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(54) **FITNESS DEVICE, EXERCISE MANAGEMENT SYSTEM USING SAME, AND METHOD FOR MANAGING EXECISE**

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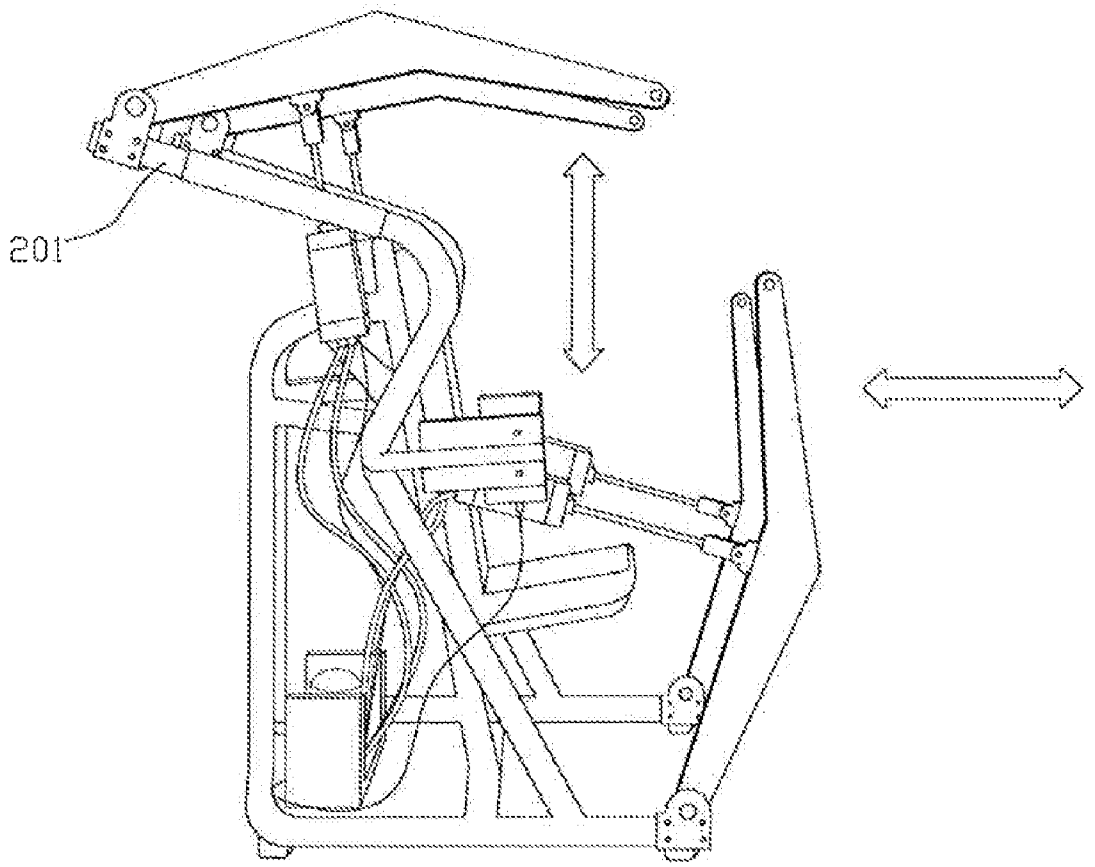
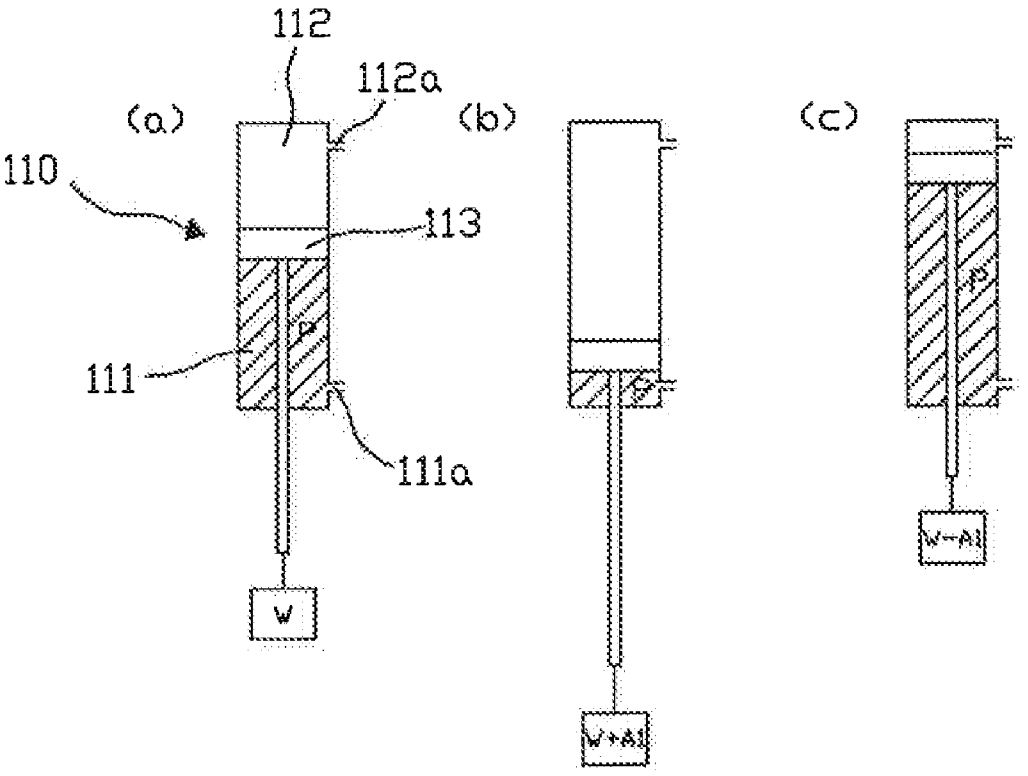
(57) **ABSTRACT**

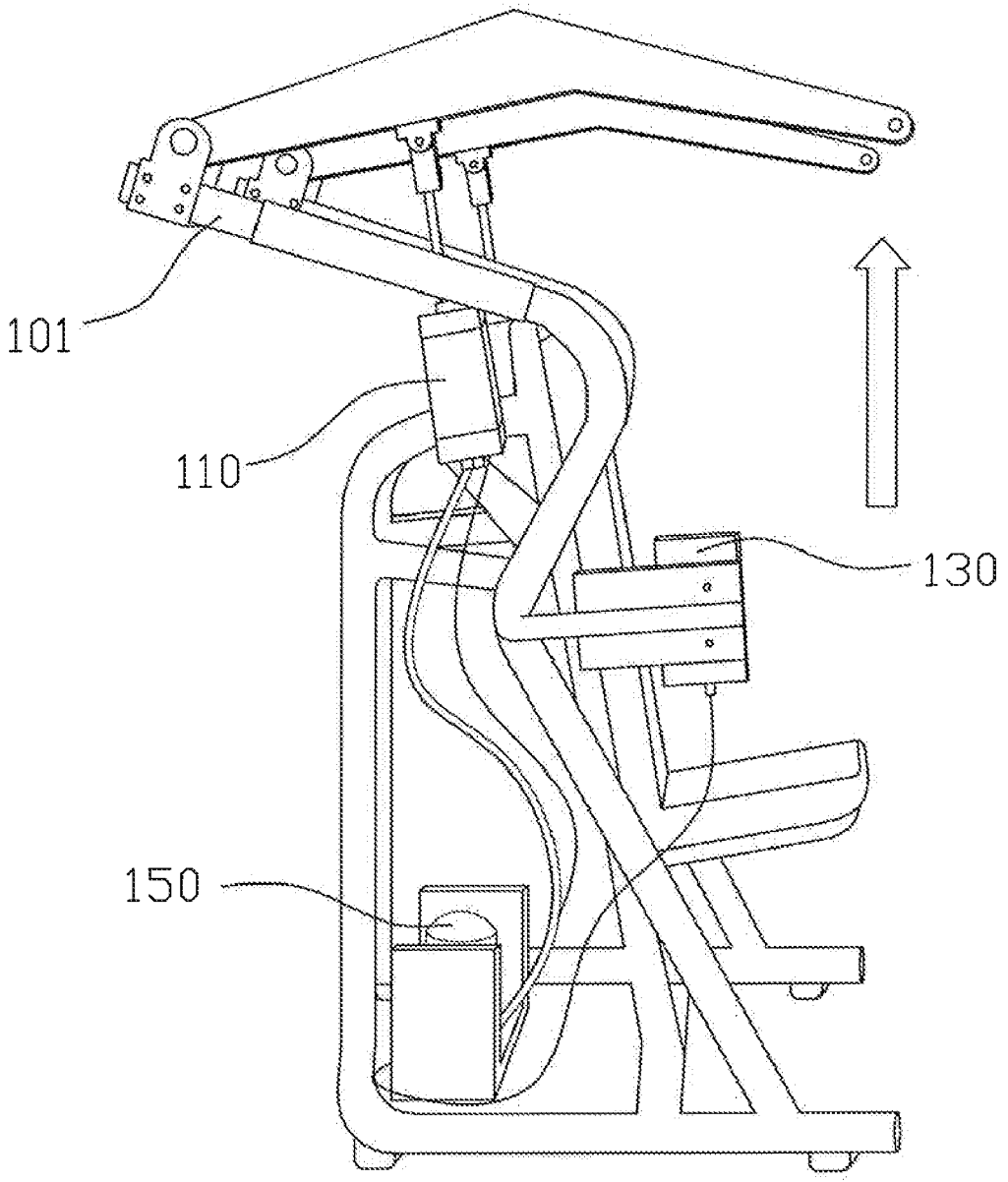
A fitness device using air pressure of a cylinder as an exercise load. The fitness device includes an air cylinder in which air pressure is maintained according to an exercise load value; a position recognition sensor for generating a position recognition signal when a piston of the air cylinder approaches a set position of a load increase of a top or a bottom of a cylinder; a controller for generating a load increase signal for increasing exercise load according to the position recognition signal; and an electric pneumatic proportion control valve for maintaining air pressure value of the air cylinder according to the exercise load value set by the controller and for increasing the air pressure of the air cylinder by 10~20% for a predetermined time by receiving the load increase signal.



