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(54) EXERCISE TRAINING SYSTEM PROVIDING PROGRAMMABLE GUIDING TRACK

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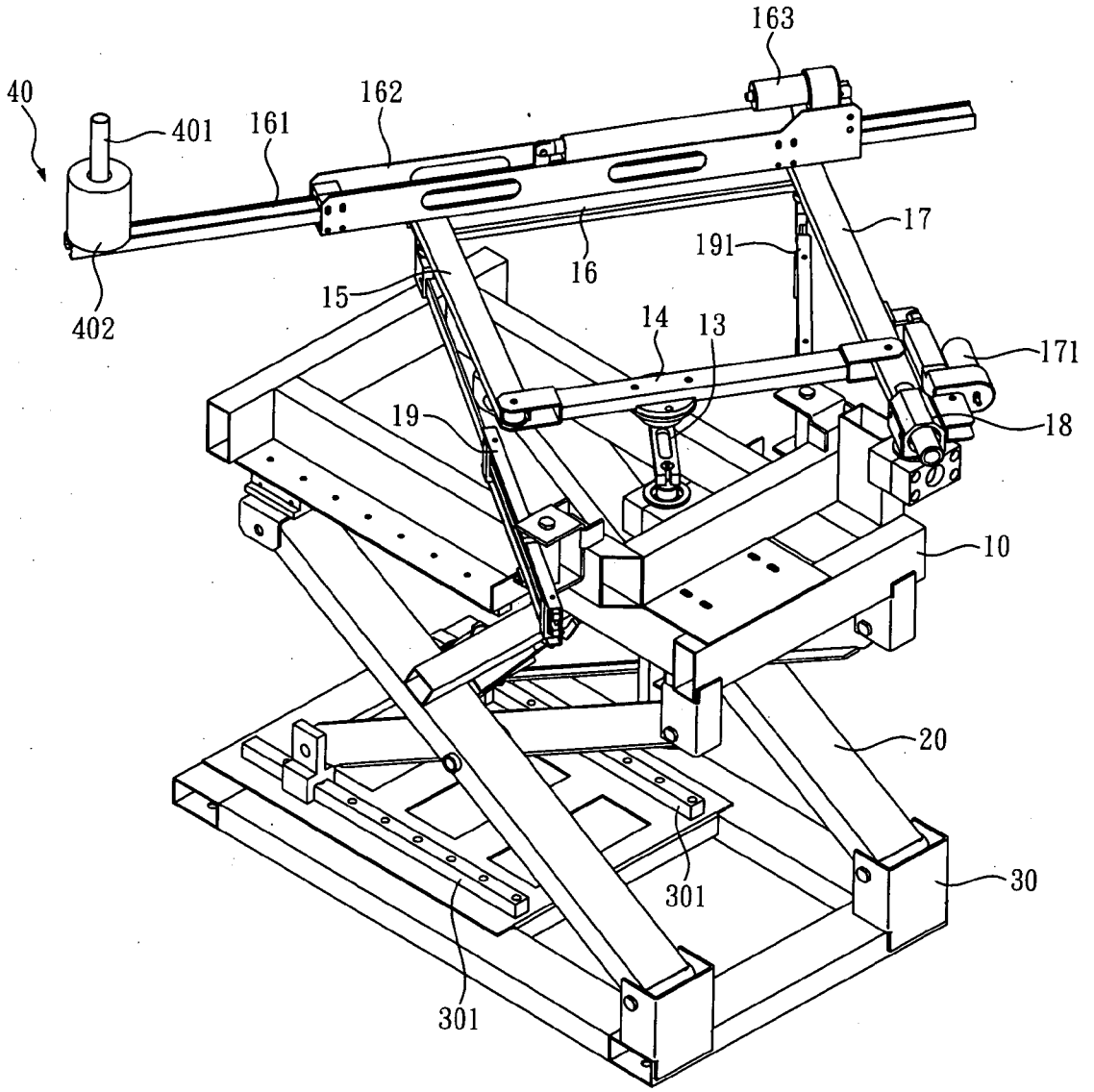
(57) **ABSTRACT**

An exercise training system primarily comprises a guiding-track generating unit and a controlling unit wherein the controlling unit can direct the guiding-track generating unit to produce a variable circulative guiding track for an exerciser to move accordingly and detect the exerciser's motion to provide objective data of performance assessment.



