invention may be directed to a method of fabricating an exercise device. In the method, an upper housing and a lower housing may be formed. Each of the upper and lower housings may be composed of a frame provided with a central opening and an outer opening on either side of the central opening. The lower housing may further include a cavity. A weight selection assembly may be formed and may be adapted to select a removable weight. A pair of handle assemblies may be formed, and each handle assembly may be inserted in a corresponding outer opening of the lower housing so as to be supported by the lower housing frame. The weight selection assembly may be inserted through the central opening in the upper housing, and the upper housing may be attached to the lower housing so that at least a portion of the weight selection assembly extends in the cavity of the lower housing.

[0012] Another exemplary embodiment of the present invention may be directed to a method of determining a fitness score for a workout by a user manipulating an exercise device. In the method, one or more detected parameters related to spatial movement of the exercise device may be received. Based on the received parameter data, a fitness score related to a quality of the workout by the user may be determined.

[0013] Another exemplary embodiment of the present invention may be directed to an arrangement for tracking movement of a hand-held, free-weight exercise device to determine quality of a workout. The arrangement may include a plurality of sensors for detecting one or more parameters related to spatial movement of the device by the user during a workout, a transceiver and a processor. The transceiver may transmit the detected parameter data to the processor, and the processor may determine a quality of a workout by the user based on the received parameter data.

[0014] Another exemplary embodiment of the present invention may be directed to a system for tracking a physical workout of a hand-held, free-weight exercise device by a
user. The system may include a plurality of sensors connected to the device for detecting one or more parameters related to spatial movement of the device by the user during the workout. The system may include a first transceiver attached to the device for transmitting the detected parameters over a link (such as a wireless link), and a second transceiver for receiving the detected parameter data over the link and forwarding the parameter data to a processor. The processor may evaluate the received parameter data to output performance data indicating quality of the workout to the user.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] Exemplary embodiments of the present invention will become more fully understood from the detailed description given herein below and the accompanying drawings, wherein like elements are represented by like reference numerals, which are given by way of illustration only and thus do not limit the exemplary embodiments of the present invention.

[0016] FIG. 1 is a plan view of an exercise device in accordance with an exemplary embodiment of the present invention.

[0017] FIG. 2A is an extended plan view of FIG. 1 illustrating a removable tray in accordance with an exemplary embodiment of the present invention.

[0018] FIG. 2B is an underside view of FIG. 1 illustrating a cavity of the lower housing of the exercise device, in accordance with an exemplary embodiment of the present invention.

[0019] FIG. 3 is an exploded view of an exercise device in accordance with an exemplary embodiment of the present invention.

[0020] FIG. 4 is a more detailed exploded view of a weight selection assembly in accordance with an exemplary embodiment of the present invention.

[0021] FIG. 5 is a partial exploded view illustrating the selector assembly relative to a stack of weights and the removable tray in accordance with an exemplary embodiment of the present invention.

[0022] FIG. 6 is an exploded view of the weight plates 300 to illustrate a method of weight selection in more detail, in accordance with an exemplary embodiment of the present invention.

[0023] FIG. 7 is a view illustrating an exemplary configuration for a weight plate in accordance with an exemplary embodiment of the present invention.

[0024] FIG. 8 is a plan view of the removable tray in accordance with an exemplary embodiment of the present invention.

[0025] FIG. 9 is a partial enlarged view of the upper housing to illustrate the selector knob in more detail.

[0026] FIG. 10 is a plan view of a rotating handle assembly in accordance with an exemplary embodiment of the present invention.

[0027] FIG. 11 is an exploded view of FIG. 10 to illustrate the construction of the rotating handle assembly.

[0028] FIG. 12 is a partial enlarged top view of the handle assembly and lower housing.

[0029] FIG. 13 is a partial exploded view illustrating a resistance/sound element in accordance with an exemplary embodiment of the present invention.

[0030] FIG. 14 is a flow diagram illustrating a method of manufacturing the exercise device in accordance with an exemplary embodiment of the present invention.

[0031] FIG. 15 is a block diagram illustrating a method and system for interaction with an exercise device in accordance with an exemplary embodiment of the invention.

[0032] FIG. 16 is a partial cut-away view of an exercise device in accordance with another exemplary embodiment of the present invention.

[0033] FIG. 17 is a top view of an exercise device in accordance with another exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

[0034] In general, the exemplary embodiments of the present invention introduce an exercise device for providing variable weight in a housing of the device. Two rotating handles may be provided in the housing, permitting various hand orientations during exercise. Unlike most dumbbell-type free-weight devices, the removable weight may be provided near the center of the exercise device, with the handles substantially outboard the removable weight. Weight may be efficiently added or removed by placing the exercise device over a separate holding tray and changing the position of a weight selector element on the device. Unused weights may be suitably stored in this holding tray. As will be seen in more detail below, additional features may be incorporated into the rotating handles, including elements that may selectively add sound and/or resistance when the handles are actuated.

[0035] FIG. 1 is a plan view of an exercise device in accordance with an exemplary embodiment of the invention and FIGS. 2A and 2B are an extended plan view and underside view of FIG. 1 illustrating a removable tray and a cavity of the lower housing in accordance with an exemplary embodiment of the invention. Referring to FIG. 1, the exercise device 1 may include an upper housing 10 and a lower housing 20. Rotating handle assemblies 40 may be provided within openings 15 provided in the upper housing 10 and lower housing 20.

[0036] Referring to FIG. 2A, a tray 30 is shown in relation to the upper housing 10 and lower housing 20. Referring to FIG. 2B, lower housing 20 may be provided within a cavity at an underside (indicated generally by arrow 255), allowing tray 30 and its contents to dock or be inserted within the exercise device 1 for tray storage or weight change via a weight selector assembly 100.

[0037] FIG. 3 is an exploded view of the exercise device 1 in accordance with an exemplary embodiment of the invention. Tray 30 may be docked inside lower housing 20. As shown in FIG. 3, the method by which handle assemblies 40 may be mounted between upper housing 10 and lower housing 20 is visible.
Additionally in FIG. 3, a weight selection assembly 100 is shown in exploded view. The weight selection assembly 100 may include at least a selector knob 101, an inner selector tube 110, and an outer selector tube 120. Selector knob 101 may be provided on the outside of upper housing 10, and extend through a central opening 106b in upper housing 10, as shown in FIG. 3. Selector knob 101 engages inner selector tube 110 to form a rotatable subassembly 101-110, for example. Inner selector tube 110 passes through the support plate 115. The support plate 115 may be rigidly fixed to upper housing 10 for providing support for the subassembly 101-110, while allowing the subassembly 101-110 to rotate.

A friction washer 113 (which may be composed of a suitable metal, rubber or plastic) may be interposed between inner selector tube 110 and support plate 115, providing a durable wear surface. Below support plate 115, the subassembly 101-110 may be rigidly connected to the outer selector tube 120, which may extend into a lower central opening 106b in lower housing 20. Opening 106b provides weight selector assembly 100 access into cavity 25. Thus, rotational input to selector knob 101 may be transmitted through the subassembly 101-110 to outer selector tube 120, while the weight selection assembly 100 (outer selector tube 120, inner selector tube 110 and selector knob 101) is supported by upper housing 10 through support plate 105.