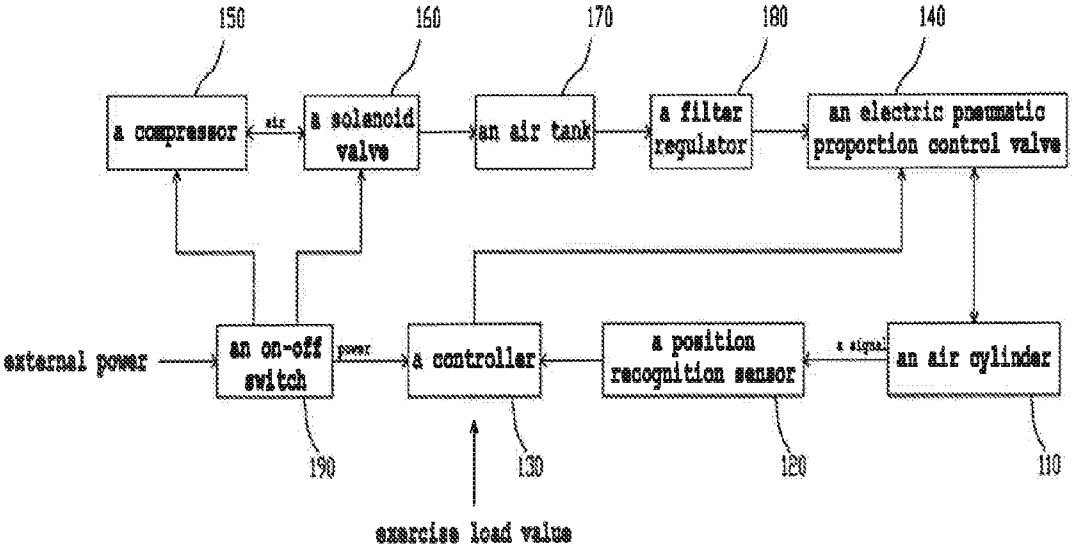
【FIG. 1】



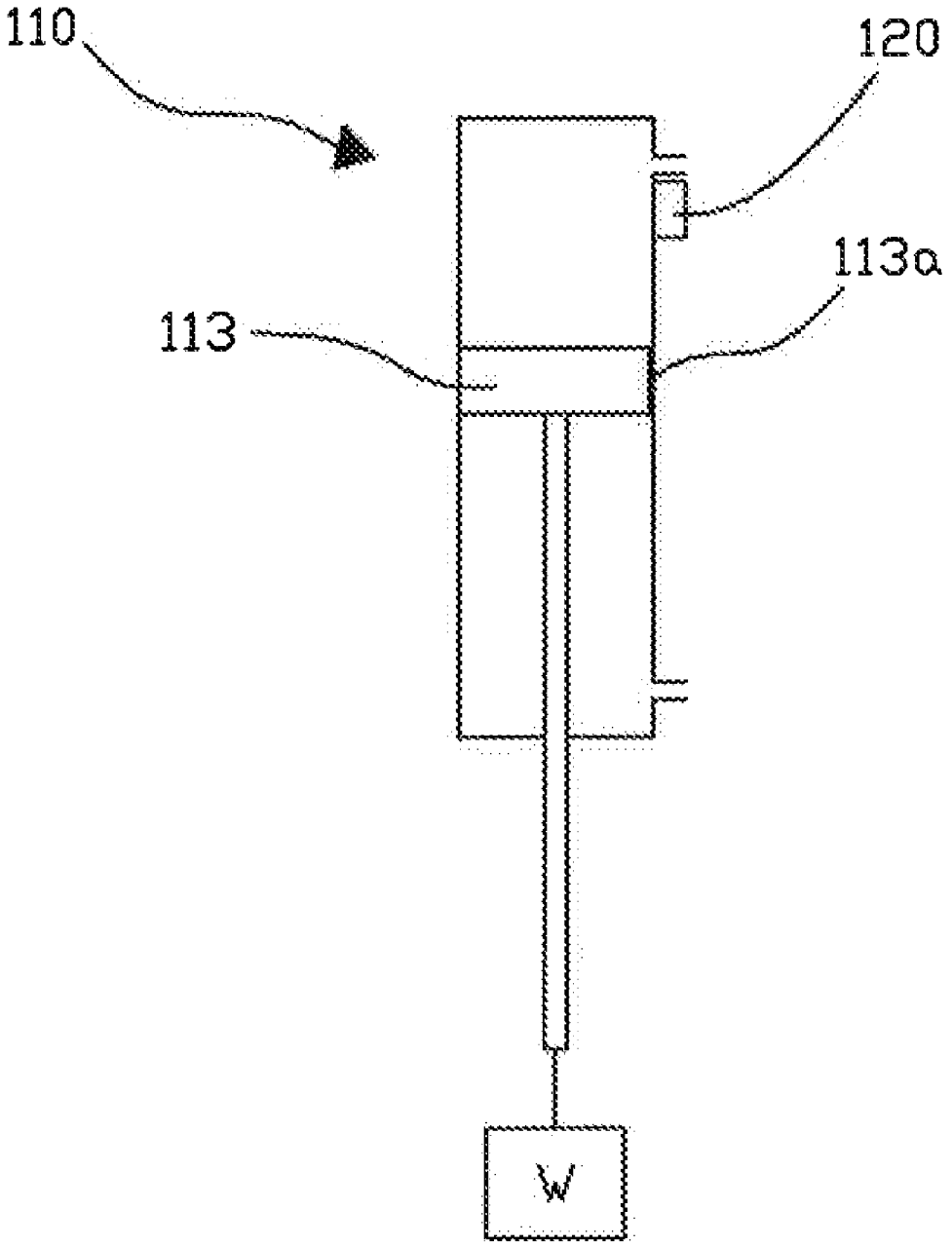
【FIG. 2】



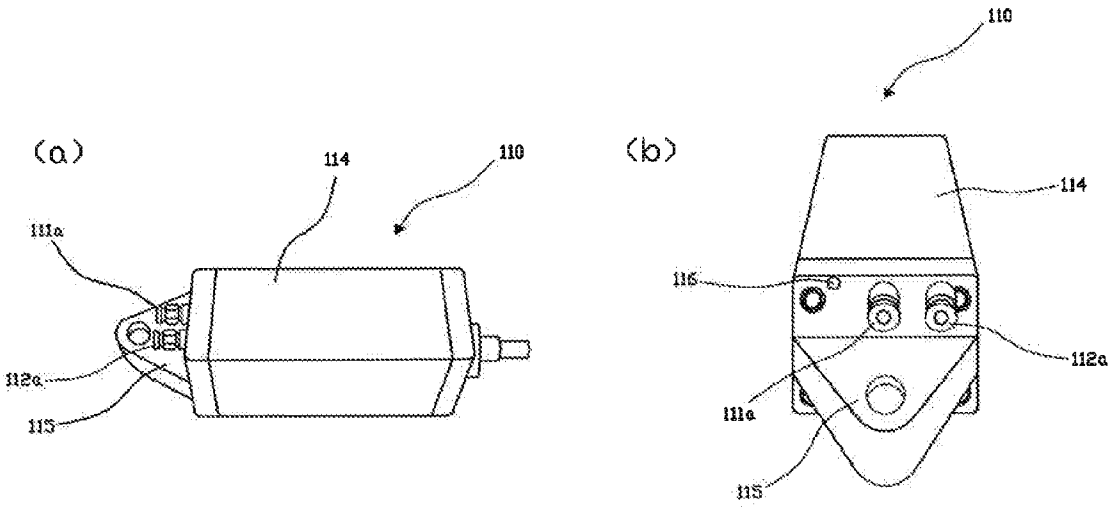
【FIG. 3】


150
160
170
180
140
a compressor
air
a solenoid valve
an air tank
a filter regulator
an electric pneumatic proportion control valve
external power
an on-off switch
power
a controller
a position recognition sensor
a signal
an air cylinder
190
130
120
110
exercise load value