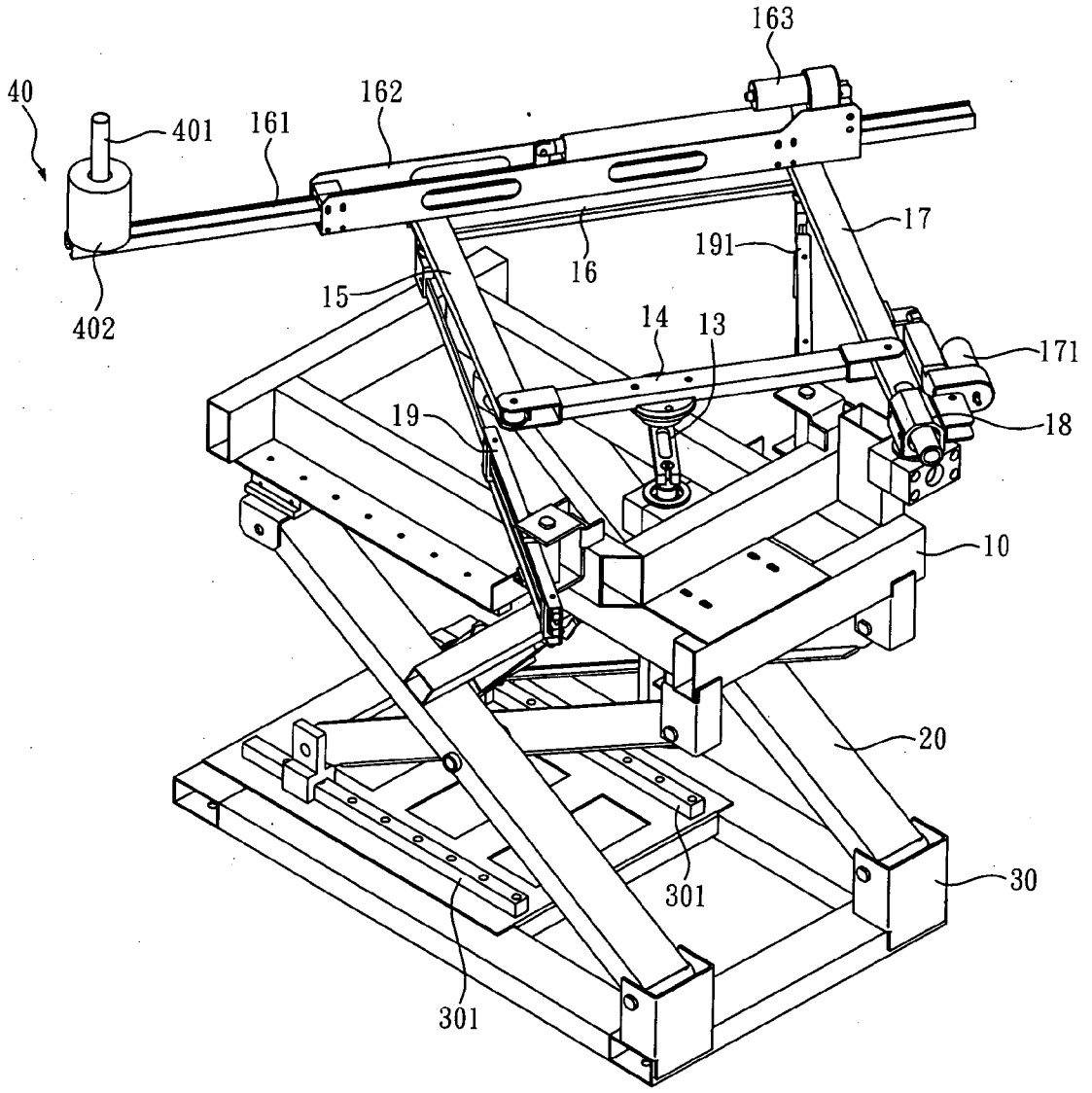



FIG. 1

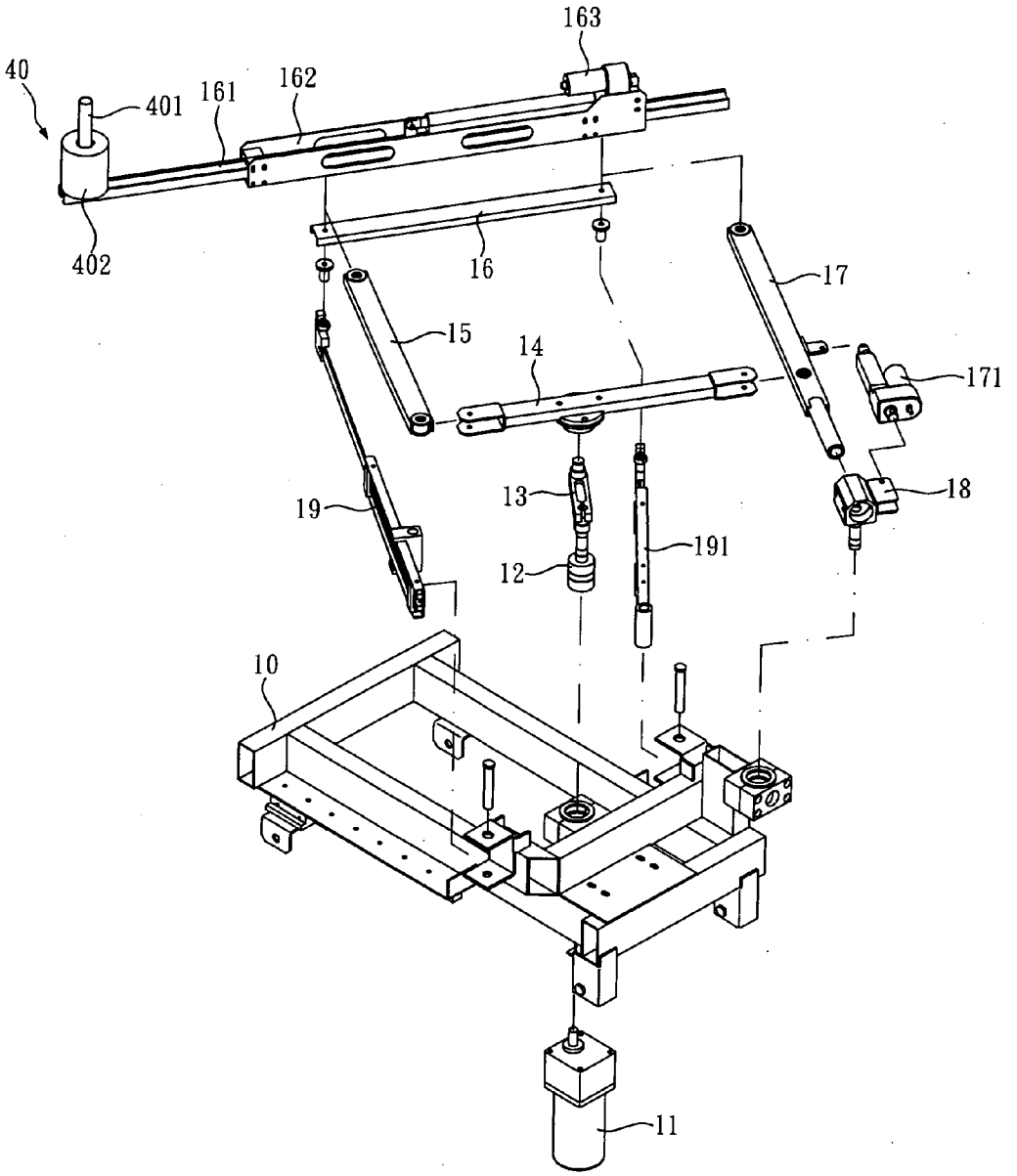



FIG. 2

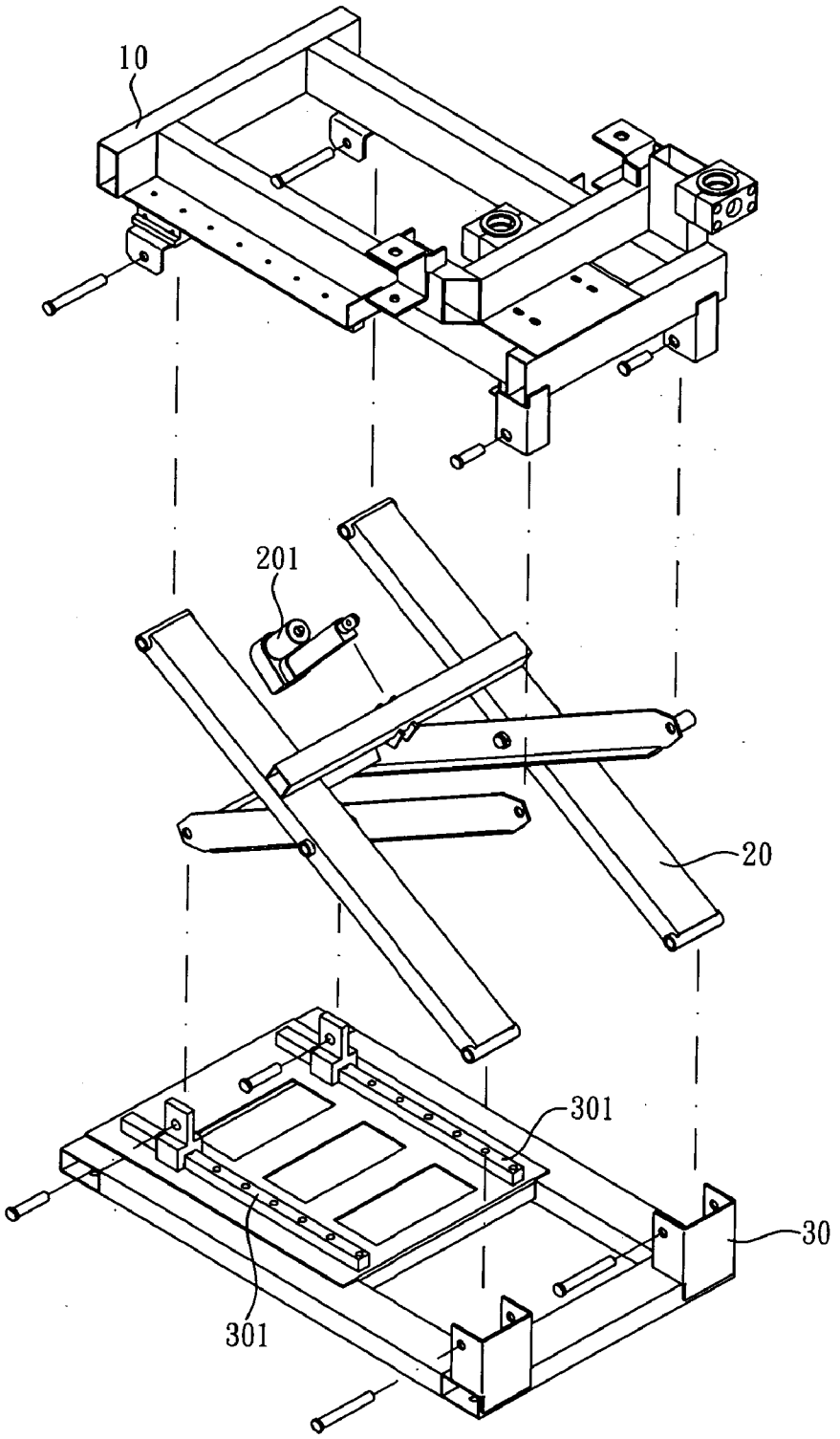



FIG. 3

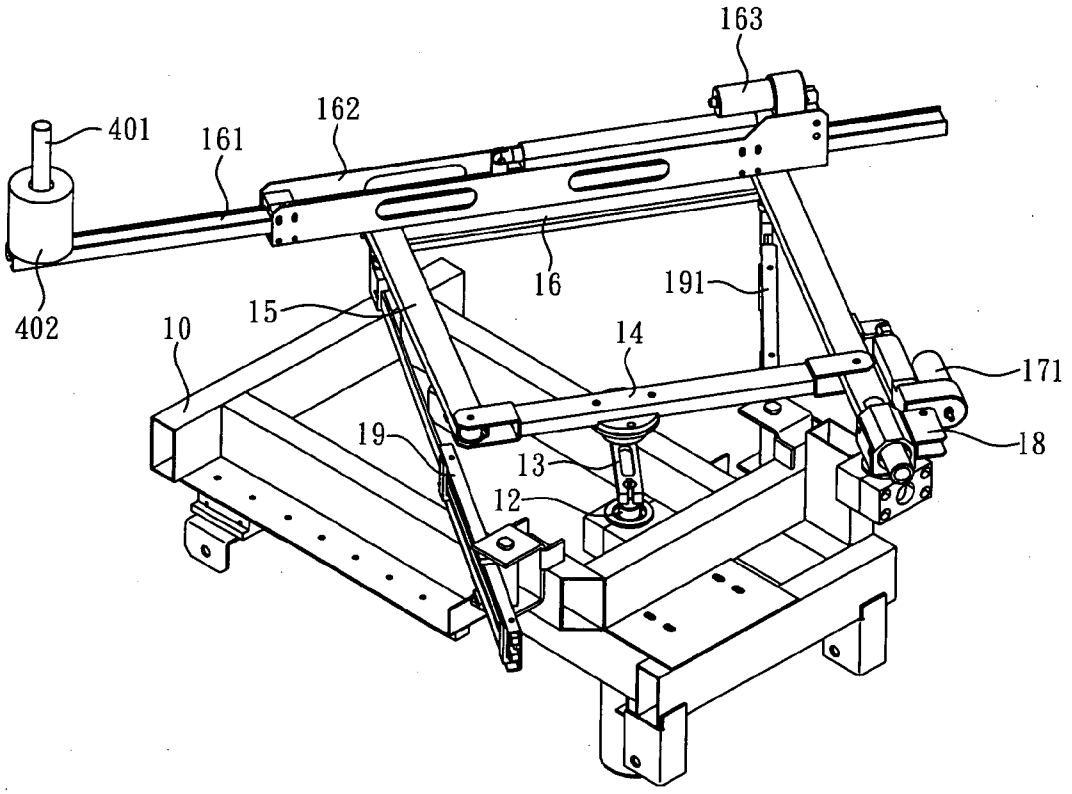



FIG. 4

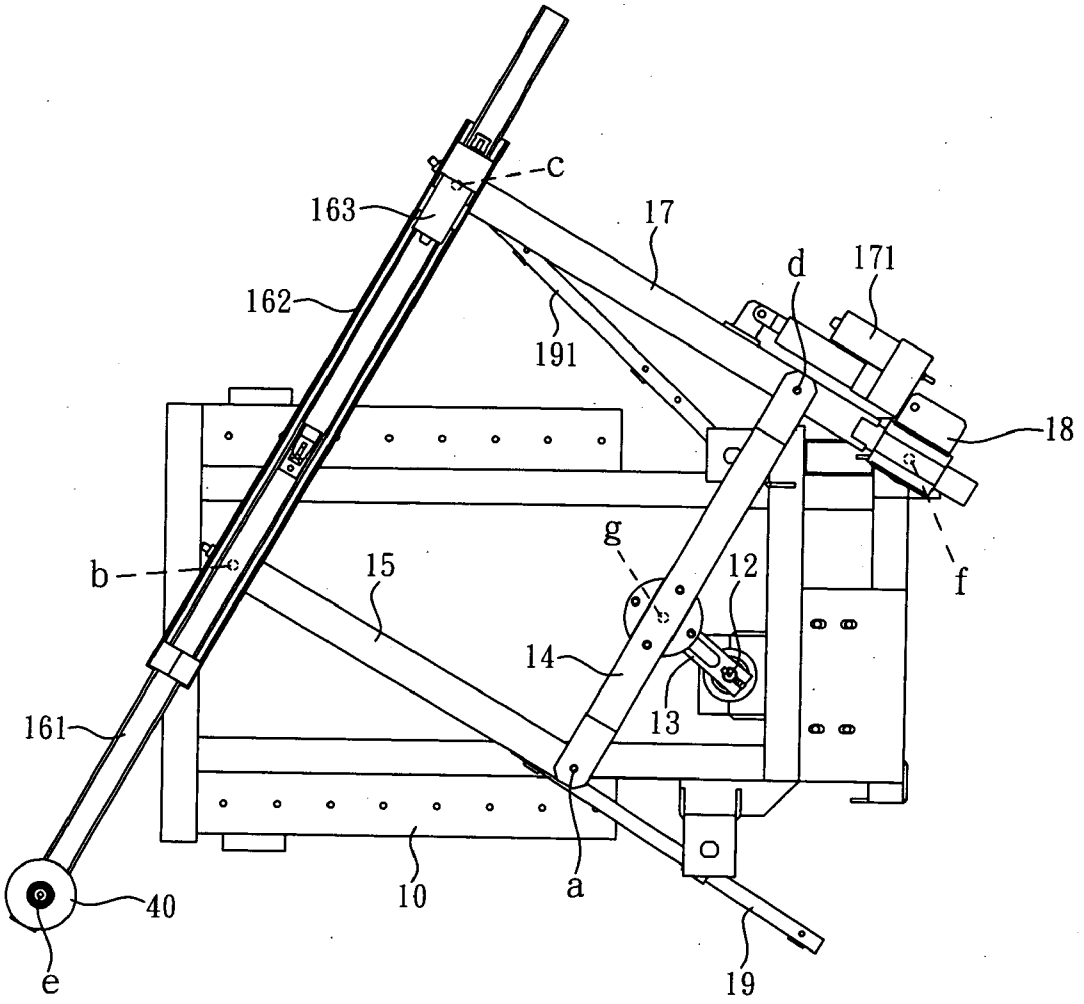



FIG. 5

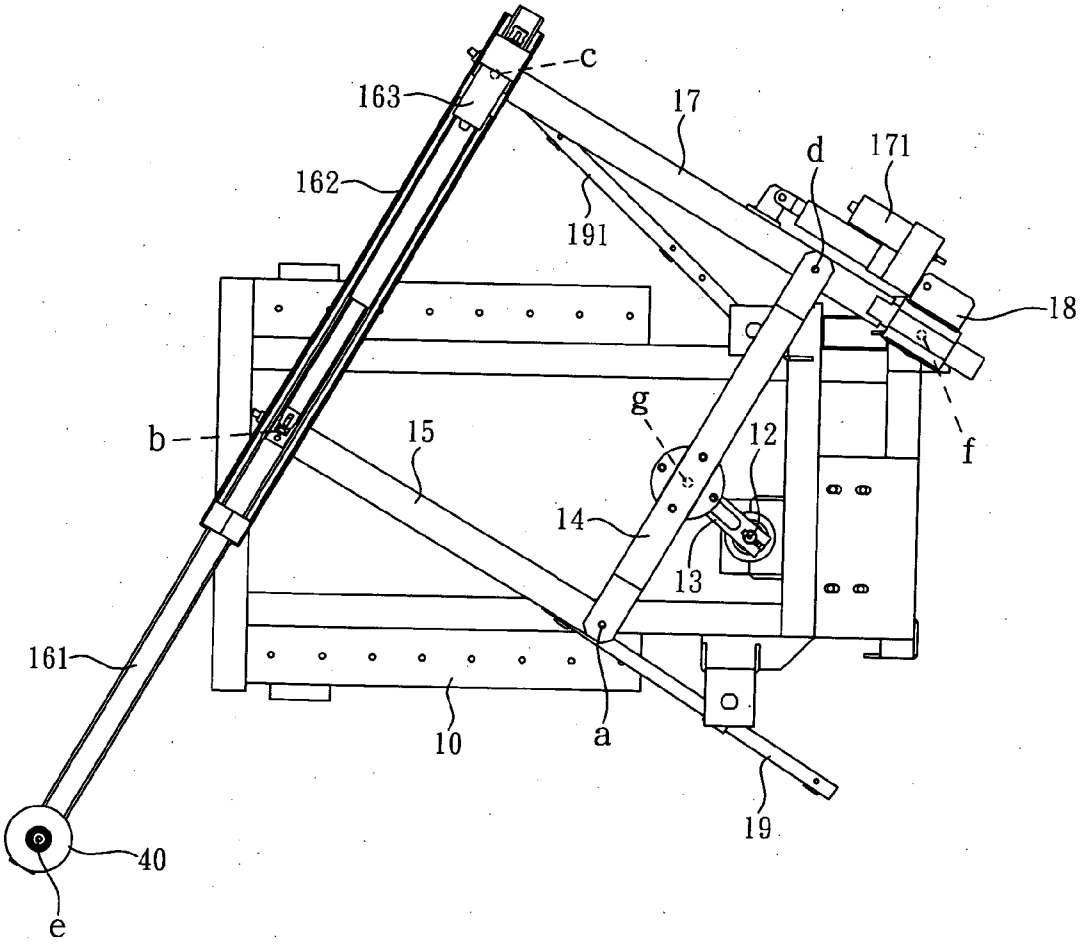



FIG. 6

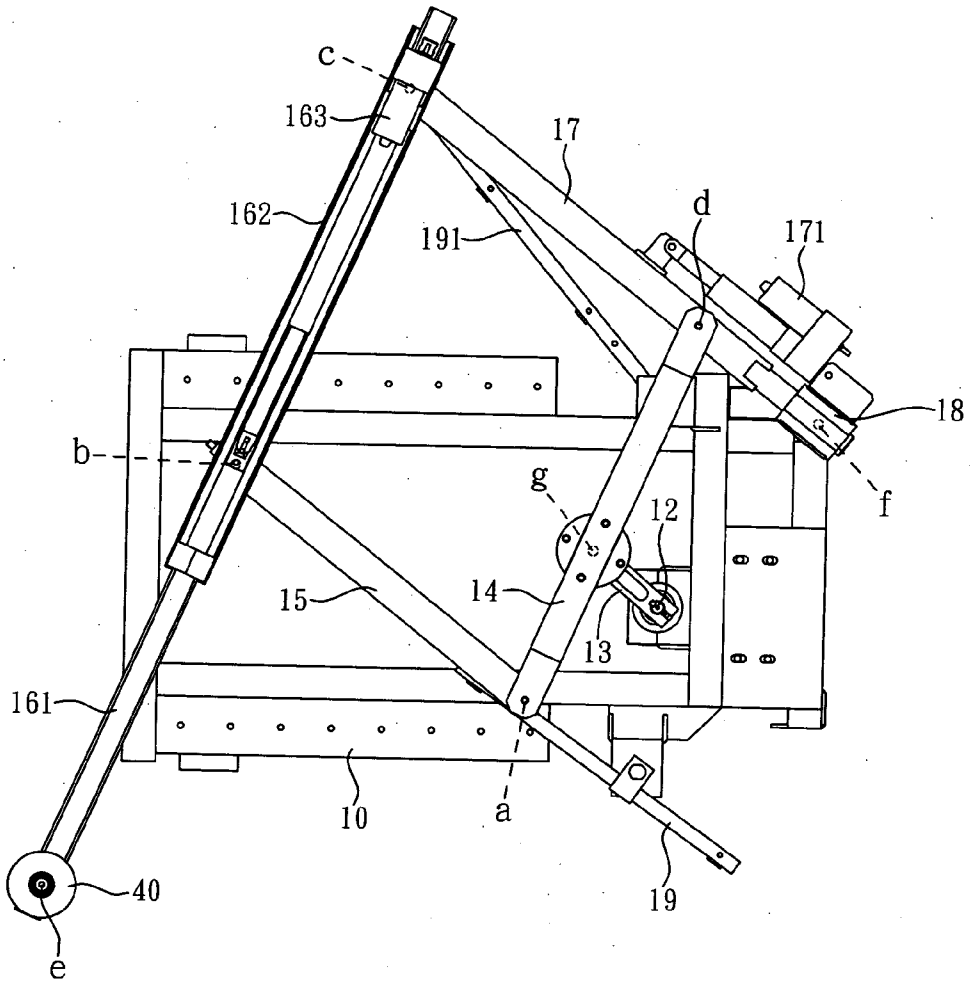



FIG. 7

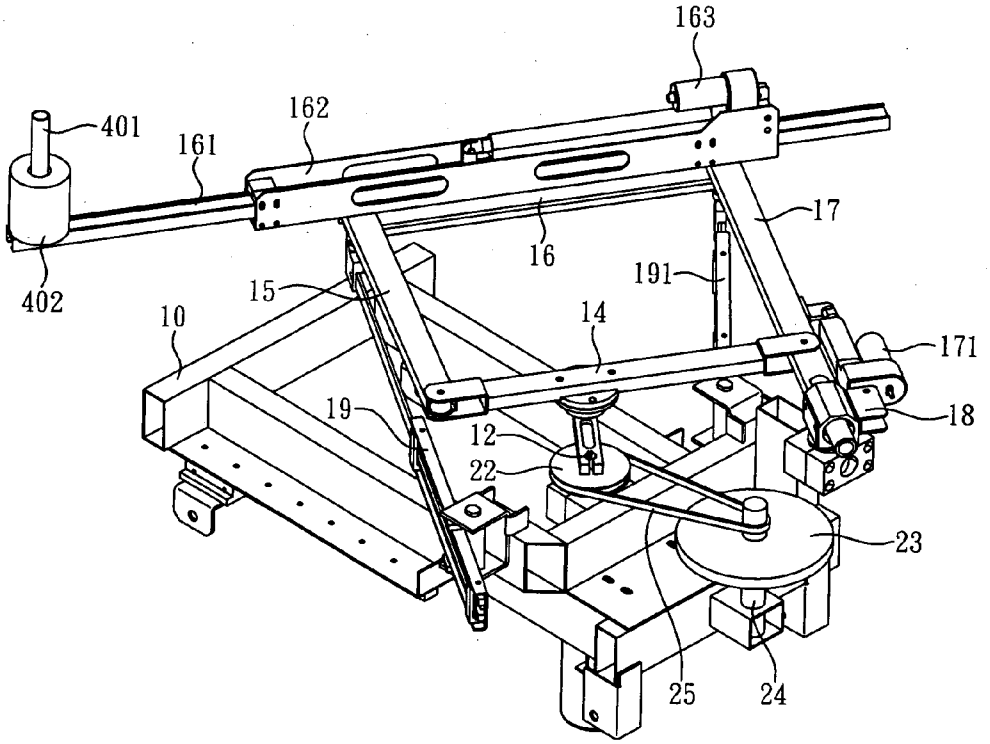



FIG. 8

# EXERCISE TRAINING SYSTEM PROVIDING PROGRAMMABLE GUIDING TRACK

## BACKGROUND OF THE INVENTION

**[0001]** 1. Technical Field

**[0002]** The present invention is related to exercise training systems, and more particularly, to an exercise training system providing programmable circulative guiding track (e.g. circular or elliptical guiding track) for an exerciser to move accordingly and detecting the exerciser's performance.

**[0003]** 2. Description of Related Art

**[0004]** Taijiquan is known for being beneficial to health and has become a popular exercise nowadays. It's also highly evaluated by general exercisers and sports scientist for its sports effect. Practicing Pushing-hands is one form of Taijiquan training. Through practicing Pushing-hands, the sensitivity, sense of balance, limb coordination and reaction rate can be substantively improved.