FIG. 4 is a more detailed exploded view of the weight selection assembly 100 in accordance with an exemplary embodiment of the present invention. Selector knob 101 engages inner selector tube 110 through a protrusion 102. Protrusion 102 may be sized to provide a slip fit into receptacle 112 of the inner selector tube 110. This slip fit allows an up-and-down sliding movement of the selector knob 101 while transmitting a turning couple to inner selector tube 110. A spring element 104 may be provided between knob 101 and inner selector tube 110, biasing knob 101 upward. Thus the spring element 104 may provide a detent function, locking knob 101 in position, unless the user of the exercise device 1 presses down on knob 101 to change the weight selection. Spring element 104 may be embodied as a plurality of plastic leaf spring elements on the underside of the knob 101. Alternatively, spring element 104 may be composed of foam or elastomer materials having a suitable anti-friction layer on a surface thereof, for example.

Inner selector tube 110 may be inserted into outer selector tube 120 during initial assembly of the exercise device 1. Fasteners (not shown) may be introduced into holes 111 and 121 to secure the inner selector tube 110 to the outer selector tube 120. The fasteners may be embodied as rivets or screws, although other fasteners may be used, such as snaps between the inner and outer tube, adhesives, ultrasonic welding, and/or posts that provide an interference fit in holes 111 or 121, for example.

The outer selector tube 120 may include a plurality of protrusions or teeth 122, arranged on an outer surface of the outer selector tube 120, as shown in FIG. 4. In general, weight selection may be accomplished by the teeth 122 engaging weight plates arranged in tray 30. This will be described in more detail below.

FIG. 5 is a partial exploded view illustrating the weight selector assembly 100 positioned relative to a stack of weights 300 and the removable tray 30 in accordance with an exemplary embodiment of the present invention. In this exemplary embodiment, tray 30 may be designed to hold up to eight (8) weight plates 310-380, although the exemplary embodiments of the present invention are not limited to tray 30 holding eight weights, device 1 and tray 30 may be adapted to hold greater or fewer than eight weight plates. The bottom weight plate 380 may be permanently fixed to tray 30. Alternatively, the bottom portion of tray 30 may be formed so as to have an equivalent weight to the removable weight plates 310-370 that may be added or removed from tray 30. Tray 30 may also be configured to add substantial additional weight to the system for heavy-weight exercises. In other words, tray 30 could be in a substantially larger configuration than shown in FIG. 4 to incorporate a significant mass.

As shown in FIG. 5, weight plates 370, 360, 350, 340, 330, 320 and 310 may be stacked on top of weight plate 380. Each weight plate may include one or more protrusions or teeth (only teeth 312 and 382 are shown for reasons of clarity) and may be selected by changing the rotational position of outer selector tube 120. For example, if teeth 122 are positioned to engage weight tooth 312 of plate 310, weight plate 310 will be selected and held by outer selector tube 120. Similarly, if outer selector tube 120 is rotated so that teeth 122 are in engagement with weight tooth 382, weight plate 380 will be selected and held by outer selector tube 120.

In an aspect, if a given weight plate is selected by the user, all weight plates above the selected weight plate will also be selected. Thus, if weight plate 380 is selected, each of weight plates 310-380 will be held by outer selector tube 120. If weight plate 310 is selected, only that individual weight will be removed from tray 30 and retained by outer selector tube 120, as there are no weight plates above it. This allows the total weight selected to vary from a given minimum to a given maximum weight in tray 30.

As discussed above, weight plate 380 may be permanently attached to tray 30. Thus selection of weight plate 380 corresponds to the maximum weight setting on device 1. Accordingly, tray 30 with all weight plates 310-380 will be retained by outer selector tube 120. This allows use of tray 30 to provide additional weight, and may also provide a clean configuration for storage of exercise device 1.

FIG. 6 is an exploded view of the weight plates 300 to illustrate a method of weight selection in more detail, in accordance with an exemplary embodiment of the present invention. Some of the weights in FIG. 6 have been removed for clarity. Outer selector tube 120 is positioned above weight plates 310, 330, 350, and 370. FIG. 6 illustrates how weight teeth 312, 332, 352, and 372 may be arranged, so that teeth 122 on the outer tube 120 engages only one of the respective weights. Changing the rotational position of outer selector tube 120 thus changes the engagement sequence, resulting in a different weight selection.

FIG. 7 is a view illustrating an exemplary configuration for a weight plate in accordance with an exemplary embodiment of the invention. Weight plate 370 is shown as an example, although FIG. 7 is equally applicable to weight plates 310-360. The weight plate 370 may include weight
spacer elements 390 attached to the bottom as shown in FIG. 7. Spacer elements 390 may provide additional weight, and also provide adequate spacing for each weight plate to properly engage teeth 122 of the outer selector tube 120. The spacer elements 390 may be composed of a material similar to the material of weight plate 370, for example, if the spacer elements 390 are designed to add weight. Alternatively, spacer elements 390 may be made of lightweight plastic or rubber materials to provide a spacing function and/or an optional abe damping function, while adding insignificant weight to weight plate 370.

Unlike weight plates 310-370, weight plate 380 may be permanently attached to tray 30 and does not include spacer elements 390. In this exemplary embodiment, tray 30 weighs approximately the same as the weight of a given spacer element 390. Thus, the weight of weight plate 380—minus tray 30 weighs approximately the same as weight plate 370—spacer element 390.

FIG. 8 is a plan view illustrating the tray 30 in accordance with an exemplary embodiment of the present invention. FIG. 8 shows an example of how weight plate 380 may be attached to tray 30, it being understood that weight plate 380 could also form the bottom of tray 30. In this example, weight plate 380 may be attached to tray 30 with a fastener 31. Fastener 31 may be embodied as one or more snap hook elements. The snap hook elements 31 may be plastic and may be integrally molded into tray 30, if the tray 30 is made of plastic.

FIG. 9 is a partial enlarged view of the upper housing 10 to illustrate the selector knob 101 in more detail. A label 103 may be provided around the rotational periphery of the selector knob 101 on upper housing 10. The label 103 may include indicia to indicate the selected weight. In FIG. 9, the position and orientation of selector knob 101 correspond with an indicator on label 103, here shown as numbers, although other indicia could be used, such as percentages or a “Euro-style” fuel gauge graphic that wraps around the knob 101, somewhat like a ramp, for example.

The increments and indicia on label 103 may depend upon the chosen weight range for a particular embodiment of the present invention. In the example of FIG. 9, the weight ranges from 4 lb. to 20 lb. in nine (9) equal increments. The nine increments correspond to a position for each of the eight weights in this exemplary embodiment, and an additional selector position for no weight selected. The position for no weight selected leaves only the weight of the exercise device 1 without weights 310-380 and tray 30.