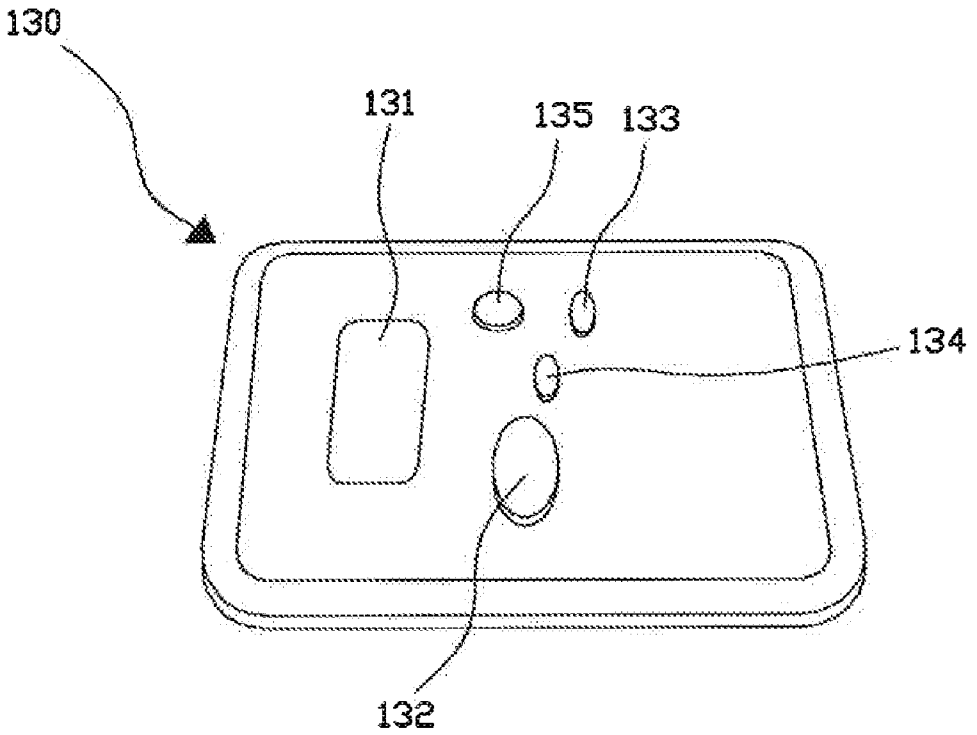
【FIG. 4】



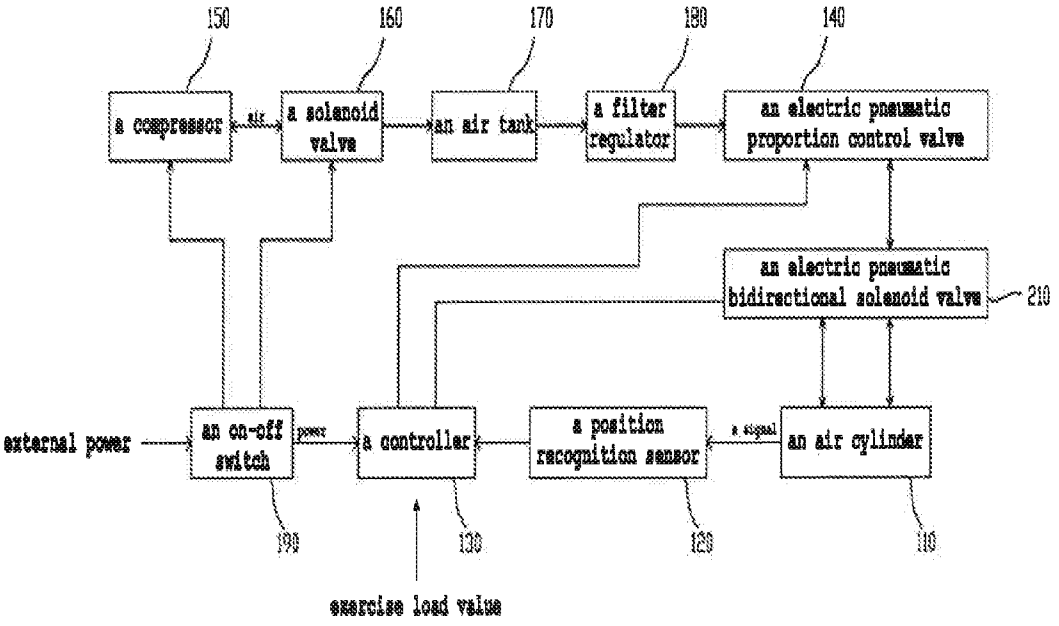
【FIG. 5】



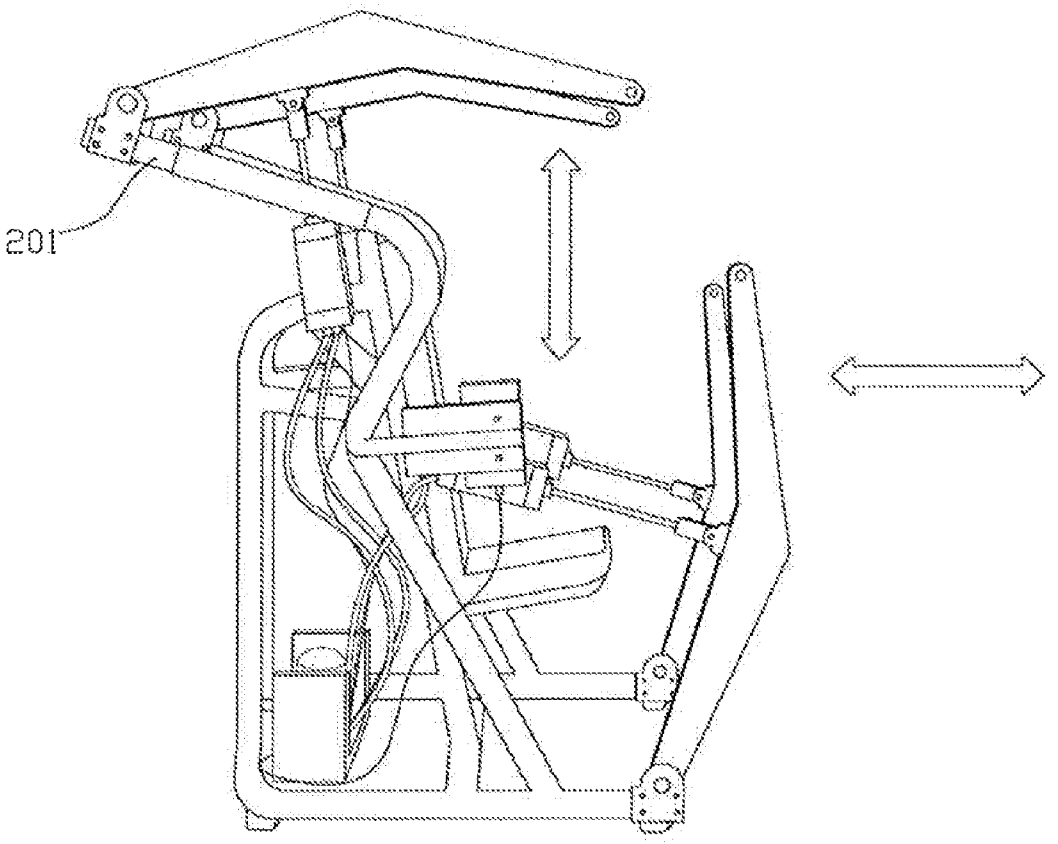
【FIG. 6】



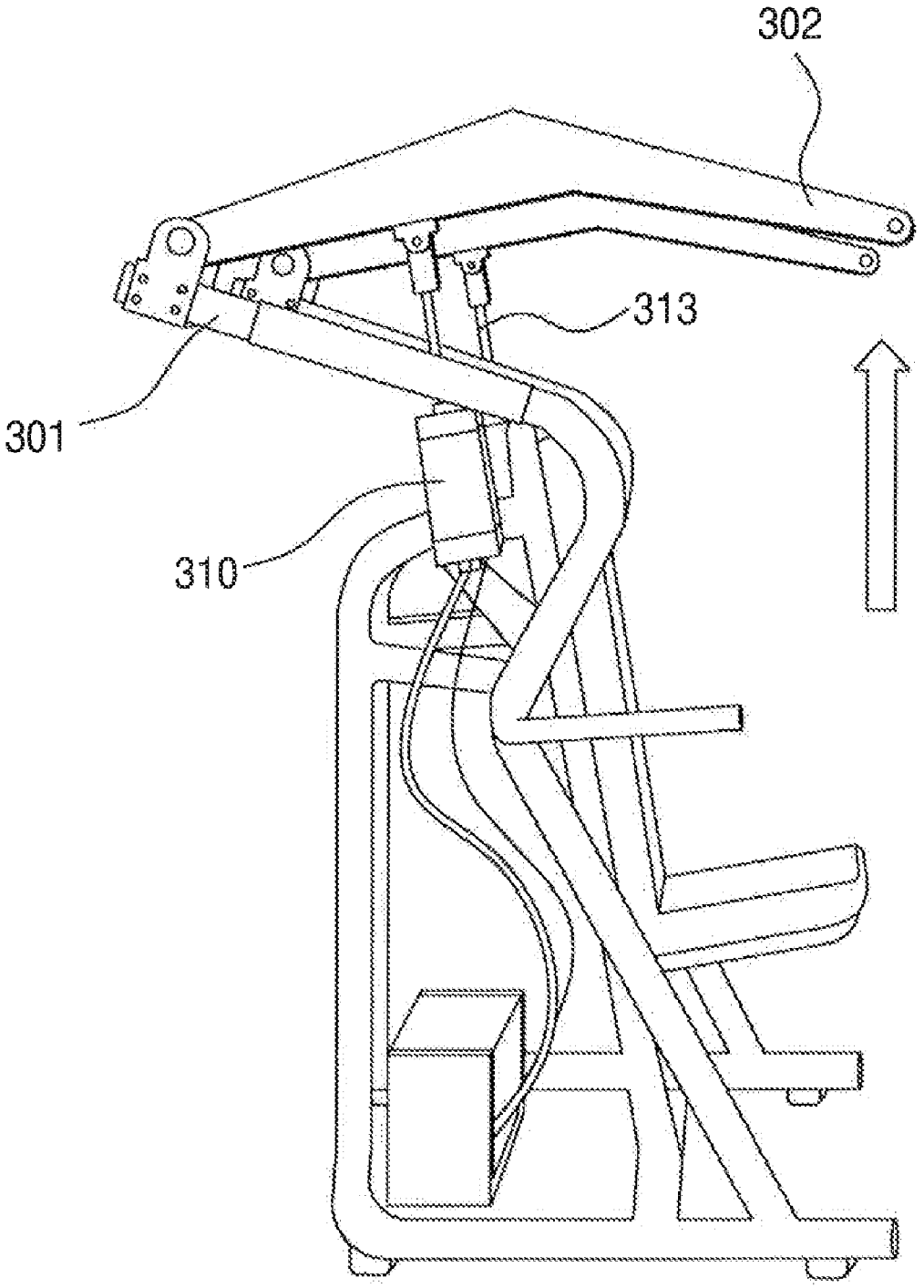
【FIG. 7】


150
160
170
180
140
a compressor
air
a solenoid valve
an air tank
a filter regulator
an electric pneumatic proportion control valve
an electric pneumatic bidirectional solenoid valve
210
external power
an on-off switch
power
a controller
a position recognition sensor
a signal
an air cylinder
190
130
120
110
exercise load value

