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(54) **POSITION-LIMITING APPARATUS OF A PENDULUM MECHANISM OF AN EXERCISE EQUIPMENT**

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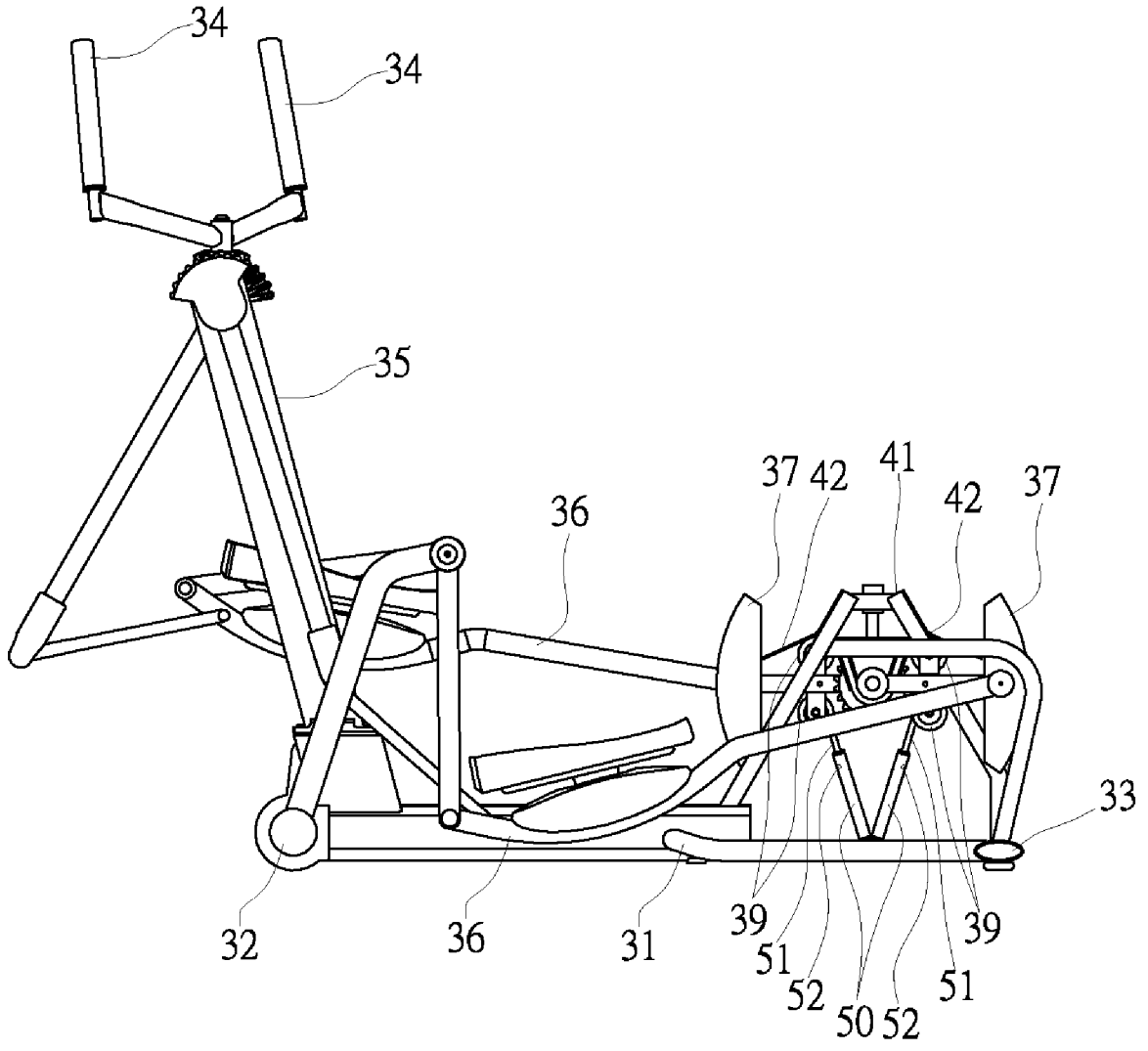
(57) **ABSTRACT**

A position-limiting apparatus of a pendulum mechanism of an exercise equipment, wherein the pendulum of the pendulum mechanism creates an expected coupled swing action responsive to the reciprocating movement done by a certain exercise equipment when subject to the action of a force, thereby providing a proper inertia movement and a gravity load action. A position-limiting apparatus is disposed at a certain position tangential to the swinging path of a pendulum of the pendulum mechanism for an effective restriction of the maximal swing of the pendulum. Moreover, a pneumatic cylinder is provided for creating a proper exercise resistance.