**[0005]** In a traditional training method, Pushing-hands is typically practiced through sparring. To practice Pushing-hands, two exercisers face each other and contact the opponent's wrist and make the contacted wrists circling repeatedly in a circular or elliptical guiding track synchronously. During practicing, both the exercisers detect the opponent's motion by his hand, wrist as well as lower arm and give proper reaction. It is important for the exercisers to keep the wrists intercontacting lightly yet avoiding mutual resistance. Thus, Pushing-hands facilitates training for generalized sensitivity, limb coordination and reaction rate. However, one fundamental problem of such traditional training method of Pushing-hands is that the practice requires two participants. Additionally, an exerciser may not get objective data of performance assessment from his opponent as a reference material. Thus the popularization of Pushing-hands is limited.

**[0006]** Some sport facilities have therefore been developed to overcome foresaid limitation in Pushing-hands and benefit the popularization of Taijiquan. However, such prior art facilities are usually noninteractive, unadjustable and non-programmable, hence such facilities are inadequate to provide satisfactory training effect.

**[0007]** On the other hand, though Taiwan Patent M064330 provides an interactive Taijiquan simulator whereby an exerciser can practice dodging and parrying, such prior art interactive Taijiquan simulator has no detecting element or means to monitor the exerciser's performance and the guiding track and operating mode thereof are not adjustable. Thus, a need exists for an exercise training system for Pushing-hands practice that provides interactive operating mode and programmable circulative guiding track.

## SUMMARY OF THE INVENTION

**[0008]** The present invention has been accomplished under these circumstances in view and discloses an exercise training system for simulating an opponent in Pushing-hands practice to provide different guiding tracks and practicing mode and respond to the exerciser with objective data of performance assessment.