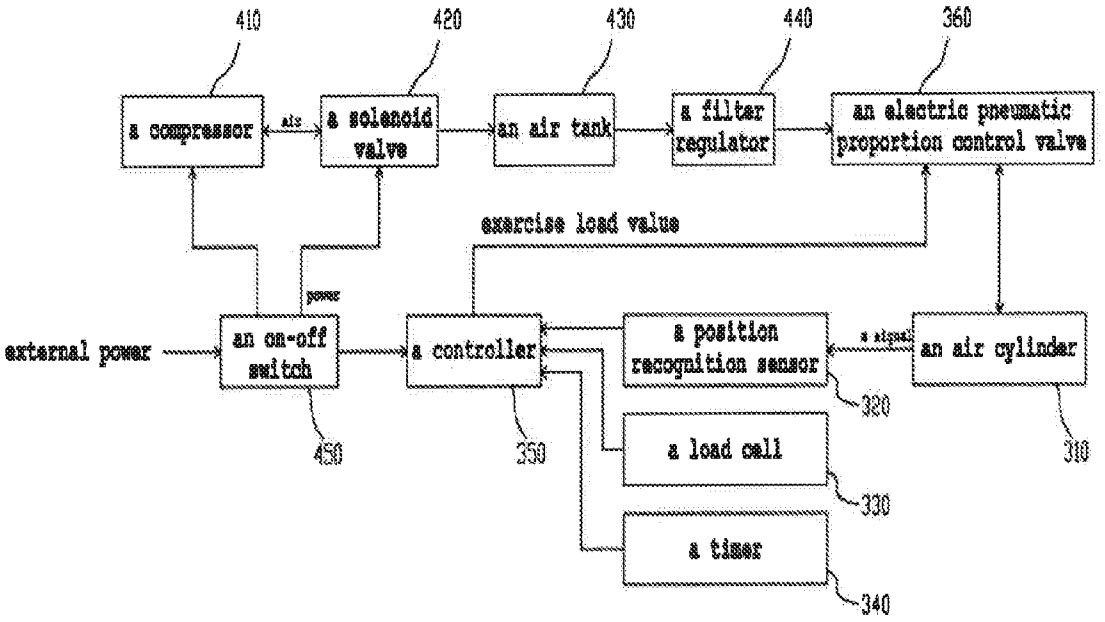
【FIG. 8】



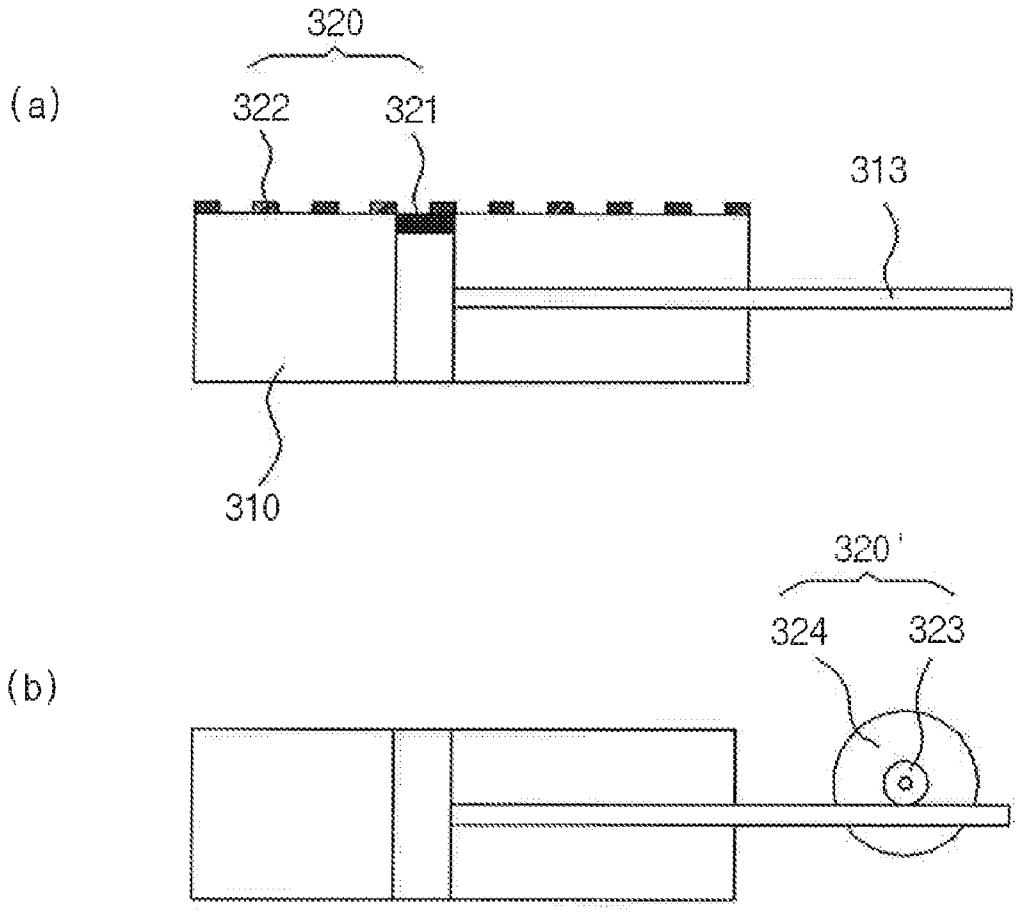
【FIG. 9】



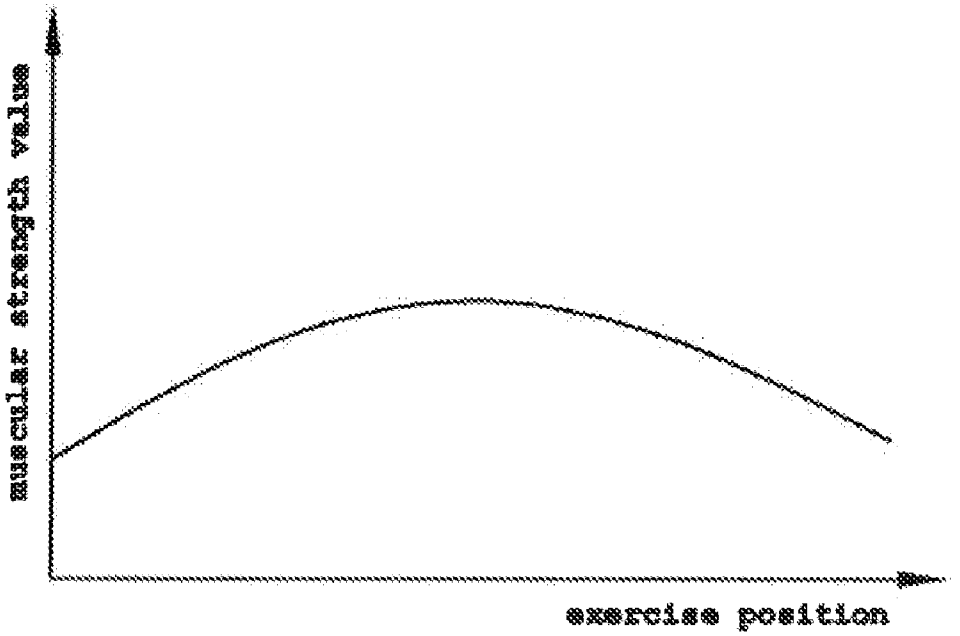
【FIG. 10】


410
420
430
440
360
a compressor
air
a solenoid valve
an air tank
a filter regulator
an electric pneumatic proportion control valve
exercise load value
power
external power
an on-off switch
a controller
a position recognition sensor
a signal
an air cylinder
450
350
320
310
a load cell
330
a timer
340

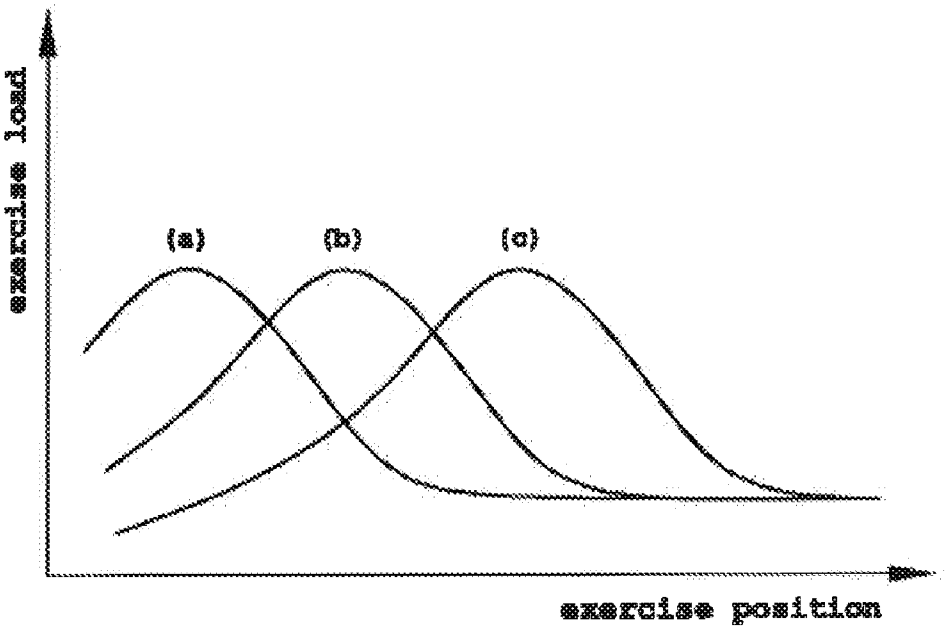
【FIG. 11】



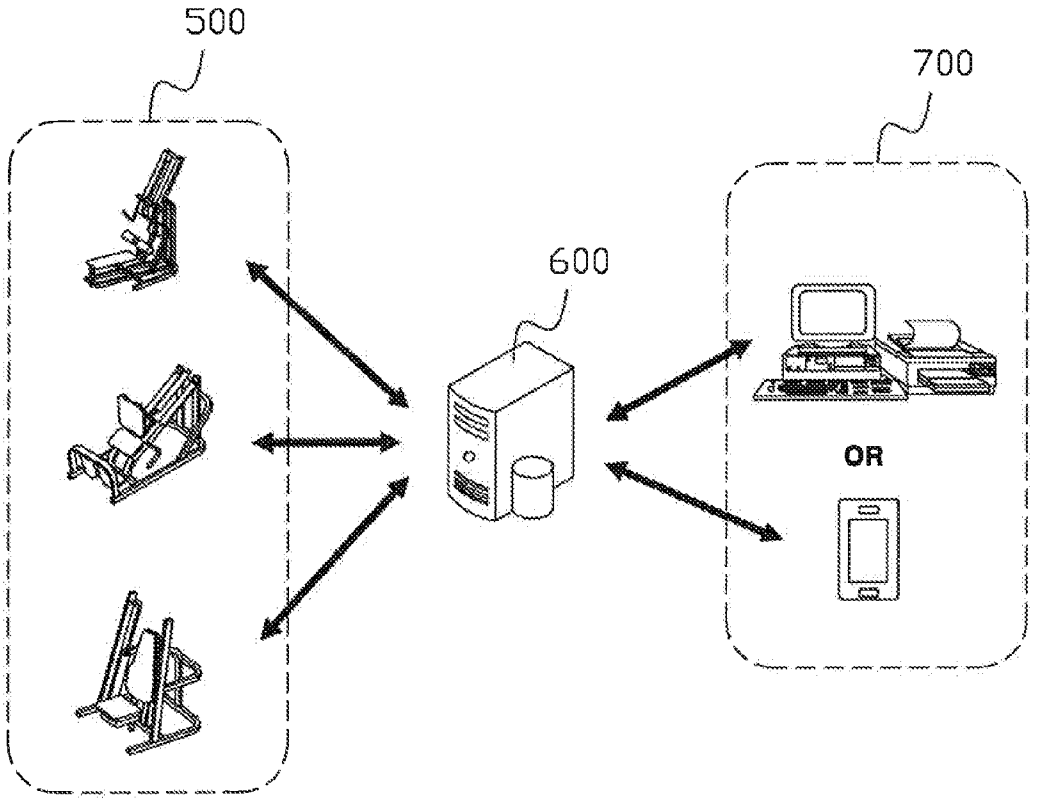
[FIG. 12]