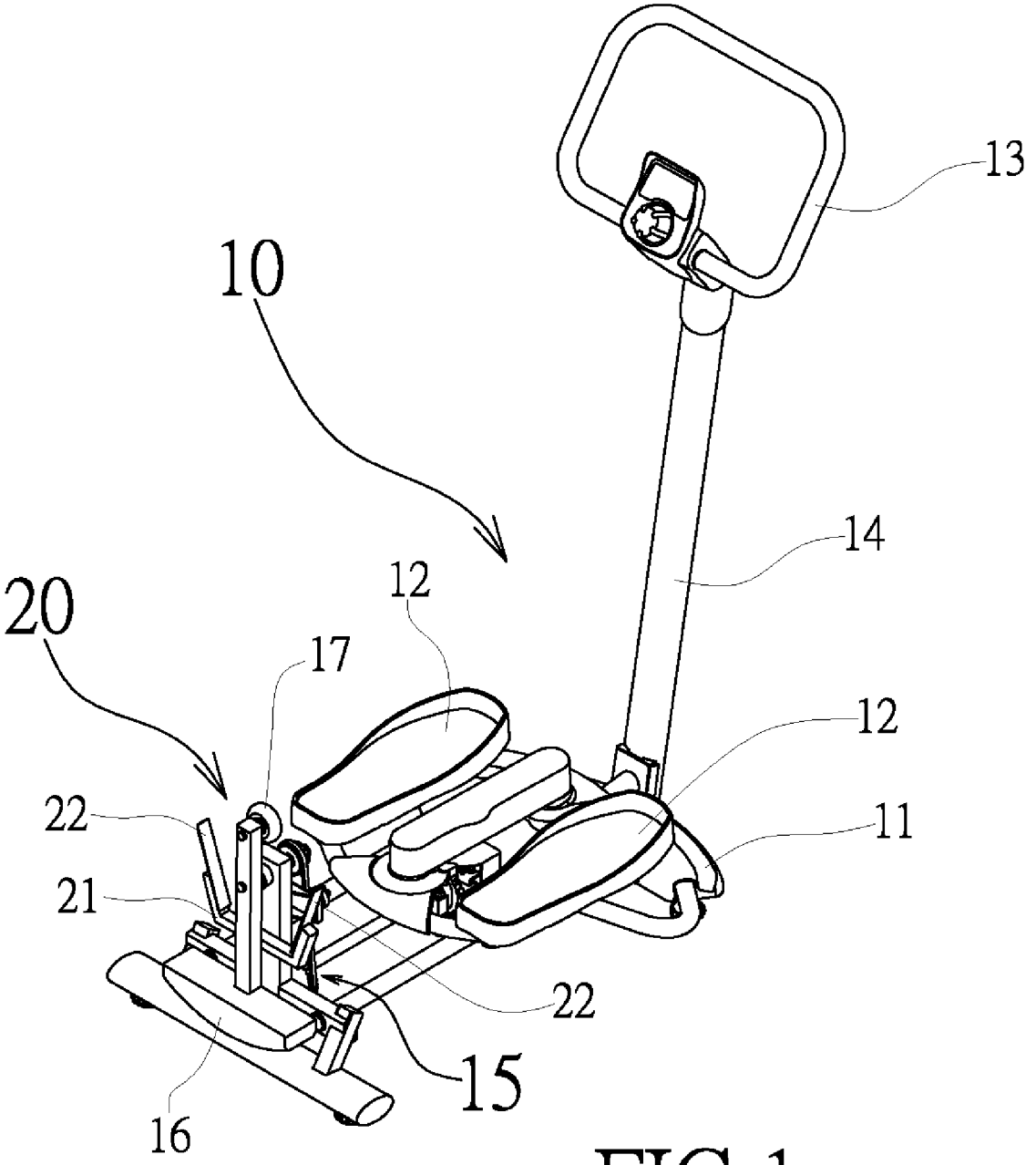


FIG.1

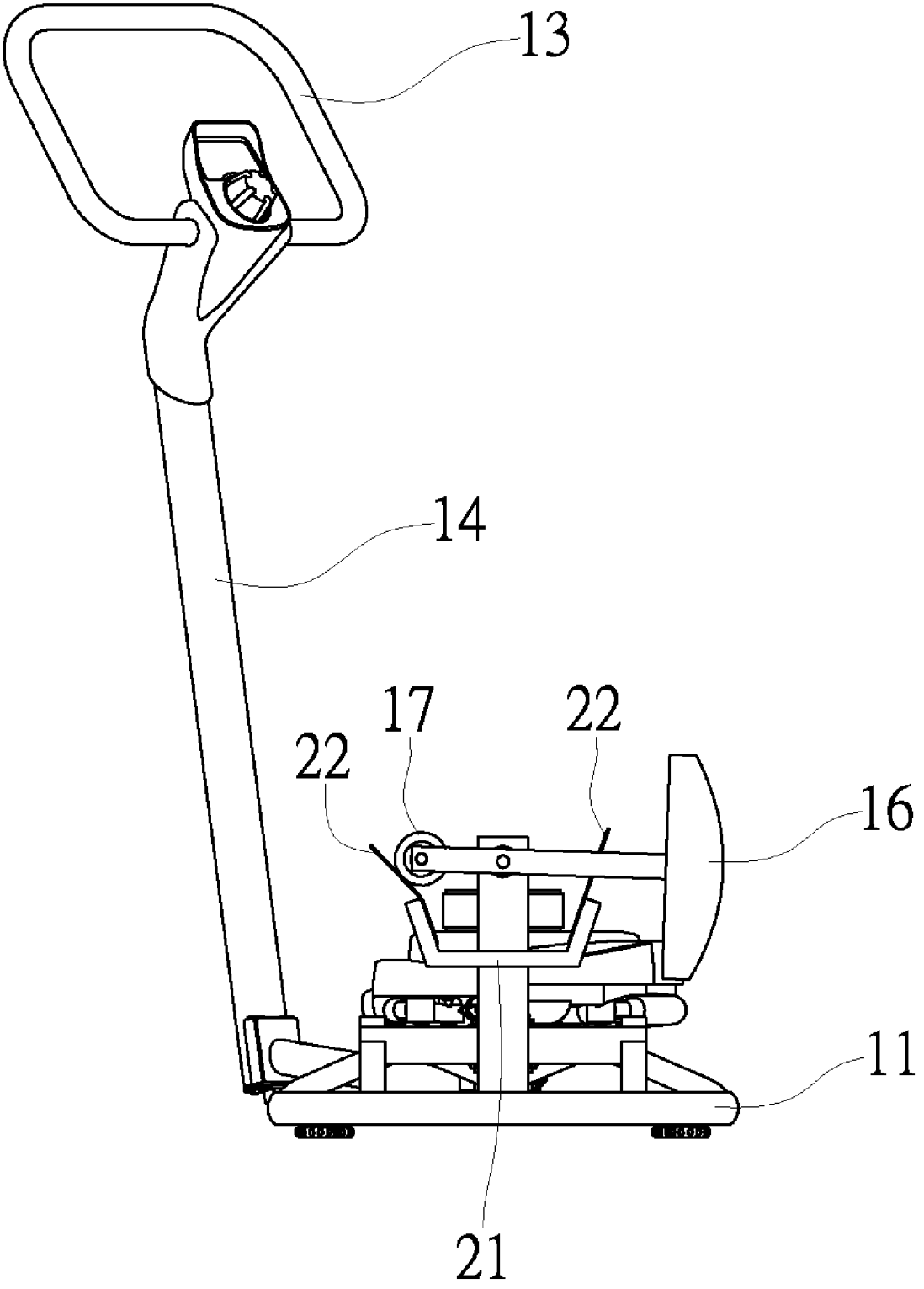


FIG.2

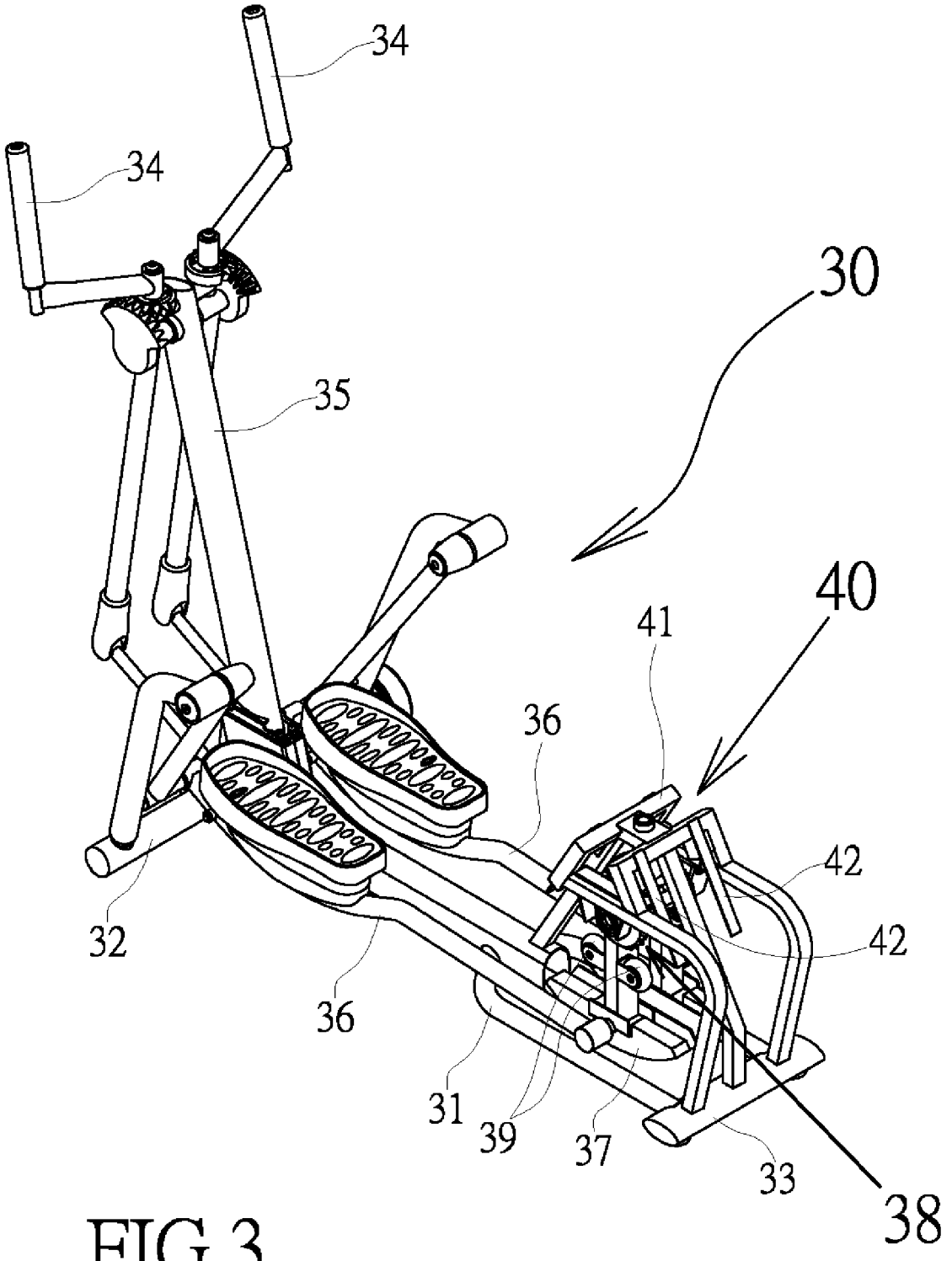


FIG.3

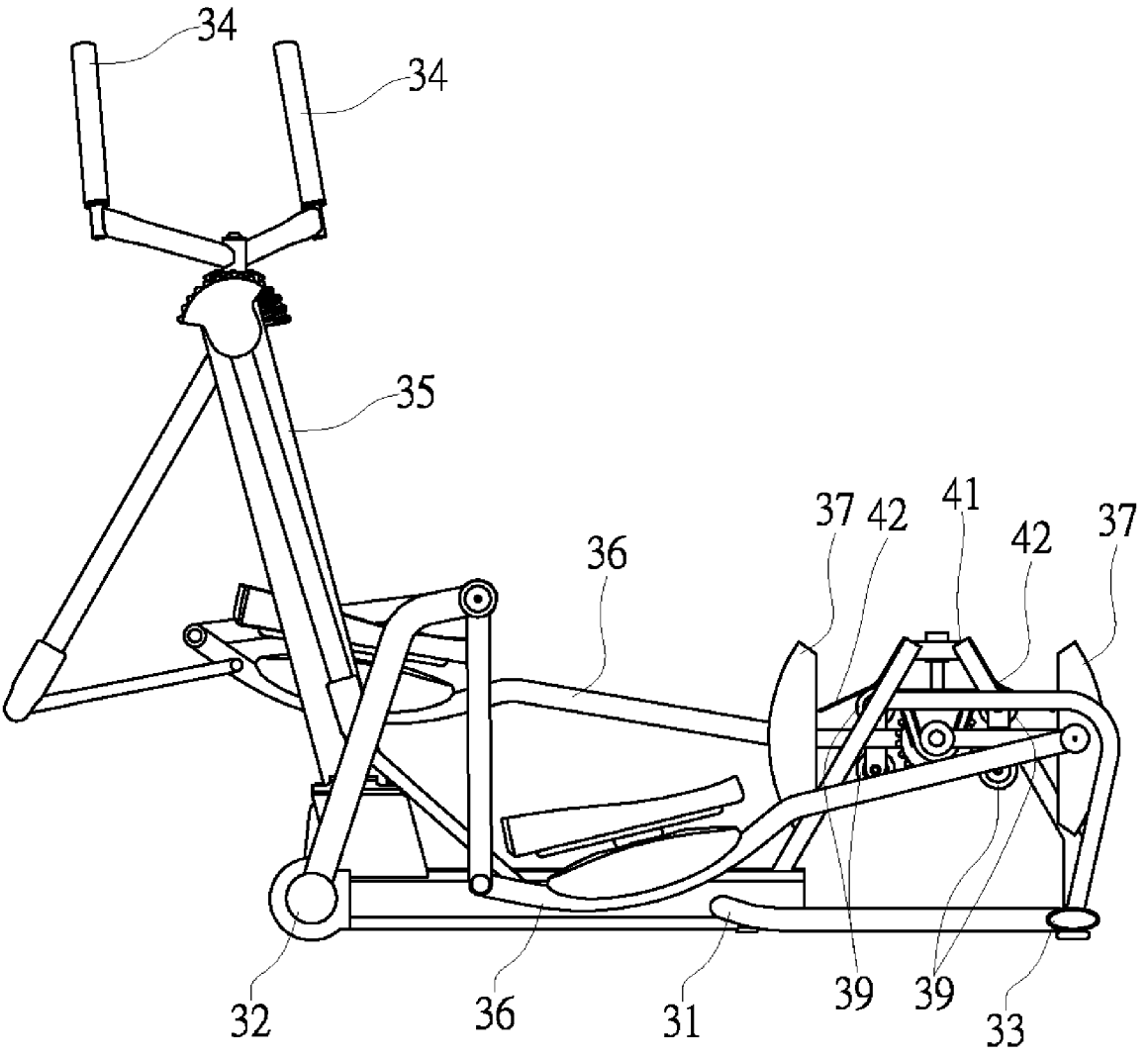


FIG.4

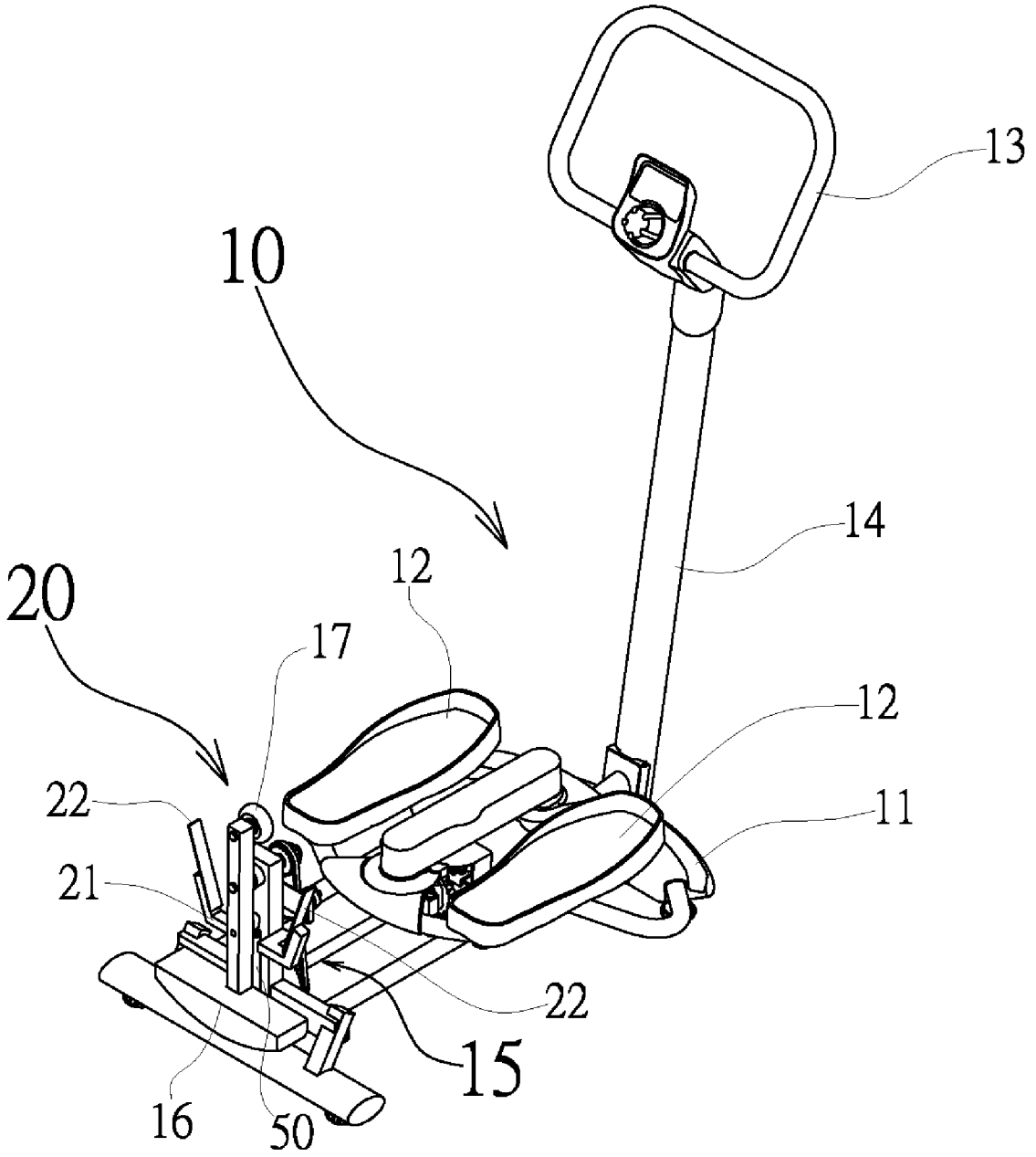


FIG.5

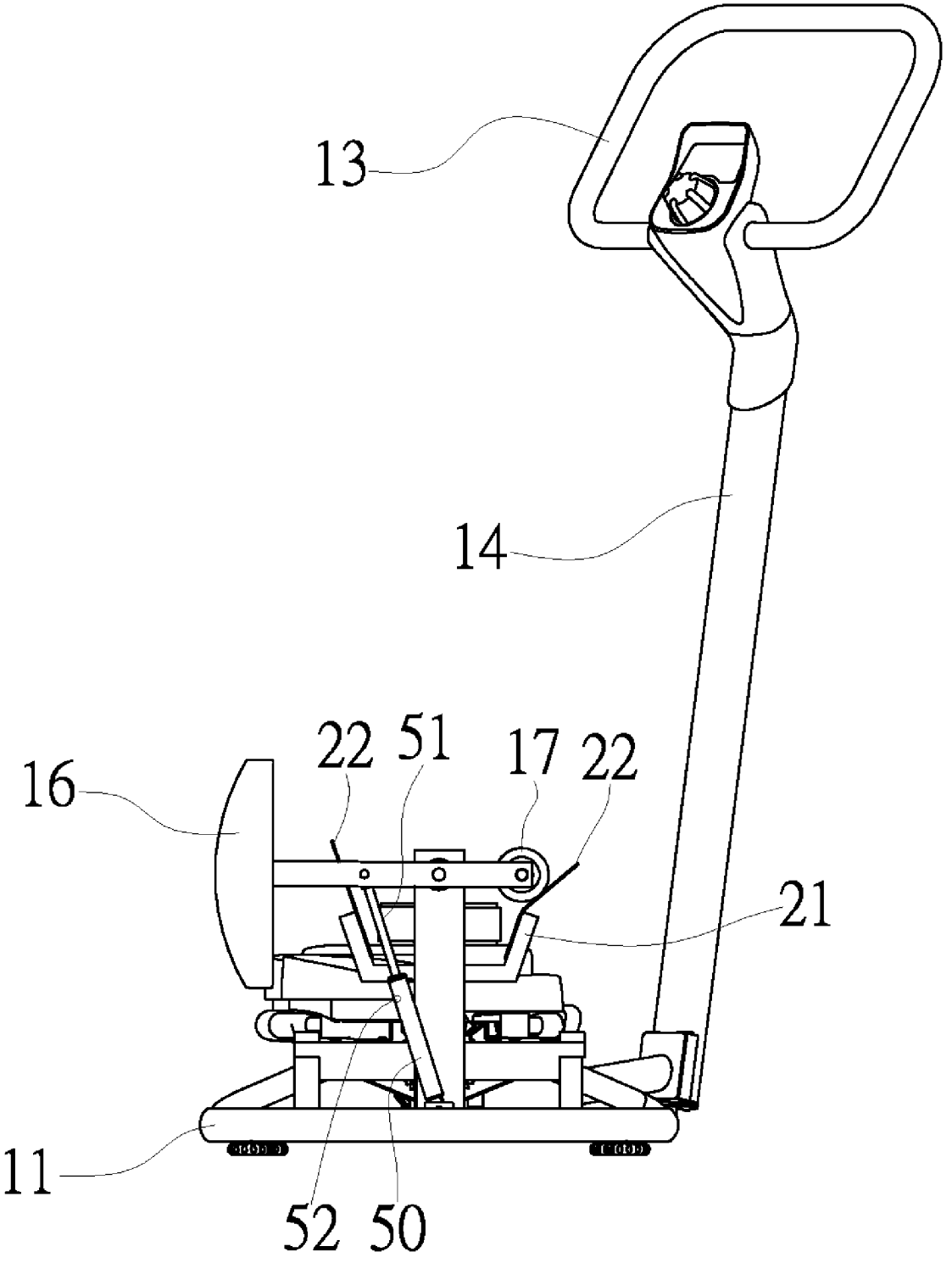


FIG.6

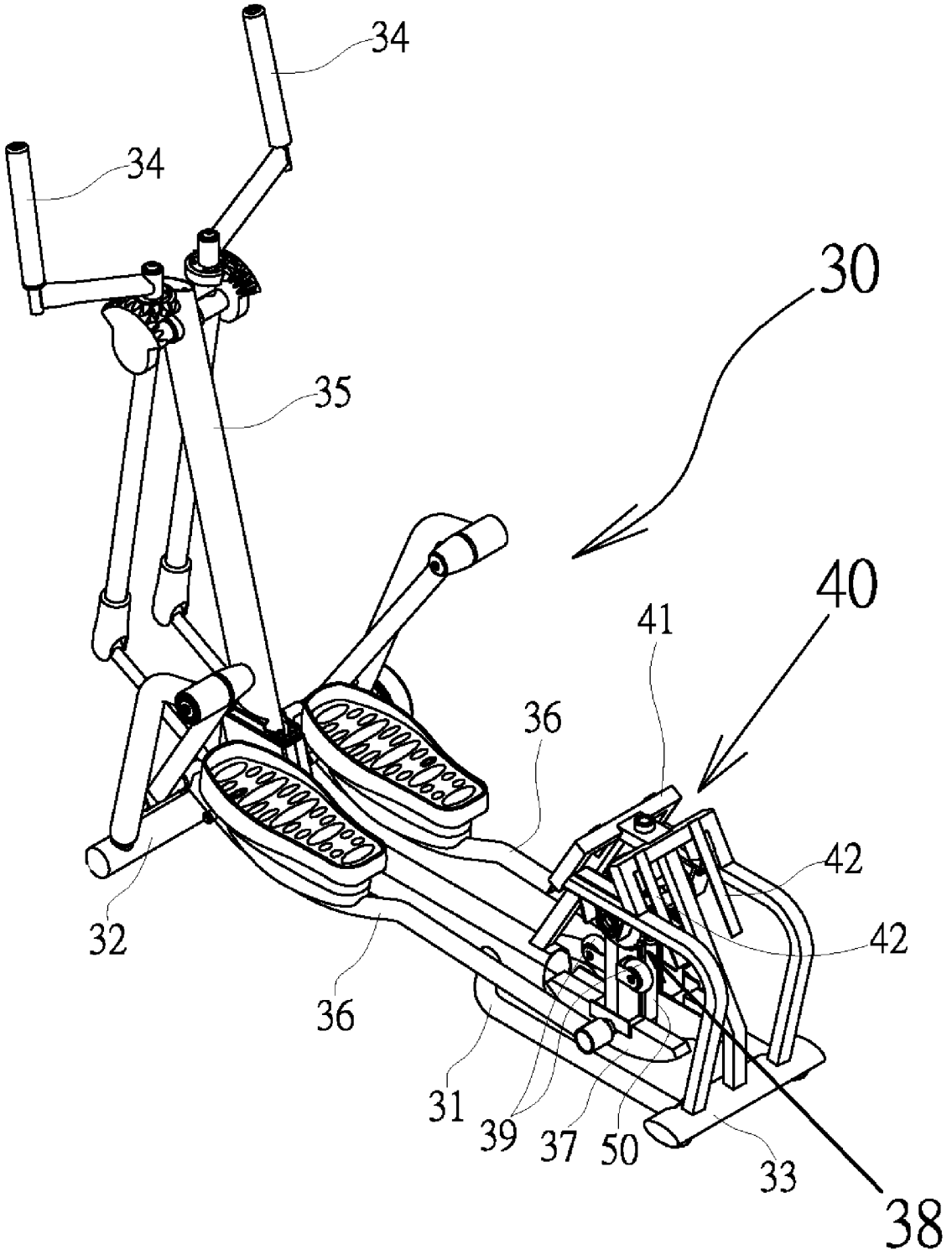


FIG.7

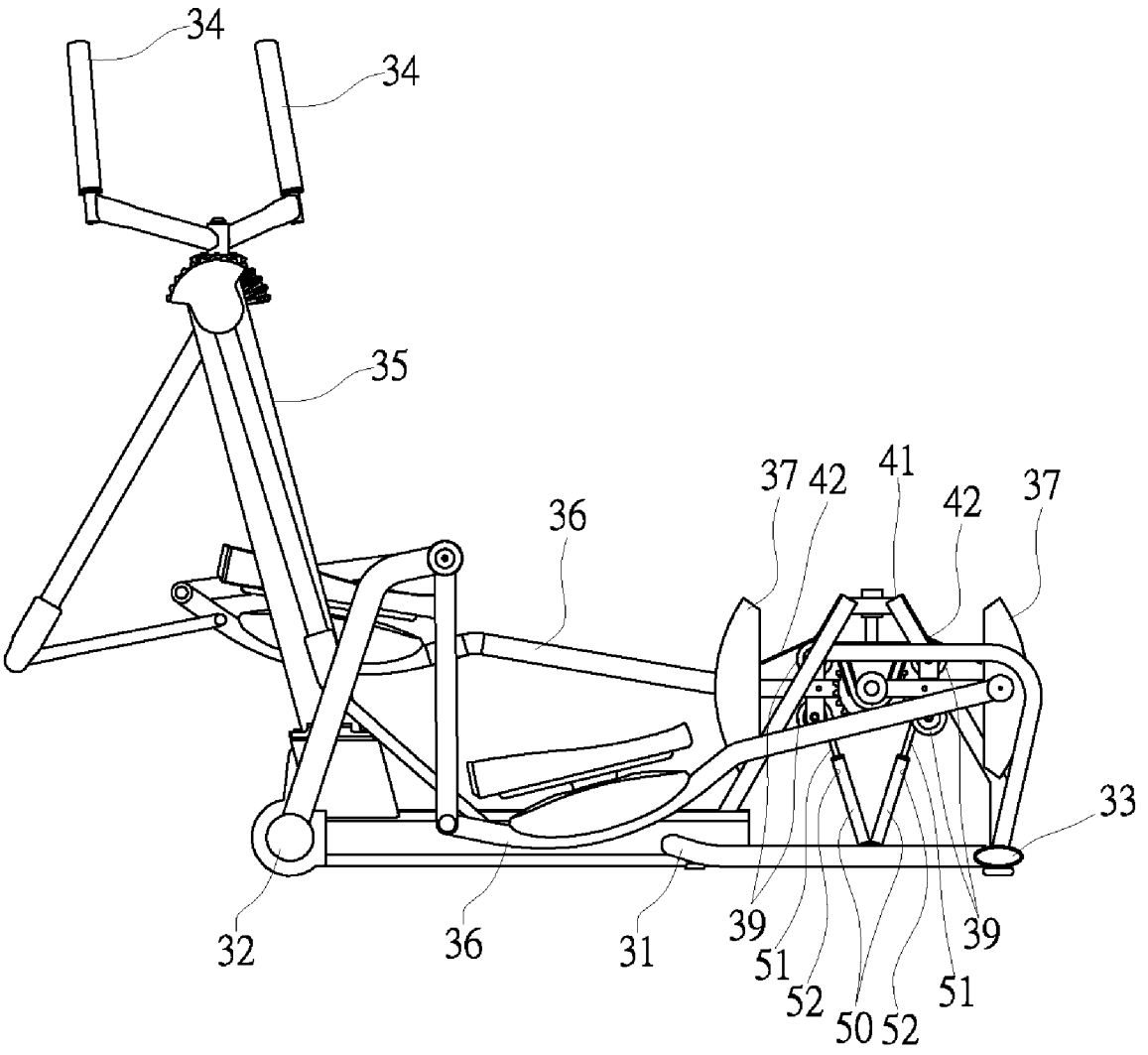


FIG.8

POSITION-LIMITING APPARATUS OF A PENDULUM MECHANISM OF AN EXERCISE EQUIPMENT

BACKGROUND OF THE INVENTION

[0001] 1. Fields of the Invention

[0002] The invention relates to a position-limiting apparatus of a pendulum mechanism of an exercise equipment, and more particularly, to a mechanism that ensures a effective restriction of the maximal swing of the pendulum. Moreover, a pneumatic cylinder is provided for creating a proper exercise resistance.

[0003] 2. Description of the Related Art