The weight of the assembly tray 30 minus the weight 380 weighs the same as any of the other weight plates 310-370 with corresponding spacer elements 390. The weight of the tray 30 replaces the weight of the spacer elements 390, so in this example, the tray 30 weighs 1 lb. Accordingly, in this example, the exercise device 1 weighs approximately 4 lb.

Each additional selected weight plate 310-370 adds 2 lb. Thus, the maximum weight possible in this example is seven 2 lb weights, plus the eighth weight plate 380 and tray 30, which weighs two pounds, for a total of 20 lb. As discussed above, the weight increments, maximum and minimum weights are merely exemplary, the exercise device 1 and tray 30 could be adapted to hold different ranges of weights, depending on the desired size of the exercise device 1 and desired accompanying weight. An exemplary range of weight may be between about 2 pounds to at least 100 pounds of weight, although conceivably the exercise device 1 could be adapted to hold even greater amounts of weight.

FIG. 10 is a plan view of a rotating handle assembly 40, and FIG. 11 is an exploded view to illustrate the construction of the rotating handle assembly 40. Referring to FIGS. 10 and 11, the handle assembly 40 may include ring halves 410, a rigid tube 420 and a handle 430. Handle 430 may be a soft handle or a malleable material such as foam, flexible rubber or soft plastic, for example and may be provided over rigid tube 420 as shown in FIG. 10, for example. The tube 420, and handle 430 collectively form a subassembly 420-430. Subassembly 420-430 may be placed between ring halves 410, for example.

The handle assembly 40 may be mounted between upper housing 10 and lower housing 20 in a manner that allows handle assembly 40 to rotate independently. Thus, it may be possible for a user of the exercise device 1 to change hand orientation while exercising with the exercise device 1. This may provide unique advantages for training desired muscle groups by performing particular exercises.

FIG. 12 is a partial enlarged view of the handle assembly 40 and lower housing 20, and FIG. 13 is a partial exploded view illustrating a resistance/sound element in accordance with an exemplary embodiment of the present invention. The exercise device 1 may also include an element or device to create sound and resistance while the user actuates handle assemblies 40. Sound and resistance may be generated by interaction between a resistance/sound element 50 and a selector switch 60.

Referring to FIG. 12, the resistance/sound element 50 may be mounted in lower housing 20, in proximate relationship to teeth 411 of rotating handle assembly 40. To vary the position of the selector switch 60, the user may reach up inside the cavity 25 of lower housing 20 when no weight is selected. Alternatively, selector switch 60 may be provided on an outer surface of the upper housing 10 or lower housing 20 in the vicinity of the rotating handle assemblies 40. Thus, the user may vary the sound and resistance created while actuating handle assembly 40.

In this example, the selector switch 60 may have a range of motion between two extreme positions. A first extreme position of selector switch 60 may result in maximum sound and resistance, while at a second extreme position, resistance/sound element 50 is not contacting teeth 411, so there is minimum sound and resistance.

Referring to FIG. 13, resistance/sound element 50 may be flexible and may include teeth 51 positioned to contact teeth 411 of rotating handle assembly 40. Resistance sound element 50 may include mounting lugs 52 which may engage corresponding mounting bosses (not shown for reasons of clarity) on lower housing 20 and upper housing 10 to mount sound resistance element 50 to lower housing 20. Selector switch 60 may further include a ramp 61 and a table 62. When the selector switch 60 is moved to a given position, ramp 61 comes in contact with resistance/sound element 50, biasing the teeth 51 towards teeth 411 of handle.
assembly 40. The resultant contact creates sound and resistance while handle assembly 40 is actuated by the user. The user may change the position of selector switch 60 by moving tab 62 on the switch body.

[0061] A selector switch 60 and sound resistance element 50 may be provided for each of the two rotating handle assemblies 40 of the exercise device 1. Thus, it may be possible to independently select sound and resistance for one or both of the handle assemblies 40.

[0062] Manufacturing Methods

[0063] FIG. 14 is a flow diagram illustrating a method of manufacturing the exercise device in accordance with an exemplary embodiment of the present invention. Referring to FIG. 14, there is shown an exemplary manufacturing process for fabricating the exercise device 1. It should be understood that the following functions may be performed in a variety of different functional orders to fabricate the complete exercise device 1.

[0064] In the method, the upper housing 10 may be formed (1410) and the lower housing 20 may be formed (1420) by a suitable fabrication process, described in further detail below. Each of the upper housing 10 and lower housing 20 may be composed of a frame provided with a central opening and a pair of outer openings, one opening at each side of the central opening. The central opening may be openings 106a and 106b of FIG. 3, and the outer openings may be openings 15 shown in FIG. 1, for example. Further, the lower housing 20 may be formed so as to have a centrally located cavity, which may be cavity 25 of FIG. 1, for example.

[0065] Weight selection assembly 100 may then be formed (1430) by a suitable fabrication process described in further detail below, although this may be formed independent from the upper and lower housing 10 and 20. To form the weight selection assembly 100, the inner selector tube 110 and selector knob 101 may be formed, and the selector knob 101 inserted into the inner selector tube 110 to form the subassembly 101-110. The outer selector tube 120 may be formed, with the subassembly 101-110 inserted into outer selector tube 120 to provide a contiguous weight selection assembly 100. Friction washer 113 and support plate may be provided between the subassembly 101-110 and outer selection tube 120 (see FIG. 3) for support.

[0066] The rotating handle assemblies 40 may be formed (1440) by a suitable fabrication process described in further detail below, although rotating handle assemblies 40 may also be formed independent from the forming of the upper and lower housing 10 and 20 and weight selection assembly 100. Each handle assembly 40 may be inserted (1450) into a corresponding opening 15 of the lower housing 20 (as shown in FIG. 3) so as to be supported by the lower housing 20 frame.

[0067] The weight selection assembly 100 may be inserted (1460) through the central opening 106a in the upper housing 10, and the upper housing 10 with weight selection assembly 100 may be attached (function 1470) to the lower housing 20 so that a portion of the weight selection assembly (e.g., outer selector assembly 120 with teeth 122) extends into the cavity 25 of the lower housing 20. Suitable fasteners may be provided to fixedly secure the upper and lower housings 10 and 20 together, such as rivets, screws, adhesives, etc. Accordingly, fabrication of the exercise device 1 is completed.

[0068] Separately, tray 30 may be formed by a suitable fabrication process, described in further detail below. Tray 30 may be formed in a configuration for holding weight plates 310-380 and the dimension adapted so as to comfortably fit within the cavity 25 of the lower housing 20 for engagement of one or more weight plates 310-380 therein by weight selection assembly 100.

[0069] In general, individual components of the exercise device 1 described herein may be fabricated primarily from lightweight materials such as moldable plastic. Upper housing 10 and lower housing 20 may be formed by an injection molding process from a high impact plastic, such as Acrylonitrile Butadiene Styrene (ABS). ABS is an easily machined, tough, low cost rigid thermoplastic material with high impact strength, and may be a desirable material for turning, drilling, milling, sawing, die-cutting, shearing, etc. However, ABS is merely one exemplary material, equivalent materials may include various thermoplastic and thermoset materials that have characteristics similar to ABS. For example, take-filled polypropylene, high strength polycarbonates such as GE Lexan, or blended plastics may be used instead of or in addition to ABS.