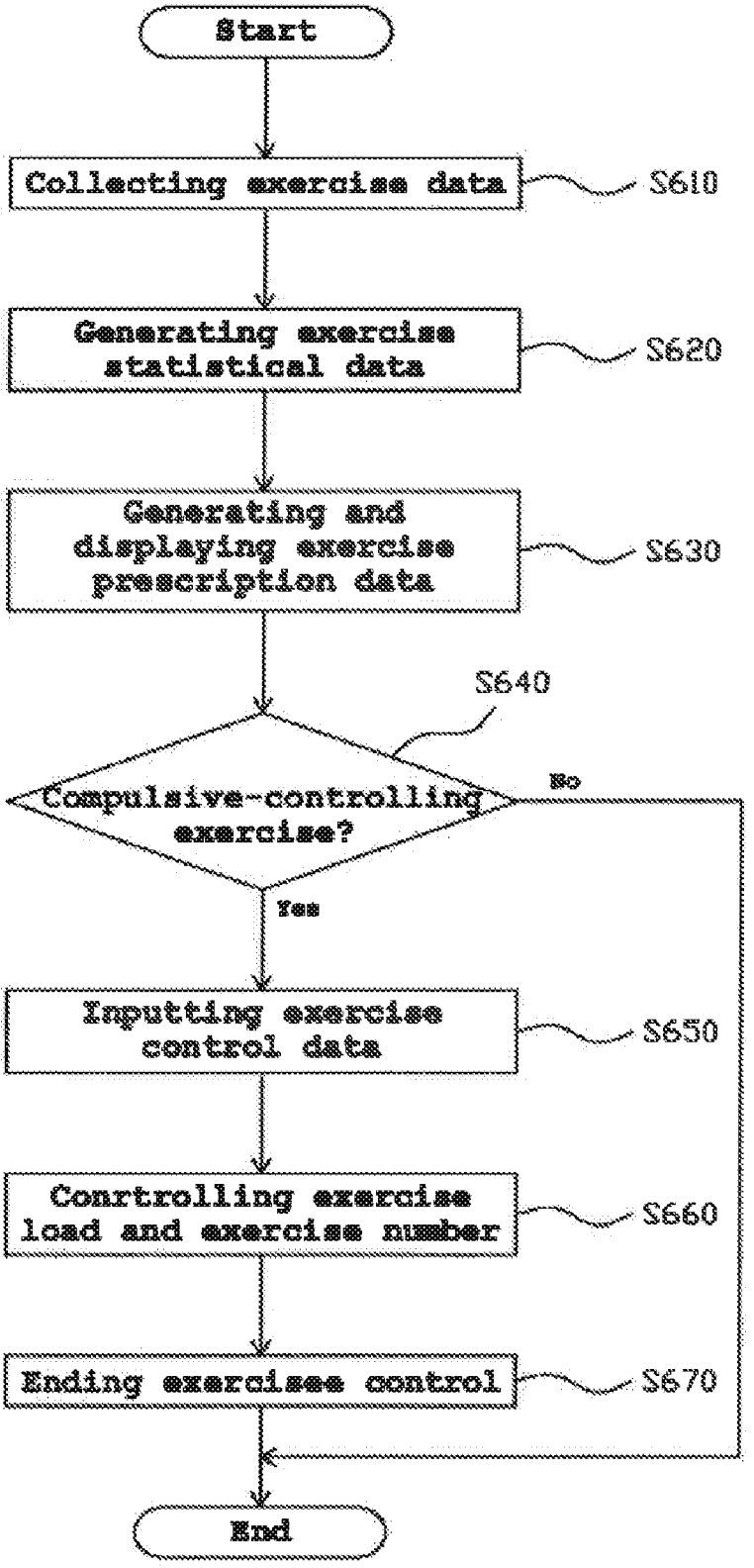
[FIG. 13]



【FIG. 14】



[FIG. 15]


Start
Collecting exercise data
S610
Generating exercise statistical data
S620
Generating and displaying exercise prescription data
S630
S640
Compulsive-controlling exercise?
No
Yes
Inputting exercise control data
S650
Conrtrolling exercise load and exercise number
S660
Ending exercises control
S670
End

FITNESS DEVICE, EXERCISE MANAGEMENT SYSTEM USING SAME, AND METHOD FOR MANAGING EXECISE

CROSS REFERENCE TO PRIOR APPLICATIONS

[0001] This U.S. non-provisional patent application is a Continuation Application of PCT International Application No. PCT/KR2011/001874 (filed on Mar. 18, 2011), which claims priority to Korean Patent Application Nos. 10-2010-0023983 (filed on Mar. 18, 2010), 10-2010-0086457 (filed on Sep. 3, 2010) and 10-2010-0126160 (filed on Dec. 10, 2010), which are all hereby incorporated by reference in their entirety.

BACKGROUND

[0002] The invention relates to a fitness device using air pressure of a cylinder as exercise load, and to an exercise management system and an exercise management method using the fitness device.

[0003] Generally, in order to exercise by using a fitness device (such as a barbell or a dumbbell) for strengthen muscles at a gym, a user pushes or pulls a lever connected to a metal weight having predetermined weight in a direction overcoming gravity. In the fitness device of the metal weight type, an effect of muscle exercise is induced in only one direction. Also, if the user does not bear the excessive weight and drops the fitness deive, there is always a danger of injury.

[0004] In order to improve the above problems, a fitness device using oil pressure or air pressure instead of the metal weight is being developed recently. Since the fitness device using the oil pressure does not have a power source, it is impossible to control intensity of the oil pressure to have a wanted value. In the fitness device using the oil pressure, by changing a size of an orifice of an oil-pressure cylinder, force applying the user during pushing and pulling a lever and a progress speed are changed and a bidirectional exercise is possible. In the fitness device using the air pressure, weight lifting is induced by overcoming the air pressure supplied from a compressor in one direction when the user pushes or pulls a lever. Also, in the fitness device using the air pressure, exercise intensity can be controlled by adjusting air pressure intensity.

[0005] However, in the conventional fitness device using the oil or air pressure, the oil or air pressure is varied according to a position of a piston inside the cylinder. Thus, it is difficult to accurately and constantly control the oil or air pressure, and thus, the fitness device is not suitable for a fitness device where a precise control is required. Also, the conventional fitness using the oil or air pressure cannot perform roles of a personal trainer in a gym (that is, enhancing weight lifting effect by adding exercise load at an appropriate operating point through compulsively pushing or pulling). Thus, in the conventional fitness using the oil or air pressure, enhanced exercise effect cannot be expected. In addition, when the personal trainer suddenly adds the exercise load, the fitness device may be damaged and a lifetime thereof may be shortened.

[0006] Further, in the conventional fitness using the oil or air pressure, when the user pushes and pulls the lever for the bidirectional exercise, the bidirectional load cannot be effectively and accurately controlled.

[0007] Furthermore, safety problems due to malfunction may be induced. Also, since a manufacturing cost is high, it is difficult for ordinary person to use it for all purpose in the gym.

[0008] On the other hand, in conventional fitness device using the metal weight or the oil or air pressure, because the user personally sets exercise load according to own experience or goal, the user may exercise by using inappropriate exercise load and it may cause damage of a muscle. Also, for the users not being able to set the exercise load (for example, the blind, the old and the infirm, patients in rehabilitation, and so on), using the fitness device is more difficult and more dangerous, compared with the ordinary person.

[0009] Further, when the patients in rehabilitation use the fitness device in order to rehabilitate the muscle, same load is supplied in each stroke. Then, power may be concentrated to a damaged portion of the muscle.

[0010] Furthermore, in the gym (health club), the trainer generally determines an exercise program on his own initiative according to an exercise prescription after measuring basal physical fitness or body and modifies the exercise program after substantial amount of time. Accordingly, the exercise program cannot be quickly modified according to the change of the basal physical fitness or the circumstance. Also, since exercise data regarding the fitness device cannot be accumulated, exercise progress cannot be properly evaluated and subsequent exercise program may be progressed without any clear plan.

[0011] In addition, in the conventional fitness device using the metal weight, the user or the trainer should record the exercise load, an exercise number, a type of the used fitness device, and exercise time personally. Thus, exercise data cannot be easily and accurately managed. Also, if there is no trainer, an exercise amount of the user cannot be compulsively controlled according to the prescription of the exercise program.

SUMMARY OF THE INVENTION

[0012] The invention is provided to overcome the above problems. The invention is to provide a precise fitness device being able to accurately and constantly control air pressure.

[0013] Also, the invention is to provide a fitness device being able to enhance weight lifting effect.

[0014] In addition, the invention is to provide a fitness device being able to effectively and accurately control bidirectional exercise load during bidirectional exercise.

[0015] Further, the invention is to provide a fitness device being safe and being able to reduce a manufacturing cost.

[0016] Furthermore, the invention is to provide a fitness device being able to automatically set exercise load suitable for a user.

[0017] Also, the invention is to provide a fitness device being able to activate a muscle in consideration of a damaged portion of the muscle.

[0018] In addition, the invention is to provide an exercise management system and an exercise management method being able to systematically manage exercise of a user by accurately and reliably collecting exercise data.

[0019] Further, the invention is to provide an exercise management system and an exercise management method being able to provide exercise management information to a user and to compulsively control an exercise amount and exercise load according to exercise prescription.

[0020] The technical problems to be solved of the invention are not limited to the above technical problems to be solved. Other unmentioned technical problems to be solved of the invention can be clearly understood from the following descriptions by skilled person in the art to which the invention pertains.

[0021] A fitness device according to the invention uses air pressure of a cylinder as an exercise load. The fitness device includes an air cylinder in which air pressure is maintained according to an exercise load value; a position recognition sensor for generating a position recognition signal when a piston of the air cylinder approaches a set position of a load increase of a top or a bottom of a cylinder; a controller for generating a load increase signal for increasing exercise load according to the position recognition signal; and an electric pneumatic proportion control valve for maintaining air pressure value of the air cylinder according to the exercise load value set by the controller and for increasing the air pressure of the air cylinder by 10~20% for a predetermined time by receiving the load increase signal.