[0004] Previously, the applicant of the invention has disclosed a new pendulum type coupling mechanism for certain exercise apparatuses (such as waist-twisting exerciser, an elliptical cross trainer, etc.) having different kinds of the reciprocating movement to replace the inertia flywheel type structure for meeting the exercise requirement of the operators in a better way and for effectively avoiding the exercise injuries. The patent of the above-mentioned structure is still pending (see U.S. patent application Ser. No. 12/177,150) so that no further descriptions thereto are given hereinafter. The invention is an extended structure relative to the pendulum type coupling mechanism previously developed.

SUMMARY OF THE INVENTION

[0005] A primary object of the invention is to provide a position-limiting apparatus of a pendulum mechanism of an exercise equipment that provides a position-limiting apparatus disposed at a certain position tangential to the swinging path of a pendulum of the pendulum mechanism for an effective restriction of the maximal swing of the pendulum. Moreover, a pneumatic cylinder is provided for creating a proper exercise resistance that ensures a effective restriction of the maximal swing of the pendulum.

[0006] According to the invention, the position-limiting apparatus primarily consists of a subsidiary support and two high-strength flexible metal pieces that are mounted at the side of the pendulum of the pendulum mechanism.

[0007] Furthermore, the pendulum includes a compression roller at a position corresponding to the metal pieces such that the compression roller is gradually in contact with the metal pieces along the direction tangential to the movement path when the pendulum approaches to the swing peak. At that time, the metal pieces are subject to the compression force and therefore gradually deformed, thereby creating a graduate counteracting effect (or a deceleration action on the pendulum) with their own strength. In this way, an effective restriction of the maximal swing of the pendulum is ensured. Thereafter, the resilience of the flexible metal pieces creates a counteracting force acting on the pendulum such that the pendulum swings in the other