[0070] An exemplary injection molding system for forming molded plastic articles may be the Roboshot injection molding machine from Milacron-Fanuc. The Roboshot is one of many known injection molding machines for forming plastic injection molds. Other plastic molding processes such as vacuum forming may be used, but these alternative processes may not provide the structural advantages and cost advantages of injection molding. Alternatively, the upper housing 10 and lower housing 20 may be formed using a metal casting process such as sand casting, die casting, or investment casting, for example.

[0071] The weight selection assembly 100 may also be molded of plastic. Selector knob 101 and inner selector tube 110 may be formed by an injection molding process from a high impact plastic such as ABS. Selector knob 101 and inner selector tube 110 may be formed from virtually any plastic or metal material, since they are not critically loaded. The decision of material may be based on factors such as cost and/or appearance considerations.

[0072] Outer selector tube 120 may require a more durable material as it requires additional strength. Due to the loads on teeth 122, outer selector tube 120 may be molded of a more durable material than ABS, such as glass-filled nylon. However, the composition of outer selector tube 120 is not limited to glass-filled nylon, any material having similar fracture toughness characteristics to glass-filled nylon may be suitable equivalents. Such materials may be characterized as being able to absorb energy without cracking, or materials which do not shatter under substantially sharp impact loads, for example. Metal castings may be used to form outer selector tube 120, as well as machined metal construction. Other high performance molded and composite materials may also be adequate for outer selector tube 120, but may not offer cost advantages as compared to glass-filled nylon, for example.

[0073] Support plate 115 may be fabricated from high performance molded or sheet plastic, a suitable light, yet
strong metal such as a high-strength, low alloy steel, aluminum, etc., and/or a composite synthetic material such as a carbon fiber/epoxy material, for example. Alternatively, support plate 115 may be incorporated into molded upper housing 10. Friction washer 113 may also be formed from a wide variety of metals and plastics. The function of friction washer 113 is to provide desirable wear surface characteristics at a relatively low cost.

[0074] Removable weight tray 30 may be formed from injection molded ABS. However, tray 30 may be molded or machined from a number of different plastic or composite materials, or may be cast from a number of different metals. Cost and weight may play a consideration in choosing the desired process and material for forming tray 30.

[0075] The weight plates 300 may be stamped from hot-rolled steel, for example. Alternatively, weight plates 300 may be cut from cold-rolled steel, stamped from a stainless steel alloy, formed of cast metals or machined metals, etc. Further, the weight plates may be formed by a process using heavy filler materials such as concrete or soft lead in a molded or formed outer housing. It is also within the skill of the art to employ other known methods of assembling stamped metal pieces to create the weight plates. A basic requirement is that the weight plates 300 be formed of a strong enough material that the teeth 312-382 are sufficiently durable and at a reasonably accurate enough location on the associated weight plate to successfully engage teeth 122 of the outer selector tube 120.

[0076] As discussed above, the spacer elements 390 may be composed of a suitable incompressible metal material used to form the weight plates 300, such as hot-rolled steel, titanium, aluminum, etc. However, spacer elements 390 could be formed of a plastic and/or hard rubber compound. The rubber may provide acceptable noise damping characteristics if only a spacing function is desired for spacer elements 390. Metal may be desirable because it adds weight. The spacer elements 390 may be spot-welded or punched and welded to each of the weight plates 310-370. Rivets, screws, adhesives and other known fasteners within the skill of the art may be used in place of spot welding.

[0077] The rotating handle assemblies 40 may be composed of a rigid aluminum tube 420 encased by a soft handle 430 that may be embodied as a foam rubber grip 430, for example. Grip 430 may either be extruded or molded into a desired shape. The ring halves 410 may be formed by an injection molding process of ABS plastic, for example, although a number of alternative methods may be employed to form handle assemblies 40.

[0078] For example, the entire assembly could be cast or molded as a single piece of plastic or metal. Alternatively, tube 420 can be formed of any desired material that has sufficient strength to perform under the anticipated loads. Further, the handle assemblies 40 may change based upon the empty weight requirements of the cavity 25. In this example, the empty weight of overall exercise device 1 should be approximately 4 lb. Handle assemblies 40 provide a convenient location to tailor the final empty weight of the exercise device 1 without tray 30 and associated weigh plates 300.

[0079] Depending on the design, the empty exercise device may be lightened or weighted based on the materials chosen for the components of the handle assemblies. For example, tube 420 may be a thin-walled aluminum for tube 420. If, by a different choice of material for upper housing 10 and lower housing 20, for example, weight needed to be added to reach 4 lbs empty, tubes 420 could be composed of hollow or solid steel. Filling tube 420 with lead or concrete might significantly alter the weight of the handle assembly 40. Likewise, casting the entire handle assembly 40 from a metal or metal-filled plastic may also increase the weight.

[0080] The construction of soft handle 430 may vary based upon factors such as comfort and durability requirements. The shape of soft handle 430 can be molded for maximum comfort or extruded to lower cost, as an example. Similarly, tube 420 could be formed in a contoured shape, eliminating the need for soft handle 430. If the entire handle assembly 40 was molded or formed as an integral part and the central handle region was contoured, the soft handle 430 could be eliminated.

[0081] There may be a number of ways to provide sound and resistance for rotating handle assemblies 40. This sound and resistance may be selectable. The sound and resistance element 50 and selector switch 60 in the exemplary embodiment represent a simple contact friction system. However, in addition to friction of flexible elements or springs, the resistance may be generated by fluid viscosity, magnetic induction, or electromagnetism, for example. Sound may be generated by contact friction, air movement, vibration of taut string elements, or may be generated via an electrical/electronic source or device. If additional resistance is required, elastomer friction blocks (not shown) may be added to the existing design.

[0082] Method and System for Interacting with an Exercise Device

[0083] FIG. 15 is a block diagram illustrating a method and system for interaction with an exercise device in accordance with an exemplary embodiment of the invention. In particular, there is described a system and method for tracking a physical workout by a user manipulating an exercise device.

[0084] Although motion tracking systems for weight machines with mechanically constrained movements have been developed, due to the inherent difficulties of tracking devices with free ranges of motion, no known capability is believed to exist for free weight exercise devices. Accordingly, the following method may be adapted for an exercise device such as described above. However, the following method may be implemented in exercise devices other than the device 1 described above, such as conventional free weights, individual weight stations such as weight machines of a NAUTILUS® system, exercise bikes, treadmills, step machines, STAIRMASTER® machines, etc.

[0085] Referring to FIG. 15, in the method, one or more devices at the exercise device may detect one or more parameters related to spatial movement of the exercise device by a user (shown generally as user 1510, as indicated by the dotted lines extending from the user 1510 to the exercise device). In an aspect, the detecting function may be performed by one or more suitable sensors 1520 physically located on the exercise device. In another aspect, the detecting function may be performed by one or more suitable sensors 1520 located externally (not shown) from the
exercise device. The parameters may be embodied as one or more of a rate of lift parameter of the exercise device during movement by the user, a range of motion parameter of the exercise device, a rate of movement by the user, a number of repetitions parameter of the exercise device by the user for a specified workout routine, and/or a jitter parameter related to pitch and yaw (e.g., translational movement) of the exercise during movement by the user.