[0022] Also, the air cylinder of the invention is a single-acting air cylinder. The electric pneumatic proportion control valve is connected to one air chamber of air chambers divided by a head of the piston, and controls air entered or exited in each stroke to have same air pressure value at same exercise load value although a position of the piston changes.

[0023] In addition, the controller of the invention includes a load setting portion where the exercise load value is set, a load-increase-signal generating portion for generating the load increase signal, a type changing portion for changing a type of exercise, and an emergency stopping portion for inducing an emergency stop of the exercise.

[0024] Further, the electric pneumatic proportion control valve according to the invention maintains the air pressure of the air cylinder at blackout by keeping opening degree to have opening degree before the blackout.

[0025] Furthermore, the fitness device of the invention further includes an electric pneumatic bidirectional solenoid valve. One end of the electric pneumatic bidirectional solenoid valve is connected to the electric pneumatic proportion control valve. The other end of the electric pneumatic bidirectional solenoid valve is connected to each of air entrances of the air chambers divided by the piston of the air cylinder. The electric pneumatic bidirectional solenoid valve connects from the electric pneumatic proportion control valve to one chamber of the air chambers selectively and provides bidirectional exercise load.

[0026] Still further, the fitness device of the invention further includes a compressor for compressing air; a solenoid valve connected to the compressor, the solenoid valve preventing oil leak and exhausting remain pressure; an air tank connected to the solenoid valve, wherein the air tank for storing the compressed air; a filter regulator connected between the air tank and the electric pneumatic proportion control valve, wherein the filter regulator for controlling the air pressure of the air discharged from the air tank and for filtering the air; and an on-off switch for supplying an external power to the controller, the compressor, and the solenoid valve or for shutting the external power.

[0027] Another fitness device according to the invention includes an air cylinder for providing an inner air pressure as exercise load; a piston connected to an exercise lever, wherein a first stroke of the piston being for measuring a maximum exercise stroke, a second stroke of the piston being for measuring a maximum muscular strength value, and a third stroke of the piston being for compensating an exercise load value; a position recognition sensor installed at the air cylinder or the piston, wherein the position recognition sensor for detecting an exercise position of the piston and generating an exercise position signal; a load cell installed at a head of the piston, wherein the load cell for detecting the exercise load applied to the piston and generating an exercise load signal; a timer for detecting time of each stroke and generating an exercise time signal; a controller, wherein the controller for setting the air cylinder to a no load value and measuring the maximum exercise stroke by the exercise position signal during the first stroke, the controller for setting the air cylinder to a maximum load value and measuring the maximum muscular strength value by the exercise load signal during the second stroke, the controller for setting the air cylinder to a basic exercise load value by using the maximum exercise stroke and the maximum muscular strength value during the third stroke, and the controller for setting a normal exercise load value from the fourth stroke by compensating the basic exercise load value by using exercise speed measured by the exercise position signal and the exercise time signal of the third stroke; and an electric pneumatic proportion control valve for maintaining the air pressure value of the air cylinder in proportion to the exercise load value set by the controller.

[0028] Also, the position recognition sensor of the invention includes a magnetic element mounted on the head of the piston, and magnetic switches mounted to have regular intervals in a longitudinal direction at the air cylinder and are operated by an approach of the magnetic element.

[0029] In addition, the position recognition sensor of the invention includes a roller being in close contact with a rod of the piston and being rotated by interworking with an movement of the rod, and an encorder being connected to the roller and detecting a position of the piston according to a rotation number and a rotation direction.

[0030] Further, the fitness device of the invention stores muscular strength values according to the exercise positions in every stroke as data, after the third stroke.

[0031] Furthermore, the fitness device of the invention controls and sets the normal exercise load value according to the exercise position of every stroke, after the third stroke.

[0032] Also, in the fitness device of the invention, the exercise position of the piston in each stroke corresponds to an exercised muscle area, and the normal exercise load value increases at the exercise position corresponding to a muscle area to be activated.

[0033] In addition, the fitness device of the invention further includes an input panel for controlling the normal exercise load value.

[0034] Further, the fitness device of the invention further includes an emergency stopping button for inducing an emergency stop of the exercise. The controller rapidly changes the normal exercise load value supplied from the fourth stroke to a no load value when the emergency stopping button is operated.

[0035] Furthermore, an exercise management system of the invention includes a fitness device including a single-acting air cylinder for providing an inner air pressure of the air cylinder as exercise load, an electric pneumatic proportion control valve being connected to the air cylinder and controlling the exercise load of the air cylinder according an input voltage value, a position recognition sensor for detecting a number of a reciprocal movement of a piston of the air cyl-

inder, and a controller converting the input voltage value and the number of the reciprocal movement of the piston to exercise load information and exercise number information; a central server device for generating exercise statistical data by receiving exercise data including the exercise load information and the exercise number information from the fitness device and for generating exercise prescription data by comparing the exercise statistical data and predetermined exercise management data; and a terminal device for receiving the exercise statistical data, the exercise management data, and the exercise prescription data from the central server device and displaying them.

[0036] Also, the fitness device of the invention includes a plurality of fitness devices of different exercise types, and each of the fitness devices includes a RFID reader. A user of the fitness device is identified, the used fitness device is identified, and exercise time is checked by identifying a FRID tag possessed by the user.

[0037] In addition, the exercise data of the invention includes at least one of member information of a user, type information of the fitness device, or exercise time information.

[0038] Further, the exercise management data of the invention includes at least one of management information of the fitness device, member management information, exercise management information of the member, or muscular strength management information according to a type of the fitness device.

[0039] Furthermore, the terminal device of the invention receives an exercise control data for compulsively controlling the exercise load and the exercise number of the fitness device according to the exercise prescription data and transmits the exercise control data to the central server device. The fitness device of the invention receives the exercise control data from the central server device, and controls the input voltage value of the electric pneumatic proportion control valve and maintains the exercise load of the exercise control data until the exercise number of the exercise control data is accomplished. The fitness device ends the exercise control by eliminating the air pressure of the air cylinder after the exercise number is accomplished.

[0040] An exercise management method according to the invention includes steps of identifying a user and a used fitness device and checking exercise time by identifying a FRID tag possessed by the user of the fitness device, wherein the fitness device including a single-acting air cylinder providing an inner air pressure as exercise load, an electric pneumatic proportion control valve being connected to the air cylinder and controlling the exercise load of the air cylinder according an input voltage value, a position recognition sensor for detecting a number of a reciprocal movement of a piston of the air cylinder, and a controller for converting the input voltage value and the number of the reciprocal movement of the piston to exercise load information and exercise number information, wherein the fitness device includes a plurality of fitness devices of different exercise types, and each of the fitness devices includes a RFID; and generating exercise statistical data by a central server device through receiving at least one of member information of the user, type information of the fitness device, the exercise load information, the exercise number information, or the exercise time information; and generating exercise prescription data by comparing the exercise statistical data and predetermined exercise management data and displaying the exercise statistical data, the exercise management data, and the exercise prescription data on a terminal device.

[0041] Further, the exercise management method according to the invention further includes steps of entering an exercise control data for compulsively controlling the exercise load and the exercise number of the fitness device according to the exercise prescription data; maintaining the exercise load of the exercise control data by controlling the input voltage value of the electric pneumatic proportion control valve until the exercise number of the exercise control data is accomplished; and ending the exercise control by eliminating the air pressure of the air cylinder after the exercise number is accomplished.

[0042] By the above technical solutions, a fitness device according to the invention can accurately and constantly control air pressure.

[0043] Also, a fitness device according to the invention can enhance weight lifting effect.

[0044] In addition, a fitness device according to the invention can effectively and accurately control bidirectional exercise load during bidirectional exercise.

[0045] Further, a fitness device according to the invention can be safe and reduce a manufacturing cost.

[0046] Furthermore, a fitness device according to the invention can automatically set exercise load suitable for a user.

[0047] Also, a fitness device according to the invention can activate a muscle in consideration of a damaged portion of the muscle.

[0048] In addition, an exercise management system and an exercise management method of the invention can systematically manage exercise of a user by accurately and reliably collecting exercise data.

[0049] Further, an exercise management system and an exercise management method of the invention provide exercise management information to a user and to compulsively control an exercise amount and exercise load according to exercise prescription without a trainer.

BRIEF DESCRIPTION OF THE DRAWINGS

[0050] FIG. **1** illustrates an operating principal of an air cylinder according to an embodiment of the invention.

[0051] FIG. **2** is a schematic view illustrating the fitness device according to a first embodiment of the invention.

[0052] FIG. **3** is a block diagram illustrating functional blocks for elements of the fitness device according to the first embodiment of the invention.

[0053] FIG. **4** illustrates a position recognition sensor attached to an air cylinder according to the first embodiment of the invention.

[0054] FIG. **5** illustrates a structure of the air cylinder according to the first embodiment of the invention.

[0055] FIG. **6** illustrates a controller according to the first embodiment of the invention.

[0056] FIG. **7** illustrates a fitness device according to a second embodiment of the invention.

[0057] FIG. **8** illustrates a fitness device according to a modified example of the second embodiment of the invention.

[0058] FIG. **9** is a schematic view illustrating the fitness device according to a third embodiment of the invention.

[0059] FIG. **10** is a block diagram illustrating functional blocks for elements of the fitness device according to the third embodiment of the invention.

[0060] FIG. **11** illustrates a structure of an air cylinder and a position recognition sensor attached to a piston according to the third embodiment of the invention.

[0061] FIG. **12** is a graph of a muscular strength value with respect to an exercise position in each stroke of the fitness device according to the third embodiment of the invention.

[0062] FIG. **13** is a graph of exercise load with respect to an exercise position in each stroke of the fitness device according to the third embodiment of the invention.

[0063] FIG. **14** illustrates an exercise management system according to a fourth embodiment of the invention.

[0064] FIG. **15** is a flow chart illustrating an exercise management method according to the fourth embodiment of the invention.