direction, thereby providing an inertia movement action. In addition, a pneumatic cylinder having a telescopic rod is pivotally coupled between the pendulum and the base frame of the exercise equipment. Moreover, the pneumatic cylinder is provided with air holes for adjusting the amount of the inlet air and the outlet air, thereby creating a proper exercise resistance. In this way, the exercise effect is enhanced.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The accomplishment of this and other objects of the invention will become apparent from the following description and its accompanying drawings of which:

[0009] FIG. **1** is a perspective view of a preferred embodiment of the invention;

[0010] FIG. **2** is a side view of the embodiment of the invention according to FIG. **1**, showing the operation thereof;

[0011] FIG. **3** is a perspective view of another embodiment of the invention;

[0012] FIG. **4** is a side view of the embodiment of the invention according to FIG. **3**, showing the operation thereof;

[0013] FIG. **5** is a perspective view of a further embodiment of the invention;

[0014] FIG. **6** is a side view of the embodiment of the invention according to FIG. **5**, showing the operation thereof;

[0015] FIG. **7** is a perspective view of still another embodiment of the invention; and

[0016] FIG. **8** is a side view of the embodiment of the invention according to FIG. **7**, showing the operation thereof;

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0017] The present invention will now be described in more detail hereinafter with reference to the accompanying drawings that show various embodiments of the invention.

[0018] As shown in FIGS. **1** and **2**, a position-limiting apparatus of a pendulum mechanism is applied to a waist-twisting exerciser **10**. The waist-twisting exerciser **10** includes a base frame **11**, a pair of swivel pedals **12**, and a handrail frame **14** with a handle **13**. A pendulum mechanism **15** is coupled at the back of the swivel pedals **12**. Besides, a position-limiting apparatus **20** is disposed at a certain position tangential to the swinging path of a pendulum **16** of the pendulum mechanism **15** for an effective restriction of the maximal swing of the pendulum **16**. The position-limiting apparatus **20** primarily consists of a subsidiary support **21** and two high-strength flexible metal pieces **22** that are mounted at the side of the pendulum **16** of the pendulum mechanism **15**. Moreover, the pendulum **16** includes a compression roller **17** at a position corresponding to the metal pieces **22** such that the compression roller **17** is gradually in contact with the metal pieces **22** along the direction tangential to the movement path when the pendulum **16** approaches to the swing peak. At that time, the metal pieces **22** are subject to the compression force and therefore gradually deformed, thereby creating a graduate counteracting effect with their own strength. As a result, an effective restriction of the maximal swing of the pendulum **16** is ensured.