[0086] The sensors 1520 may be embodied as at least one of an accelerometer, a gyroscope, a pressure sensor, a proximity sensor, an infrared sensor and an optical sensor, or combinations thereof that detect one or more of the parameters and output a signal (such as an analog signal) that may be converted (i.e., by a suitable A/D converter 1525) into digital data. The digital data may be processed in an intelligent electronic device 1530 provided on the exercise device.

[0087] For example, in an embodiment in which the detected parameter data is communicated as an analog signal by the sensor(s) 1520, the signal may be converted to digital data by A/D converter 1525 and processed in a microcontroller 1530 (intelligent electronic device) operatively connected to an output of the A/D converter 1525. The microcontroller 1530 may process the digital data into a suitable form, such as an RF signal containing a data packet, that is transmitted from an antenna 1545 of a transceiver 1540 that is operatively connected to the microcontroller 1530, similar to how packetized voice or data traffic is wirelessly transmitted over an air interface from a cellular phone to a base station transceiver servicing the cellular phone, for example.

[0088] For example, if the sensor 1520, via the intelligent microelectronic device 1530, is operatively connected to a miniature RF transceiver 1540 on the exercise device, the detected parameter data may be packetized in the transceiver 1540 and transmitted as part of one or more packets of data wirelessly over an air link 1547 to an antenna 1550 of a remote receiver. The remote receiver may serve as a second transceiver 1555 at a remote location (such as a transceiver that is operatively connected to downstream processing circuitry of a processing station (as shown in FIG. 15). The processing station, which may be located within a gymnasium or workout club receives the detected parameter data over the link 1547 via antenna 1550 of transceiver 1555 and forwards the detected parameter data to downstream processing circuitry.

[0089] The various sensors, microelectronics and transceiver circuitry may be powered from a suitable power source such as rechargeable secondary battery. Rechargeable secondary batteries for powering portable electronic devices are well known, evidenced by the battery packs used to power low-voltage electronic devices such as cellular phones, personal digital assistants (PDA's) and laptop computers. Accordingly, suitable battery pack candidates may be battery packs consisting of one or more cells having a nickel-metal-hydride (NiMH), nickel cadmium (NiCd) or lithium ion (Li+) cell chemistry with associated electrolyte.

[0090] The processing station may be embodied in hardware and/or software as a digital microprocessor 1560 within a suitable personal computer that includes a wireless hub and associated transceiver components and circuitry. However, instead of a digital microprocessor, an analog processor, digital signal processor and/or one or more application specific integrated circuits controlled by a suitable microcontroller or microprocessor may be provided in the processing station, for example. Power may be provided by a suitable AC power source or embedded battery pack as described above.

[0091] Users 1510 may communicate with microprocessor 1560 over a suitable encrypted medium such as an encrypted 128-bit secure socket layer (SSL) connection 1578, although the present invention is not limited to this encrypted communication medium. If the processing station is embodied as a server, user 1510 may connect to the server over the internet or from any one of a personal computer, laptop, PDA, etc., using a suitable network interface 1585 such as a web-based internet browser. Further, processing station may be accessible to internal users 1510 via a suitable local area network connection 1580, so that internal users 1510 have access over an intranet for example. Graphical information may be communicated over the 128-bit SSL connection 1578 or LAN 1580, to be displayed on a suitable display device 1587 or 1589 of the user 1510.

[0092] The processing station may include a data bus 1576. Bus 1576 may be implemented with conventional bus architectures such as a peripheral components interconnect (PCI) bus that is standard in many computer architectures. Alternative bus architectures such as VMEBUS, NUBUS, address data bus, RAMbus, DDR (double data rate) bus, etc. may be utilized to implement bus 1576.

[0093] Microprocessor 1560 represents a central nexus from which all real time and non-real functions in the processing station are performed, such as graphical-user interface (GUI) and browser functions, directing security functions, directing calculations for display and review by the user. Accordingly, microprocessor 1560 may include a GUI 1570 which may be embodied in software as a browser. Browsers are software devices which present an interface to and interact with, users 1510 of the system 1560. The browser is responsible for formatting and displaying user interface components (e.g., hypertext, window, etc.) and pictures.

[0094] Browsers are typically controlled and commanded by the standard hypertext, mark-up language (that's HTML). Additionally, or in the alternative, any decisions in control flow of the GUI 1570 that require more detailed user interaction may be implemented using JavaScript. Both of these languages may be customized or adapted for the specific details of a given application server 200 implementation, and images may be displayed in the browser using well known JPEG, GIF, TIFF and other standardized compression schemes, other non-standardized languages and compression schemes may be used for the GUI 230, such as XML, "home-brew" languages or other known non-standardized languages and schemes.

[0095] Microprocessor 1560 may invoke cryptographic hardware or software to establish a firewall to protect the processing station from outside security breaches. The cryptographic hardware or software secures all personal information of registered users 1510.

[0096] The digital microprocessor 1560 of the processing station may evaluate the received parameter data. The evaluation may include determining a fitness score that takes into account at least one of the age, gender and health/fitness
condition of the user 1510. Additional input to the fitness score may include the aforementioned parameters related to spatial movement of the exercise device by the user 1510.

[0097] The processing station may include memory 1565 (such as various types of RAM, ROM, optical storage, magnetic disk storage, etc.) for storing or recording the performance data. The processing station may receive inputs from an input device (keyboard, mouse, touch screen, etc.) at the user 1510, via interfaces 1580, 1585, bus 1576 and G1.U 1570 for enabling display of the performance data via GUI 1570 to the user 1510.

[0098] In an aspect, the GUI 1570 may be adapted to enable, via an animated display 1575 at the processing station, a graphic display of a proper form of a selected exercise to help instruct the user 1510. For example, the GUI 1570 may be adapted to graphically mimic, on display 1575 (or displays 1587 and 1589), a particular exercise being performed by the user 1510 in at least one of a real time mode and a playback mode, so as to indicate whether the exercise is performed properly, and/or to display a fitness score for the individual exercise. Further, GUI 1570 may enable the user 1510 to locally or remotely download a given workout plan, or a review of the user's workout history, via at least one of an intranet and the Internet, as discussed above.

[0099] Based on the evaluation, the processing station may output performance data related to the workout. In an aspect, the performance data may be related to at least one of a quality measure and quantity measure of the workout. For example, the processing station may output, on display 1575, a single fitness score for the user related to quality of the workout that is based on the evaluation. Alternative, after a series of workouts, a single fitness score may be generated to evaluate the overall workout session.