DESCRIPTIONS OF REFERENCE NUMERALS OF DRAWINGS

[0065] **101**, **201**, **301**: an exercise equipment portion

[0066] **110**, **310**: an air cylinder

[0067] **111**: a bottom air chamber

[0068] **111***a*: an air entrance of a bottom air chamber

[0069] **112**: a top air chamber

[0070] **112***a*: an air entrance of a top air chamber

[0071] **113**, **313**: a piston

[0072] **113***a*: a magnetic tape

[0073] **114**: a housing

[0074] **115**: a clevis

[0075] **116**: a connection portion of a position recognition sensor

[0076] **120**, **320**, **320'**: a position recognition sensor

[0077] **130**, **350**: a controller

[0078] **131**: a load display

[0079] **132**: a load setting button

[0080] **133**: an input confirming button

[0081] **134**: a type changing button

[0082] **135**: an emergency stopping button

[0083] **140**, **360**: an electric pneumatic proportion control valve

[0084] **150**, **410**: a compressor

[0085] **160**, **420**: a solenoid valve

[0086] **170**, **430**: an air tank

[0087] **180**, **440**: a filter regulator

[0088] **190**, **450**: an on-off switch

[0089] **210**: an electric pneumatic bidirectional solenoid valve

[0090] **302**: an exercise lever

[0091] **321**: a magnetic element

[0092] **322**: a magnetic switch

[0093] **323**: a roller

[0094] **324**: an encorder

[0095] **330**: a load cell

[0096] **340**: a timer

[0097] **500**: a fitness device

[0098] **600**: a central server device

[0099] **700**: a terminal device

DETAILED DESCRIPTION OF THE INVENTION

[0100] Specific details with respect to the above technical problems to be solved, technical solutions, and advantageous effects of the invention will be included the following embodiments and drawings. Advantages, features, and methods for achieving them of the invention will be clarified with reference to the following embodiments that will be described later in detail, along with accompanying drawings.

[0101] Hereinafter, with reference to drawings, the invention will be described in more detail.

[0102] FIG. **1** illustrates an operating principal of an air cylinder according to an embodiment of the invention.

[0103] As shown in FIG. **1**, an air cylinder **110** according to an embodiment of the invention controls inhalation or exhaust of only one air chamber **111** (a bottom air chamber), and thus, an air entrance **112***a* of the other air chamber **112** (a top air chamber) is always open. When the air cylinder **110** is vertically installed, the bottom air chamber **111** is a side of load. Here, the load is gravity.

[0104] A single-acting air cylinder is balanced when air pressure supplied to the bottom air chamber **111** is same as a load the bottom air chamber **111**, and it is called maintenance of air balance. For example, when the pressure of 2 kgf/cm^2 is applied to the air cylinder having an inner diameter of ø80, weight of weights (pendulum) for balancing the pressure is 100.48 kg because the formula for calculating the weight is $(r^2)\times$(pressure). Here, the position change of the weights due to an inhale or exhaust operation is a flow change, not a pressure change. Thus, regardless of the position of the piston **113**, the load pressure inside the bottom air chamber **111** is the same.

[0105] Based on the above, in the embodiment of the invention, the air pressure is controlled and the controlled air pressure is applied to the bottom air chamber **111**. Then, a user exercises by using the load corresponding to the air pressure. In this time, when the user instead of the weights pulls downward and the force is 100.48 kg or less, the piston **113** goes up. When the user instead of the weights pulls downward and the force is 100.48 kg or more, the piston **113** goes down.

[0106] Particularly, the air balance is applied only to the single-acting air cylinder. (a) of FIG. **1** illustrates an air balance state. In this state, the load W is same as the air pressure P (that is, W=P).

[0107] In this state, if the load (that is, A**1**) is applied to press the piston **113** as shown in (b) of FIG. **1**, the piston **113** goes down and the air pressure inside the air cylinder increases by an amount corresponding to A**1**. In this time, if A**1** is eliminated, the piston **113** goes up to the original position. On the contrary to this, if A**1** is applied to raise the piston **113** as shown in (c) of FIG. **1**, the position of the piston **113** goes up and the air pressure inside the air cylinder falls by an amount corresponding to A**1**. In this time, if A**1** is eliminated, the piston **113** goes down to the original position. This is called floating. When the fitness device is manufactured based on the above, air pressure changes are different according to the positions of the piston. As stated in the above problems of the prior art, the fitness device is not suitable for a fitness device that should provide accurate exercise load using accurate air pressure at the respective position.

[0108] Accordingly, in the case that the piston **113** moves as shown in (b) of FIG. **1**, if the pressure corresponding to A**1** is rapidly exhausted, the inner air pressure can be maintained to the pressure of P, not P+A**1** although the position is changed. On the contrary to this, in the case that the piston **113** moves as shown in (c) of FIG. **1**, if the pressure corresponding to A**1** is rapidly inhaled, the inner air pressure can be maintained to the pressure of P, not P-A**1** although the position is changed.

[0109] Therefore, the air cylinder **110** according to the embodiment of the invention includes the single-acting air cylinder. By controlling the air entered to or exited from the

bottom air chamber **111** in each stroke, the single-acting air cylinder can have same air pressure value at same exercise load value although the position of the piston **113** changes. Accordingly, the fitness device according to the embodiment of the invention can accurately and constantly control the air pressure.

[0110] On the other hand, when the air entrance **112***a* of the top air chamber **112** is controlled and the air entrance **111***a* of the bottom air chamber **111** is open, an exercise in the opposite direction has same effect in the above.

First Embodiment

[0111] FIGS. **2** and **3** illustrate a fitness device according to a first embodiment of the invention. Specifically, FIG. **2** is a schematic view illustrating a fitness device according to a first embodiment of the invention, and FIG. **3** is a block diagram illustrating functional blocks for elements of the fitness device according to the first embodiment of the invention.

[0112] As shown in FIGS. **2** and **3**, a fitness device according to the first embodiment includes an exercise equipment portion **101**, an air cylinder **110**, a position recognition sensor **120**, a controller **130**, an electric pneumatic proportion control valve **140**, a compressor **150**, a solenoid valve **160**, an air tank **170**, a filter regulator **180**, and an on-off switch **190**.

[0113] The exercise equipment portion **101** includes general elements of the fitness device (for example, a chair for supporting, a lever, a supporter, and so on) besides above elements for providing exercise load. As shown in FIG. **2**, in the first embodiment of the invention, a shoulder press for exercising a deltoid muscle is used for the exercise equipment portion **101** as an example.

[0114] The air pressure inside the air cylinder **110** is maintained to air pressure according to exercise load value set by the controller **130**. By a reciprocal movement of a piston at the constant air pressure, a user can exercise using constant exercise load. The air cylinder **110** according to the first embodiment of the invention is a single-acting air cylinder. Between two air chambers (that is, a top air chamber and a bottom air chamber) divided by the head of the piston, an air is artificially inhaled or exhausted at only one air chamber where the exercise load is applied. Thus, the air pressure can be maintained constantly, and the set exercise load can be applied. Also, the air pressure can be controlled by varying an inhale amount or an exhaust amount as necessary, and the exercise load can be controlled.

[0115] The position recognition sensor **120** generates a position recognition signal when the piston of the air cylinder **110** approaches a set position of the load increase of the top of the cylinder or the bottom of the cylinder. In the first embodiment of the invention, the above roles of the trainer (that is, enhancing weight ligring effect by adding additional exercise load at an appropriate operating point) can be performed. To achieve this, the position recognition sensor **120** is included, the set position of the load increase for providing the additional exercise load is predetermined, and whether the piston approaches the set position of the load increase or not is detected. In this time, the set position of the load increase may be preferably set to the final operating point of the user during the user's exercise. For example, in the shoulder press, the top of the cylinder is a position of the piston corresponding to the final operating point of pushing up, and thus, the set point of the load increase may be the top of the cylinder (the position where the position recognition sensor **120** of FIG. **4** is attached). This is because the muscular strength can be enhanced more when an impact is applied to the final point of the exercise. Here, in order to effectively enhance the weight lifting effect, an increased amount of the exercise load may be preferably 10~20%.

[0116] The controller **130** receives the position recognition signal from the position recognition sensor **120** and generates a load increase signal for increasing the exercise load value. In the load increase signal, the increased amount of the exercise load (10~20%), the increased time of the exercise load (3~5 seconds), and so on are predetermined. Also, the increased amount and the increased time may be arbitrarily changed by a manufacturer or the user as necessary. In addition, the controller **130** sets the exercise load value that the user wants, changes the exercise load value according to the type of the fitness device, and sets the exercise load value to zero (0) at an emergency stop. This will be described later in more detail with reference to FIG. **6**.

[0117] The electric pneumatic proportion control valve **140** maintains the air pressure value of the air cylinder **110** according to the exercise load value set by the controller **130**. Also, when the electric pneumatic proportion control valve **140** receives the load increase signal from the controller **130**, the electric pneumatic proportion control valve **140** increases the air pressure of the air cylinder **110** by 10~20% for a predetermined time (3~5 seconds). In addition, the electric pneumatic proportion control valve **140** is connected to only one air chamber of the air chambers of the single-acting air cylinder **110**. Thus, the air pressure is maintained to have same air pressure value at same exercise load value by controlling the air entered or exited in each stroke although the position of the piston changes. The electric pneumatic proportion control valve **140** controls the air pressure in proportion to the voltage signal. In the first embodiment of the invention, the exercise load value or the load increase signal applied to the electric pneumatic proportion control valve **140** from the controller **130** corresponds to a signal having predetermined voltage value. The air pressure of the air cylinder **110** acting as the exercise load corresponds to the air pressure in proportion to the voltage signal. For example, the exercise load value of 0~120 kg is converted to the voltage of 0~24V. That is, the maximum exercise load value of 120 kg is controlled and set to the value of 24V. When the normal exercise load value is automatically set to 40 kg, the controller **130** provides the electric pneumatic proportion control valve **140** with the voltage of 8V. Therefore, in the first embodiment of the invention, by employing the electric pneumatic proportion control valve **140**, the air pressure value can be maintained according to the exercise load value, and thus, the precise exercise load can be provided. Also, as stated in the above, the air pressure may increase or decrease to have the wanted value as necessary.

[0118] On the other hand, when blackout is induced, the electric pneumatic proportion control valve **140** according to the first embodiment of the invention maintains opening degree of the valve in a state just before the blackout. Thus, the electric pneumatic proportion control valve **140** can maintain the air pressure of the air cylinder **110**, and can prevent an accident. Accordingly, the fitness device according to the first embodiment of the invention is safer than a fitness device having the conventional metal weight type.

[0119] The compressor **150** compresses the air for providing the air pressure to the air cylinder **110**. The compressor **150** employs a low-noise (42 dB) and compact compressor

usually used for a refrigerator so that the fitness device according to the first embodiment of the invention can be used at home or at a gym.