[0019] Likewise, as shown in FIGS. **3** and **4**, a position-limiting apparatus of a pendulum mechanism in accordance with the invention is applied to an elliptical cross trainer **30**. The elliptical cross trainer **30** includes a base frame **31**, a front ground-touching rod **32**, a rear ground-touching rod **33**, a front support **35** with two handles **34**, two pedal-connecting rods **36**, and a pendulum mechanism **38** having two pendulums **37** and coupled with the pedal-connecting rods **36**. Similarly, a position-limiting apparatus **40** is disposed at a certain position tangential to the swinging path of two pendulum **37** of the pendulum mechanism **38** for an effective restriction of the maximal swing of the pendulums **37**. The position-limiting apparatus **40** primarily consists of a subsidiary support **41** and four high-strength flexible metal pieces **42** that are mounted at the side of the pendulums **37** of the pendulum mechanism **38**. Moreover, the pendulums **37** each include two compression rollers **39** at a position corresponding to the metal pieces **42**, thereby creating the same expected effect.

[0020] As shown in FIGS. **5** through **8**, a pneumatic cylinder **50** having a telescopic rod **51** is pivotally coupled between the pendulum **16**, **37** and the base frame **11**, **31** of the exercise equipment (such as waist-twisting exerciser **10** and the elliptical cross trainer **30**). Moreover, the pneumatic cylinder **50** is provided with air holes **52** for adjusting the amount of the inlet air and the outlet air, thereby creating a proper exercise resistance. In this way, the exercise effect is enhanced. In other words, a greater exercise resistance is provided when a smaller air hole **52** (having a small air flow rate) is selected.

[0021] Many changes and modifications in the above-described embodiments of the invention can, of course, be carried out without departing from the scope thereof. Accordingly, to promote the progress in science and the useful arts, the invention is disclosed and is intended to be limited only by the scope of the appended claims.

1. A position-limiting apparatus of a pendulum mechanism of an exercise equipment, wherein the pendulum mechanism creates a coupled swing action responsive to reciprocating movement of the exercise equipment, thereby providing an inertia movement and a gravity load action; and wherein a position-limiting apparatus is disposed at a position to tangentially engage a swinging path of the pendulum mechanism so as to provide graduated restriction of a maximal swing of the pendulum mechanism.

2. The position-limiting apparatus of a pendulum mechanism of an exercise equipment as recited in claim **1**, wherein the position-limiting apparatus comprises a subsidiary support and several high-strength flexible metal pieces that are mounted at a side of the pendulum mechanism; and wherein the pendulum includes a compression roller at a position corresponding to a respective metal piece such that the compression roller is brought gradually in contact with the respective metal piece along the direction tangential to the movement path when the pendulum approaches the swing peak.

3. The position-limiting apparatus of a pendulum mechanism of an exercise equipment as recited in claim **1**, wherein an adjustable pneumatic cylinder having a telescopic rod is pivotally coupled between the pendulum and a base frame of the exercise equipment; and wherein the pneumatic cylinder.

4. A position-limiting apparatus of a pendulum mechanism applied to a waist-twisting exerciser, the waist-twisting exerciser having a base frame, a pair of swivel pedals, and a handrail frame with a handle, wherein a pendulum mechanism is coupled at the back of the swivel pedals; wherein a position-limiting apparatus is disposed at a certain position tangential to the swinging path of a pendulum of the pendulum mechanism for an effective restriction of the maximal swing of the pendulum; wherein the position-limiting apparatus primarily consists of a subsidiary support and two high-strength flexible metal pieces that are mounted at the side of the pendulum of the pendulum mechanism; and wherein the pendulum includes a compression roller at a position corresponding to the metal pieces such that the compression roller is gradually in contact with the metal pieces along the direction tangential to the movement path when the pendulum approaches to the swing peak; at that time, the metal pieces are subject to the compression force and therefore gradually deformed, thereby creating a graduate counteracting effect with their own strength, whereby an effective restriction of the maximal swing of the pendulum is ensured.

5. The position-limiting apparatus of a pendulum mechanism of an exercise equipment as recited in claim **4**, wherein a pneumatic cylinder having a telescopic rod is pivotally coupled between the pendulum and the base frame of the exercise equipment; and wherein the pneumatic cylinder is provided with air holes for adjusting the amount of the inlet air and the outlet air, thereby creating a proper exercise resistance.

6. A position-limiting apparatus of a pendulum mechanism applied to an elliptical cross trainer, the elliptical cross trainer having a base frame, a front ground-touching rod, a rear ground-touching rod, a front support with two handles, two pedal-connecting rods, and a pendulum mechanism having two pendulums and coupled with the pedal-connecting rods, wherein a position-limiting apparatus is disposed at a position tangential to a swinging path of the pendulum mechanism; wherein the position-limiting apparatus comprises a subsidiary support and four high-strength flexible metal pieces that are mounted at the side of pendulums of the pendulum mechanism; and wherein the pendulums each include two compression rollers arranged at a position corresponding to the metal pieces such that the respective compression roller is brought gradually in contact with the metal pieces along the direction tangential to the movement path when the pendulum approaches a swing peak such that the metal pieces are subject to a compression force and therefore gradually deformed, thereby creating a graduated counteracting effect.

7. The position-limiting apparatus of a pendulum mechanism of an exercise equipment as recited in claim **6**, wherein a pneumatic cylinder having a telescopic rod is pivotally coupled between the pendulum and the base frame of the exercise equipment; and wherein the pneumatic cylinder is adjustable.

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