[0100] The fitness score may be displayed locally on a display 1575 at the processing station. Alternatively, the fitness score or other data may be processed in microprocessor 1560 into a suitable form for transmission from the antenna 1550 of transceiver 1155 over an airlink 1590 to a remote location at the user 1510. For example, if the user has an electronic device configured with appropriate transceiver circuitry (wireless PDA, cell phone, wireless PC, etc), the transmitted data may be converted into a suitable digital video image for display at display units 1587, 1589.

[0101] In another aspect, the performance data may be displayed in substantially real time (except for minor transmission losses over the air link due to interference or path signal loss) for a specified workout routine. The displayed performance data may include, but is not limited to, graphical data representing a rate of lift of the exercise device during movement by the user, a range of motion of the exercise device during movement by the user and a number of repetitions of the exercise device by the user.

[0102] In another exemplary embodiment, a gaming device with interface (not shown) may be provided for translating physical movements by a user manipulating an exercise device to gaming software of the gaming device displaying an active game. For example, sensory devices 1520 on an exercise device in communication with a suitable software program or algorithm and transceiver circuitry may be adapted to convert spatial movements of the exercise device by the user to ape movements within a displayed game operatively controlled by the gaming device.

[0103] Accordingly, the method and system of tracking a physical workout by a user manipulating an exercise device such as a free weight device may offer several benefits. Instantaneous feedback of exercise metrics for range of motion, rate of lift, and number of repetitions may allow a user to adjust their form to obtain maximum muscle workout and reduce potential incidence of injury. Remote hands-free recording of exercise performance provides the user, trainer, or therapist the capability to evaluate the quality of a workout at the end of a session and progress over time. Near-instant feedback and the interactive gaming capabilities may provide an element of mental stimulation to an otherwise boring and tedious experience.

[0104] Further, a single fitness score may be output for the user for comparison to other people, thus allowing for friendly competition or just general comparison. This may add a new element to fitness training that can make training more rewarding and enjoyable. Users may also receive a single fitness score representing a consolidation of their entire workout, making it easy to remember and record. Providing a single fitness score may also facilitate the user tracking their own progress.

[0105] FIG. 16 is a partial cut-away view of an exercise device in accordance with another exemplary embodiment of the present invention. FIG. 16 is somewhat similar to FIG. 1, in that the device 1 includes rotating handle assemblies 40 an upper housing 10 and a lower housing 20 and a central cavity for receiving a plurality of plates 300. Upper housing 10 may have a raised door 13, which may be embodied as a frosted or clear plastic panel, for example. The user may view a suitable indicator such as label 103 (not shown) depicting how much weight is in the device 1. The raised door 13 may be held by spring force which may be overcome by the user pressing down against door 13 to overcome spring pressure, similar to how one might open a lattice housing of a cassette recorder or hand held VHS recorder, for example to open the door 13.

[0106] Device 1 may include a weight selector assembly which may comprise a selector knob 101 and a selector tube 120. Selector tube 120 may include a plurality of vertically arranged teeth 122 thereon for engaging teeth 122 within corresponding slots 312 of weight plates 300. The weight selector assembly may slide laterally to align teeth 122 with corresponding slots 312 of given weight plates 300 to engage the desired amount of weight plates 300 that have been selected based on the lateral movement of the weight selector assembly by a user of the device 1. There may be provided calibrations on one or more of the weight plates 300 that tells the user where to align the selector knob 101. This may be seen through the clear door 13, for example, and may be in equal weight increments, for example.

[0107] Accordingly, to pick-up weight, the selector tube 120 may extend through the slots 312 as the weight loads from the bottom of device 1 through lower housing 20 and is received into a cavity somewhat similar to as shown in FIG. 1, however, the weights are selected by lateral movement of the weight selector mechanism to lockingly engage teeth 122 with slots 312, as shown in FIG. 16. Once the desired weight is selected, door 13 may be closed. The closing action of the door 13 may pull the selected weight
plates 300' up slightly in a compressive engagement to limit movement of the weight plates 300' therein. Door 13 also provides a locking mechanism for device 1'.

[0108] Weight plates 300' may be configured in several configurations, one of which may be known as a ‘clamshell’ arrangement. Widthwise, the width of the weight plates 300' may increase from bottom to top, so as to provide individual weight plates 300' of equal weight which, when engaged by teeth 122' and secured in device 1', may maintain the center of gravity of device 1' generally in the middle of the device 1', not top heavy or bottom heavy, regardless of which weight plates 300' are selected.

[0109] Although not shown for reasons of clarity, the individual weight plates 300' may be of different thicknesses and dimensions so as to provide an equal weight for each weight plate 300'. The weight plates 300' may be configured so that they are stackable in a general vertical orientation, as shown in FIG. 16. Further, each slot 312' may include teeth (not shown). The teeth may be arranged along different locations in slots 312' of different weight plates 300', so that teeth 122' may engage corresponding teeth of a given weight plate 300' based on the position of selector knob 101'.

[0110] Each weight plate 300' may have one or more openings (not shown for reasons of clarity) other than central opening 312'. Openings may be different for different weight plates 300', depending on the vertical position of a given weight plate 300' in the stack shown in FIG. 16, for example. Each weight plate 300' may further have a different stamping to accommodate weight plates 300' having equal overall weight, for example.

[0111] Referring again to FIG. 16, selector knob 101' may traverse laterally along a guide plate 156 based on actuation by the user. Optionally, guide plate 156 may include a plurality of spaced detents or indicators that may represent a selected weight by the user. The selector knob may include a tab (not shown) that engages a given dent to maintain selector knob 101' at the selected position on guide plate 156. Depending on the weight selected, the teeth 122' of selector tube 120' may thus be aligned within slots 312' of the weight plates 300' so as to engage corresponding teeth of one or more weight plates 300', for example.

[0112] In general, individual components of the exercise device 1' described herein may be fabricated primarily from moldable lightweight materials such as ABS. The weight plates 300' may be stamped from hot-rolled steel, cut from cold-rolled steel, stamped from a stainless steel alloy, formed of cast metals or machined metals, or formed by a process using heavy filler materials such as concrete or soft lead in a molded or formed outer housing. A basic requirement is that the weights 300' be formed of a strong enough material that the plates are sufficiently durable and at a reasonably accurate enough location on the associated weight plate 300' to successfully engage teeth 122' of the selector tube 120'. The rotating handle assemblies 40 may be composed of material and formed as described in the previous exemplary embodiment, for example.

[0113] Accordingly, the teeth of a given weight plate 300' placed at different points in each opening 312' enable the teeth 122' of the selector tube 120' to engage a given weight plate 300' based on the lateral movement of the selector knob 101' and sector tube 120' during the weight selection process. A weight plate 300' orientation of a given plate 300' may be such that each weight plate 300' weighs the same and maintains the center of gravity of the device 1' when secured within the device 1' by the closing action of the door 13. Door 13, provides a locking mechanism using spring force to secure the individual weight plates 300' within the device 1', substantially eliminating the potential for vibration within the device 1'.

[0114] FIG. 17 is a top view of an exercise device in accordance with another exemplary embodiment of the present invention. Referring to FIG. 17, an exercise device 1' may include a housing 10' having a central cavity 25' containing a plurality of weight sleeves 36 and a pair of outboard rotating handle assemblies 40'. Additionally, device 1' may include additional handles 44 that may be part of housing 10'. Materials and processes for forming the components of device 1' may be as similar to those materials and processes as described above for the previous exemplary embodiments.