**[0009]** It is one object of the present invention to provide an exercise training system for training an exerciser's sensitivity, sense of balance, limb coordination and reaction rate with Pushing-hands practice.

**[0010]** It is another object of the present invention to provide an exercise training system that allows an exerciser to practice Pushing-hands without the need of a practicing partner.

**[0011]** It is still another object of the present invention to provide an exercise training system that utilizes adjustable linkage system to perform variable guiding track for meeting an exerciser's need and leading effective training of Pushing-hands exercise.

**[0012]** It is yet another object of the present invention to provide an exercise training system that is equipped with sensing elements to detect an exerciser's performance of Pushing-hands for warning the exerciser of the inappropriate exertion or exporting the detecting results as training reference material.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0013]** FIG. **1** is a perspective view of the exercise training system according to the present invention;

**[0014]** FIG. **2** is an exploded view of the upper part of the exercise training system according to the present invention;

**[0015]** FIG. **3** is an exploded view of the lower part of the exercise training system according to the present invention;

**[0016]** FIG. **4** is an assembly drawing of the upper part of the exercise training system according to the present invention;

**[0017]** FIG. **5** is a top view of the upper part of the exercise training system according to the present invention;

**[0018]** FIG. **6** is a schematic view showing the extension arm stretching out of the third link according to the present invention;

**[0019]** FIG. **7** is a schematic view showing the fourth link sliding against the pivot set according to the present invention; and

**[0020]** FIG. **8** is a perspective view illustrating one embodiment of the present invention wherein a flywheel system is attached to the motor.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

**[0021]** FIGS. **1** to **7** are provided for describing one embodiment of the present invention wherein an exercise training system primarily comprises a guiding-track generating unit and a controlling unit which is explained in more detail below.