[0115] The weight sleeves 36 may each contain a removable weight plate 300' (not shown). For example, the weight sleeves 36 of cavity 25' may be configured to store weight between about 5-55 pounds, although this is merely an exemplary range of weight. Device 1' may further include one or more self-locking spring loaded mechanisms (not shown for clarity) to secure the weights 300' in sleeves 36.

[0116] The rotating handles 40' may freely rotate to provide wrist supination (outward rotation) at a desired given angle. The handle assemblies 40' may include a rotatable outer bezel 48 thereon that is calibrated to include a number of handle positions, here shown in terms of degrees from vertical. Positions of the handles may be selectable to exercise a specific muscle group (bicep, tricep, back chest etc, depending on the hand orientation of the user on the device 1'). The user may thus select a free spinning or locked position of supination or pronation (inward rotation) of the wrist.

[0117] Device 1' may thus be a combination of a barbell, dumbbell, and medicine ball. Unlike traditional barbells and dumbbells, weights may be attached centrally, as opposed to the ends. Slots (not shown) with locking mechanisms may be provided in the center of the device 1' for sleeves 36 of weights 300' to be installed. Based on the amount of weight installed, the device 1''s weight load may span a wide range of weight, in upwards of a hundred pounds or more, for example.

[0118] Device 1' may have several alternative configurations, not illustrated herein for reasons of brevity. In an aspect, the device 1' may include a horizontal handle attached at either end with two shorter handles. The shorter horizontal handles may attach to two vertical handles, which in turn may connect to the lower housing 20' of the device 1'. Inward of the vertical handles may be medicine ball equivalent sized grips that encapsulate either end of the weight slots. The weight slots may receive the sleeves 36 of weight. Further, the vertical handles may be extended on the bottom of device 1' to support exactly the same horizontal handle configuration as found on the top of the device 1'. Accordingly, device 1' of FIG. 17 may include up to six horizontal handles, two short and one long handle on either side of device 1'.

[0119] In another aspect, device 1' may include two removable, rotating handle assembly modules 40' that may
be operatively attached to either end of the device 1". The handle modules may provide handholds that can be set to rotate freely clockwise/counter-clockwise, or which may be locked at any angle to work a desired muscle group. The handle modules may be adjustable inward and outward to allow a user to adjust the width of their hand holds as needed. The weight slots, horizontal handles and medicine ball grips may be similar to as described above.

[0120] The exemplary embodiments of the present invention being thus described, it will be obvious that the same may be varied in many ways. For example, the exercise device 1, 1', 1" may include a housing configured differently than as upper housing 10 and a lower housing 20, such as one piece, multiple piece (1-2) or modular connective construction (fixed housing with removable and/or reconfigurable connective modular housing portions), for example. Additionally, a cavity 25 or opening may be provided on the device 1 in places other than centrally located within lower housing 20, as is evident to those having ordinary skill in the art.

[0121] Handle assemblies 40 may be configured to provide directional movement other than rotational (lateral, transverse, etc.) within openings 15, for example. Further, one of ordinary skill in the art may adapt rotating handle assemblies 40 to include other structural elements in lieu of teeth to engage resistance/sound element 50, for example. As described above, resistance/sound element 50 and selector switch 60 illustrate one exemplary embodiment, other configurations for providing sound and resistance are evident within the ordinary skill of the art.

[0122] Moreover, tray 30 may be configured in one or more alternative yet equivalent structural forms or shapes for holding and/or storing weight plates 300 than the exemplary configuration of FIG. 2B, for example. With regard to weight plates 300, although shown in a generally square or plainer configuration, it is evident to the ordinary skilled artisan to make and/or form the weights in other shapes, dimensions and orientations. Further, other mechanisms proving the equivalent function of engaging weight selector assembly 100 may be provided on the weight plates 300, in lieu of or in conjunction with the exemplary weight plate teeth shown in FIGS. 6 and 7, for example.

[0123] As is evident within the ordinary skill of the art, multiple alternative configurations providing an equivalent function may be substituted for and/or may accompany, the weight selection assembly 100 described herein. For example, there may be provided various alternative structures for selecting weight other than the exemplary selector knob 101, and inner and outer selector tubes 110 and 120 may be replaced by several alternative structures, as would be evident to one having ordinary skill in the art. Alternatively, a single selector tube may be utilized in any of devices 1, 1', 1" instead of inner and outer selector tubes 110 and 120.

[0124] With regard to FIG. 15, parameters other than, or in addition to, rate of lift, range of motion and number of repetitions by the user of an exercise device may be tracked and displayed on a suitable display device. Moreover, the exemplary fitness score may take into account other parameters and characteristics other than, or in addition to one or more of age, gender and/or health/fitness of the user 1510. Further, it is within the skill of the art to configure alternative sensory devices or equivalent structure that provide a like output signal based on a detected parameter, other than or in addition to the aforementioned accelerometers, gyroscopes, pressure sensors, proximity sensors, infrared sensors and/or optical sensors.

[0125] Such variations are not to be regarded as departure from the spirit and scope of the exemplary embodiments of the present invention. All such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the following claims.

What is claimed is:

1. An exercise device, comprising:
   an upper housing,
   a lower housing, and
   a pair of rotatable handle assemblies between the upper and lower housings, the lower housing including a cavity for receiving a removable weight.

2. The device of claim 1, wherein the cavity is centrally located in the lower housing so that the removable weight is provided near the center of the exercise device, so that each handle assembly of the pair is outboard either side of the weight.

3. The device of claim 1, further comprising:
   a tray adapted to hold the removable weight, the tray adapted for insertion into the cavity of the lower housing.

4. The device of claim 1, further comprising a weight selector, wherein weight is added or removed within the cavity in the lower housing by placing the exercise device over the tray so that the tray is inserted into the cavity and adjusting the position of the weight selector.

5. The device of claim 1, wherein the weight selector includes:
   a selector knob provided on the device and adapted to be actuated by a user of the device,
   an inner selector tube, and
   an outer selector tube,
   wherein the selector knob is engaged to the inner selector tube to form a subassembly that is rigidly connected to outer tube assembly, and
   wherein the outer selector tube includes a plurality of teeth for engaging the removable weight.

6. The device of claim 5, further comprising:
   a tray adapted to hold the removable weight, the tray adapted for insertion into the cavity of the lower housing, wherein the removable weight is embodied as one or more vertically stacked weight plates in the tray.

7. The device of claim 6, wherein one of the vertically stacked weight plates is permanently fixed in the tray.

8. The device of claim 6, wherein each weight plate has one or more teeth for engaging the teeth on the outer selector tube, based on a rotational position of the outer selector tube.

9. The device of claim 8, wherein
   the rotational position of the outer selector tube is based on a weight selection position of the selector knob, and
   the user actuates the selector knob on the device to a desired weight to align teeth of the outer selector tube.
so as to engage teeth of one or more given weight plates in the tray to achieve the desired weight and remove the desired weight from the tray.

10. The device of claim 9, wherein, if a given weight plate is engaged by the weight selector, all weight plates above the given weight plate are also engaged by the weight selector.

11. The device of claim 1, further comprising one or more resistance/sound elements for providing aural and resistance feedback to a user actuating the rotating handle assemblies.

12. The device of claim 11, wherein each rotating handle assembly includes teeth on an outer periphery thereof

the resistance/element has a flexible configuration and is in proximate relationship to the teeth of a given handle assembly for engaging the teeth as the handle assembly is being turned, providing an audible sound and a resistance to the rotational movement.

13. The device of claim 12, further comprising a selector switch adjustable by the user to change the sound and resistance, via positioning of the resistance/sound element to a range of positions between a maximum sound and resistance position and a minimum sound and resistance position.

14. An exercise device, comprising:

an upper housing;

a lower housing, the lower housing provided with a central cavity for insertion of one or more removable weights, each of the upper and lower housings further including a frame and a pair of outer openings, one opening at either side of the central cavity;

a pair of rotating handle assemblies provided in corresponding outer openings; and

a weight selection assembly for selecting a desired amount of weight for insertion in the central cavity.

15. The device of claim 14, further comprising a tray configured for holding weights and adapted so as to be engaged by the weight selection assembly within an opening provided at an underside of the lower housing.

16. The device of claim 15, wherein one or more of the upper housing, lower housing, rotating handle assemblies, weight selection assembly and tray are formed by an injection molding process from a high impact plastic.

17. A method of fabricating an exercise device, comprising:

forming an upper housing;

forming a lower housing, each of the upper and lower housing composed of a frame provided with a central opening and an outer opening on either side of the central opening, the lower housing further including a cavity;

forming a weight selection assembly adapted to select a removable weight;

forming a pair of handle assemblies;

inserting each handle assembly in a corresponding outer opening of the lower housing so as to be supported by the lower housing frame;

inserting the weight selection assembly through the central opening in the upper housing; and

attaching the upper housing to the lower housing so that at least a portion of the weight selection assembly extends in the cavity of the lower housing.

18. The method of claim 17, further comprising:

forming a tray configured for holding one or more removable weights and of a dimension so as to fit within the cavity of the lower housing for engagement of the one or more removable weights therein by the weight selection assembly.

19. The method of claim 18, wherein at least one of the steps of forming the upper housing, lower housing, weight selection assembly, pair of handle assemblies and tray includes performing a process selected from the group comprising an injection molding process, a vacuum forming process and a metal casting process.

20. The method of claim 17, wherein the step of forming the weight selection assembly includes:

forming an inner selector tube;

forming a selector knob;

inserting the selector knob into the inner selector tube to form a subassembly;

forming the outer selector tube, and

inserting the subassembly into outer selector tube.

21. A method of determining a fitness score for a workout by a user manipulating an exercise device, comprising:

receiving one or more detected parameters related to spatial movement of the exercise device; and

determining a fitness score related to quality of the workout by the user, based on the received parameter data.

22. The method of claim 21, wherein the receiving step includes receiving the detected parameters over one of a wired link and a wireless link.

23. The method of claim 21, further comprising:

displaying the fitness score for the user.

24. The method of claim 21, wherein the detected parameters include at least one of a rate of lift parameter of the exercise device during movement by the user, a range of motion parameter of the exercise device during movement by the user, a number of repetitions parameter of the exercise device by the user for a specified workout routine, and a jitter parameter related to pitch and yaw of the exercise device during movement by the user.

25. The method of claim 21, wherein the determining step includes determining the fitness score as a function of at least one of an age, gender and fitness condition of the user.

26. The method of claim 21, further comprising:

displaying the fitness score and a comparison of the user's fitness score to fitness scores of other users.

27. The method of claim 26, wherein fitness scores of other users are obtained via one of an intranet and the internet.

28. An arrangement for tracking movement of a handheld, free-weight exercise device to determine quality of a workout, comprising:

a plurality of sensors for detecting one or more parameters related to spatial movement of the device by the user during a workout,
a transceiver, and

a processor, the transceiver transmitting the detected parameter data to the processor, the processor determining a quality of the workout by the user based on the received parameter data.

29. The arrangement of claim 28, wherein the plurality of sensors are embodied as at least one of an accelerometer, a gyroscope, a pressure sensor and an optical sensor, or combinations thereof.

30. The arrangement of claim 28, wherein the plurality of sensors detect at least one of a rate of lift parameter of the exercise device during movement by the user, a range of motion parameter of the exercise device during movement by the user, a number of repetitions parameter of the exercise device by the user for a specified workout routine, and a jitter parameter related to pitch and yaw of the exercise during movement by the user.

31. A gaming device containing an arrangement as described in claim 28, the arrangement interacting with existing gaming software to translate movement of the gaming device into moves within an existing game being implemented by the gaming software.

32. A system for tracking a physical workout of a handheld, free-weight exercise device by a user, comprising:

a plurality of sensors connected to the device for detecting one or more parameters related to spatial movement of the device by the user during the workout;

a first transceiver attached to the device for transmitting the detected parameters over a wireless link;

a second transceiver for receiving the detected parameter data over the link and forwarding the parameter data to a processor,

the processor evaluating the received parameter data to output performance data indicating quality of the workout to the user.

32. The system of claim 31, further comprising:

a memory for storing the performance data; and

an interface for receiving input to the processor and for enabling display of the performance data to the user.

33. The system of claim 32, wherein the interface is a graphical user interface.

34. The system of claim 33, wherein the graphical user interface is adapted to enable, via an animated display, a proper form of a selected exercise to help instruct the user.

35. The system of claim 33, wherein the graphical user interface is adapted to graphically mimic, on a display, a particular exercise being performed by the user in at least one of real time and playback, to indicate whether the exercise is performed properly, and to score the individual exercise.

36. The system of claim 33, wherein the graphical user interface communicates with the user over one of an internet or intranet.

37. An exercise device, comprising:

a housing, and

a pair of rotatable handle assemblies,

each rotating handle assembly of the pair arranged on either side of the housing, the housing adapted to hold a removable weight therein so that the removable weight is centrally located in the device.

38. The device of claim 37, further comprising:

a tray adapted to hold the removable weight, the tray adapted for insertion into a cavity at an underside of the housing, wherein the removable weight is embodied as one or more vertically stacked weight plates in the tray, and

a weight selector, wherein weight is added or removed within the cavity by placing the exercise device over the tray so that the tray is inserted into the cavity and adjusting the position of the weight selector to engage one or more of the vertically stacked weights in the tray.

39. The device of claim 37, further comprising:

a weight selector include a laterally moving selector knob and a selector tube, wherein weight is added or removed by laterally moving the selector knob and selector tube to engage one or more vertically stacked weights.

40. The device of claim 37, further comprising:

a central cavity within the housing, the central cavity containing a plurality of weights sleeves, each weight sleeve adapted to house a removable weight.

* * * * *