**[0022]** In FIGS. **1** and **2**, according to the present embodiment, the guiding-track generating unit includes a base frame **10** whereon a power device **11** that may be an electric motor or an electric geared motor is installed; a transmission shaft **12** is connected to the power device **11**; a crank **13** is connected to the transmission shaft **12** and a linkage system is fixed on the crank **13**.

**[0023]** As can be seen in FIGS. **4** and **5**, the linkage system is composed of a first link **14**, a second link **15**, a third link **16** a fourth link **17** and a pivot set **18** wherein each said link is pivotly connected to the adjacent links to form a quadrilateral shape wherein the first link **14** is fastened to the crank **13** with the middle part at a crank joint (g) and is combined with the second link **15** with one end at a first link joint (a); the second link **15** with one end remote from the first link joint (a) connected to the third link **16** at a second link joint (b); the third link **16** with one end remote from the second link joint (b) connected to the fourth link **17** at a third link joint (c); and

the fourth link **17** with one end remote from the third link joint (c) connected to the first link **14** at a fourth link joint (d). Further, the fourth link **17** is pivotly fastened to the base frame **10** with the pivot set **18** assembled to the fourth link **17** at a pivot joint (f) located beyond the fourth link joint (d). Thereupon, when the linkage system is operated, a circulative guiding track can be depicted by the extreme of the third link **16** adjacent to the second link joint (b) which is referred to a track point (e) hereinafter.

**[0024]** Additionally, according to the present embodiment, the third link **16** further comprises a frame **162** and an extension arm **161** wherein the frame **162** is pivotly connected to the second link **15** and fourth link **17** respectively at the second link joint (b) and third link joint (c) and the extension arm **161** is slidably installed in the frame **162** and operatively connected to an actuator **163** so that the extension arm **161** can extend or retract with respect to the frame **162** and in turn render the distance between the third link joint (c) and the track point (e) altered, as shown in FIG. **6**.

**[0025]** Also, according to the present embodiment, the fourth link **17** is assembled with the pivot set **18** in a slidable way and operatively connected to an actuator **171** which is fixed on the pivot set **18** so that the fourth link **17** can slide against the pivot set **18** to render the distance between the fourth link joint (d) and the pivot joint (f) altered. As shown in FIG. **7**, when the fourth link **17** slides against the pivot set **18** under the impetus of the actuator **171**, the distance between pairs of links are varied.

**[0026]** According to foregoing structure, when the power device **11** drives the transmission shaft **12** to rotate the crank **13**, the linkage system is hauled to move, and meantime the length alterations of the third link **16** and fourth link **17** result in variation of the circulative moving path of the track point (e).

**[0027]** Referring to FIG. **5**, as previously discussed, when the distance between the second link joint (b) and third link joint (c) is equal to the distance between the first link joint (a) and the fourth link joint (d) (i.e. bc=ad), and the distance between the first link joint (a) and the second link joint (b) is equal to the distance between the third link joint (c) and the fourth link joint (d) (i.e. ab=cd), the track point (e) moves along a approximately elliptical guiding track. Alternatively, when the value derived from dividing the distance between the third link joint (c) and the track point (e) by the distance between the crank joint (g) and the fourth link joint (d) is equal to the value derived from dividing the distance between the third link joint (c) and the pivot joint (f) by the distance between the fourth link joint (d) and the pivot joint (f) (i.e. ce/dg=cf/df), the track point (e) moves along a round guiding track.

**[0028]** According to another concept of the present invention, an extendable track **19** or linking rod **191** can be arranged respectively between the links **14**, **15**, **16**, **17** in the way that each track **19** or linking rod **191** can swing horizontally with respect to the base frame **10** so as to bear the weight and ensure a stable movement of the linkage system.

**[0029]** Furthermore, the disclosed exercise training system may comprise a guide device **40** settled at foresaid track point (e) so that an exerciser can lean his hand thereon and move his hand following the guiding track formed by the moving path of the track point (e). According to one concept on the present invention, the guide device **40** can be a sway stick system that includes a sway stick **401** and a sway stick stand **402** wherein the sway stick **401** can freely sway with respect to the sway stick stand **402** under an external pushing force and right itself when the pushing force is relieved. Said sway stick **401** further comprises a touch sensing element or circuit that is communicated with the controlling unit for detecting contact and exertion of an exerciser's hand.

**[0030]** Besides, between the power device **11** and transmission shaft **12**, a torque limiter (not shown) may be equipped as a safety device or a transmission mechanism (not shown) such as a coupler or a belt pulley may be provided for steadying the rotary speed of the transmission shaft **12**. As shown in FIG. **8**, the flywheel system comprises a flywheel shaft **24** deposited on the base frame **10**, a flywheel **23** mounted on the flywheel shaft **24**, a belt pulley **22** provided on the transmission shaft **12** and a drive belt **25** connecting the belt pulley **22** and flywheel **23**.

**[0031]** The disclosed exercise training system may further include a brace **20** and a foundation **30** as shown in FIGS. **1** and **3** wherein the brace **20** can be a vertical translation mechanism composed of an actuator **201** arranged on the brace **20** and a pair of guide rails **301** provided on the foundation **30**. As depicted in the figures, the brace **20** is basically an X-shaped structure with the upper end pivotly fastened to the bottom of the base frame **10** while with the lower end slidably coupled with the guide rails **301** so that when the actuator **201** drives the lower end of the brace **20** sliding along the guide rails **301**, the vertical distance between the base frame **10** and the foundation **30** can be adjusted.

**[0032]** In addition, the controlling unit of the exercise training system according to the present invention comprises a controlling circuit operatively connected to the power device **11**, actuator **163** of the third link **16**, actuator **171** of the third link **17**, and the actuator **201** of the brace **20**, a detecting system communicated with the guide device **40**, a database, a computing unit and a input device, a display device and an alarm device which are communicated with the controlling circuit, database and computing unit and performs following functions:

**[0033]** 1. controlling the guiding track: controlling the scope, shape and altitude of the moving path of the track point (e) with a constant-track mode or a variable-track mode wherein the constant-track mode leads a training course with the guiding track retaining constant scope, shape and altitude throughout while the variable-track mode leads a training course with the guiding track varied in a preprogrammed range at preprogrammed time points.

**[0034]** 2. controlling the operating speed: controlling the moving speed of the linkage system with a constant-speed mode or a variable-speed mode wherein the constant-speed mode leads a training course with the track point (e) moving stably at a preset speed while the variable-speed mode leads a training course with the moving speed of the track point (e) varied within a preprogrammed range at preprogrammed time points.

**[0035]** 3. detecting motion: utilizing the touch sensing element or circuit of the guide device **40** to detect the relationship between an exerciser's hand and the guide device **40** and generate a feedback signal as an evaluating material of the consistence of the moving speed and moving path between the exerciser's hand and the guide device **40**.

**[0036]** 4. implementing database for programming a training parameter: comprising one or more databases the may record human physiological information and corresponding machine operating speed, track and fault tolerance so that an

exerciser can input individual physiological information and easily get the exercise training system programmed with a training parameter.

**[0037]** 5. computing and gauging an exerciser's performance: taking the information recorded in the database as a parameter to gauge an exerciser's performance detected by the detecting system; figuring out the failure that is defined as a motion rushing or delayed beyond the tolerance; performing a warning sign through the display device or the alarm device; and recording the failure occurrence frequency and time points.

**[0038]** Although a particular embodiment of the invention has been described in detail for purposes of illustration, it will be understood by one of ordinary skill in the art that numerous variations will be possible to the disclosed embodiments without going outside the scope of the invention as disclosed in the claims.

What is claimed is:

**1**. An exercise training system comprising a guiding-track generating unit and a controlling unit wherein the controlling unit can direct the guiding-track generating unit to produce a variable circulative guiding track and detect the consistence of an exerciser's motion and the movement of the guiding-track generating unit.

**2**. The exercise training system as claimed in claim **1**, wherein the guiding-track generating unit comprises a base frame, a power device, a transmission shaft, a crank and a linkage system wherein the power device drives the transmission shaft to rotate the crank under the control of the controlling unit and renders the linkage system to move so that a circulative guiding track is formed along the moving path of an extreme of the linkage system.

**3**. The exercise training system as claimed in claim **2**, wherein the linkage system comprises a first link, a second link, a third link and a fourth link wherein the first link is fastened to the crank and the circulative guiding track is formed along the moving path of an extreme of the third link.

**4**. The exercise training system as claimed in claim **2**, wherein the linkage system is pivotly fastened to the base frame with a pivot set assembled to one end of the fourth link.

**5**. The exercise training system as claimed in claim **2** further comprising a flywheel system for steadying the rotary speed of the transmission shaft wherein the flywheel system comprises a flywheel shaft deposited on the base frame, a flywheel mounted on the flywheel shaft, a belt pulley provided on the transmission shaft and a drive belt connecting the belt pulley and flywheel.

**6**. The exercise training system as claimed in claim **2**, wherein the third link further comprises a frame, an extension arm and an actuator that is fasten to the frame so that the actuator can drive the extension arm to extend or retract with respect to the frame the frame under the control of the controlling unit and therefore vary the length of the third link.

**7**. The exercise training system as claimed in claim **2**, wherein the fourth link is assembled with the pivot set in a slidable way and operatively connected to an actuator which is fixed on the pivot set so that the actuator can drive the fourth link to slide against the pivot set.

**8**. The exercise training system as claimed in claim **2**, wherein a brace and a foundation are provided under the base frame.

**9**. The exercise training system as claimed in claim **8**, wherein the brace is a vertical translation mechanism that can be controlled by the controlling unit to adjust the vertical distance between the base frame and the foundation.

**10**. The exercise training system as claimed in claim **2**, wherein the third link further comprises a guide device for an exerciser to lean his hand thereon and move his hand correspondingly.

**11**. The exercise training system as claimed in claim **10**, wherein the guide device comprises a touch sensing element or circuit which is communicated with the controlling unit.

**12**. The exercise training system as claimed in claim **11**, wherein the guide device is a sway stick system that includes a sway stick and a sway stick stand wherein the sway stick can freely sway with respect to the sway stick stand under an external pushing force and transform the sway angle into a signal for being delivered to the controlling unit and right itself when the pushing force is relieved.

**13**. The exercise training system as claimed in claim **3**, wherein an extendable track or linking rod is arranged respectively between the links in the way that each track or linking rod can swing horizontally with respect to the base frame so as to bear the weight and ensure a stable movement of the linkage system.

**14**. The exercise training system as claimed in claim **1**, wherein the controlling unit comprises:

a guiding track controlling function for controlling the guiding-track generating unit to perform a preprogrammed constant or variable guiding track for leading an exerciser to move accordingly;

an operating speed controlling function for controlling the guiding-track generating unit to move under a constant-speed mode or a programmable variable-speed mode; and

a motion detecting function for detect the relationship between an exerciser's hand and the guide device to gauging the consistence of the moving speed and moving path between the exerciser's hand and the guide device.

**15**. The exercise training system as claimed in claim **14**, wherein the controlling unit is communicated with a human physiological database.

**16**. The exercise training system as claimed in claim **15**, wherein the controlling unit can program a training course according to the human physiological database.

**17**. The exercise training system as claimed in claim **16**, wherein the controlling unit comprises a computing function to gauge an exerciser's performance detected by the detecting system with respect to the human physiological database.

**18**. The exercise training system as claimed in claim **1**, wherein the controlling unit comprises an input device.

**19**. The exercise training system as claimed in claim **1**, wherein the controlling unit comprises a display device.

**20**. The exercise training system as claimed in claim **1**, wherein the controlling unit comprises an alarm device.

* * * * *