[0120] The solenoid valve **160** is connected to the compressor **150**, and opens the air pressure flow from the compressor **150** to the air tank **170** and shuts the air pressure flow. Also, the solenoid valve **160** is connected to the compressor **150**, and prevents oil leak and exhausts remain pressure. Particularly, when the air of the compressor **150** is compressed, the oil inside the compressor **150** may often leak to the outside. The solenoid valve **160** has an entrance of three ports. Two ports are connected to the compressor **150** and the air tank **170**, respectively, and an oil returning connection is formed between the other one port and the compressor **150**. The leaked oil is returned to the compressor **150** by the oil returning connection, thereby preventing the oil leak. In addition, when the user completes the operation of the fitness device and the power is shut, the solenoid valve **160** exhausts the remained air inside a whole pneumatic road from the compressor **150** to the air cylinder **110**. Thus, the air pressure of the fitness device is initialized. Accordingly, an accident generated due to the exercise load instantaneously provided by the remained air when the user uses the fitness device again can be prevented. In this time, the solenoid valve **160** also has entrances of the three ports. Two ports are connected to the compressor **150** and the air tank **170**, respectively, and the other one port forms an outer exhaust pipe. On the other hand, in order to perform both functions for preventing the oil leak and for exhausting remain pressure, a solenoid valve having four ports may be used. The open and the shut of the solenoid valve **160** can be controlled by the controller **130**.

[0121] The air tank **170** is connected to the solenoid valve **160** and stores the compressed air. Since the fitness device repeats instant movements, it is difficult to directly provide the air pressure from the compressor **150** according to the movements of the fitness device. Therefore, in the first embodiment of the invention, the air pressure can be provided smoothly by the air tank **170** for storing the compressed air.

[0122] The filter regulator **180** is connected between the air tank **170** and the electric pneumatic proportion control valve **140**, controls the air pressure of the air discharged from the air tank **170**, and filters the air. Specifically, the filter regulator **180** adjusts the air pressure between the air tank **170** and the electric pneumatic proportion control valve **140**, and filters the air provided to the electric pneumatic proportion control valve **140**, thereby eliminating impurities.

[0123] The on-off switch **190** provides external power (220V) to the controller **130**, the compressor **150**, and the solenoid valve **160**, or shuts the external power. Accordingly, when the user switches on the on-off switch **190** before the exercise, the fitness device is operated. When the user switches off the on-off switch **190** after the exercise, the fitness device is stopped. Also, as necessary, the fitness device may be ended by force.

[0124] The operation order of the fitness device having the above structure according to the first embodiment of the invention will be described. First, power is provided to the fitness device by switching on the on-off switch **190**. The power supplied by the on-off switch **190** operates the controller **130**, the compressor **150**, and the solenoid valve **160**. The air pressure generated by the compressor **150** is finally provided to the air cylinder **110** via the solenoid valve **160**, the air tank **170**, the filter regulator **180**, and the electric pneumatic proportion control valve **140**. In this time, the controller **130** controls the electric pneumatic proportion control valve **140** through using the exercise load value set by the user as the voltage signal. Thus, the electric pneumatic proportion control valve **140** maintains the air pressure according to the exercise load value through using the inhale and exhaust operation interworking with the movement of the piston. In addition, when the piston approaches the set position of the load increase by the user's exercise, the position recognition sensor **120** transmits the position recognition signal to the controller **130**, and the controller **130** transmits the load increase signal to the electric pneumatic proportion control valve **140**. The electric pneumatic proportion control valve **140** increases the air pressure of the air cylinder according to the load increase signal, thereby increasing the exercise load of the fitness device.

[0125] Therefore, the fitness device according to the first embodiment of the invention can control the air pressure accurately and constantly, and can enhance the weight lifting effect.

[0126] FIG. **4** illustrates the position recognition sensor attached to the air cylinder according to the first embodiment of the invention.

[0127] As shown in FIG. **4**, in the first embodiment of the invention, a magnetic tape **113***a* is attached to the piston **113**, and the position recognition sensor **120** is attached to the set position of the load increase of an outer wall of the air cylinder **110**. Thereby, when the piston **113** moves and approaches the set position of the load increase, the position recognition sensor **120** detects it and generates the position recognition signal. The set position of the load increase is determined according to the attachment position of the position recognition sensor **120** and may be changed as necessary. Therefore, the piston **113** approaches the set position of the load increase can be easily detected by a simple structure.

[0128] FIG. **5** illustrates a structure of the air cylinder according to the first embodiment of the invention.

[0129] As shown in FIG. **5**, the air cylinder **110** according to the first embodiment of the invention includes a housing **114**, a pair of air entrances **111***a* and **112***a*, and a clevis **115**. The housing **114** surrounds a cylinder. The pair of the air entrances **111***a* and **112***a* are connected to the top air chamber and the bottom air chamber divided by the piston, respectively. The pair of the air entrances **111***a* and **112***a* are formed side by side at one end of the housing **114**. The clevis is integral with the housing **114**. In addition, as described using FIG. **4**, the position recognition sensor is attached to the outer wall of the cylinder and is positioned inside the housing **114**. A connection portion **116** of the position recognition sensor is formed at the one end of the housing **114**.

[0130] Therefore, in the first embodiment of the invention, the structure of the air cylinder **110** can be simplified, and thus, it can be convenient to use and the manufacturing cost of the fitness device can be reduced.

[0131] FIG. **6** illustrates the controller according to the first embodiment of the invention.

[0132] As shown in FIG. **6**, the controller **130** includes a load setting portion where exercise load value is set, a load-increase-signal generating portion for generating a load increase signal, a type changing portion for changing an exercise type, and an emergency stopping portion for inducing an emergency stop of the exercise.

[0133] Particularly, as shown in FIG. **6**, the load setting portion includes a load display **131**, a load setting button **132**, and an input confirming button **133**. The load setting portion

can make the user set the load, and supplies the voltage of 0~24V to the electric pneumatic proportion control valve. That is, the user inputs the exercise load value of kg unit displayed on the load display **131**, and the load setting portion converts the exercise load value to the voltage and supplies the voltage to the electric pneumatic proportion control valve. For example, in the case that the voltage value corresponding to the exercise load value of 120 kg is predetermined to 24V, when the user inputs 40 kg using the load setting button **132** and presses the input confirming button **133**, the controller **130** supplies voltage of 8V to the electric pneumatic proportion control valve. Here, setting the load is only accomplished by an input confirmation using the input confirming button **133**. Thus, the user can recognize the load change. Accordingly, a secondary accident due to the load change can be prevented.

[0134] The load-increase-signal generating portion generates the above load increase signal. Although it is not shown in FIG. **6**, a button for operating or stopping this function may be provided.

[0135] The type changing portion includes a type changing button **134**. In a fitness device where two or more exercise can be performed, a wanted type can be selected through the type changing button **134**. Then, overall set values (the exercise load range, the increased amount of the exercise load, and so on) at each type can be changed according to the type.

[0136] The emergency stopping portion includes an emergency stopping button **135**. When the emergency stopping button **135** is pressed, the load of the air cylinder becomes instantly zero (0) and the exercise load is instantly eliminated. Therefore, the fitness device according to the first embodiment of the invention is safer than a fitness device having the conventional metal weight type.

Second Embodiment

[0137] FIG. **7** illustrates a fitness device according to a second embodiment of the invention.

[0138] As shown in FIG. **7**, a fitness device according to a second embodiment includes an exercise equipment portion **101**, an air cylinder **110**, a position recognition sensor **120**, a controller **130**, an electric pneumatic proportion control valve **140**, an electric pneumatic bidirectional solenoid valve **210**, a compressor **150**, a solenoid valve **160**, an air tank **170**, a fitter regulator **180**, and an on-off switch **190**.

[0139] Each of the exercise equipment portion **101**, the air cylinder **110**, the position recognition sensor **120**, the controller **130**, the electric pneumatic proportion control valve **140**, the compressor **150**, the solenoid valve **160**, the air tank **170**, the filter regulator **180**, and the on-off switch **190** of the fitness device according to the second embodiment of the invention has a structure, function, and operation same as or similar to each of the exercise equipment portion **101**, the air cylinder **110**, the position recognition sensor **120**, the controller **130**, the electric pneumatic proportion control valve **140**, the compressor **150**, the solenoid valve **160**, the air tank **170**, the filter regulator **180** and the on-off switch **190** of the fitness device according to the first embodiment of the invention, respectively. Thus, the detailed descriptions regarding them can be referred to the descriptions of the first embodiment of the invention described with reference to FIGS. **2** to **6**, and thus, the detailed descriptions regarding them will be omitted.

[0140] One end of the electric pneumatic bidirectional solenoid valve **210** is connected to the electric pneumatic proportion control valve **140**. The other end of the electric pneumatic bidirectional solenoid valve **210** is connected to air entrances **111***a* and **112***a* of top and bottom air chambers **111** and **112** of an air cylinder **110**. The electric pneumatic bidirectional solenoid valve **210** selectively connects one air entrance of both air entrances **111***a* and **112***a* and the electric pneumatic proportion control valve **140** using electrical signal, and opens the other air entrance. The electric pneumatic bidirectional solenoid valve **210** freely changes the connected air entrance by using the electrical signal. This electrical signal is supplied from the controller **130**. In the second embodiment of the invention, the electric pneumatic bidirectional solenoid valve **210** is additionally mounted, and thus, exercise of two types can be performed using one fitness device. For example, the exercise equipment portion **101** shown in FIG. **2** controls the air pressure of the top air chamber of the air cylinder **110** and opens the air entrance of the bottom air chamber, thereby achieving a shoulder press fitness device. Also, the exercise equipment portion **101** shown in FIG. **2** controls the air pressure of the bottom air chamber of the air cylinder **110** and opens the air entrance of the top air chamber, thereby achieving a pull down fitness device.

[0141] Therefore, in the fitness device according to the second embodiment of the invention, by employing the electric pneumatic bidirectional solenoid valve, a bidirectional exercise load can be controlled accurately and effectively.

[0142] FIG. **8** illustrates a fitness device according to a modified example of the second embodiment of the invention.

[0143] As shown in FIG. **8**, an element being able to exercise in a forward-and-backward direction is additionally mounted on an exercise equipment portion **201**, and an air cylinder and an electric pneumatic bidirectional solenoid valve are further included. Then, the fitness device that can multiply perform exercise of different types can be provided. The above type changing button makes a conversion of an up-and-down motion and a forward-and-backward motion convenient.

Third Embodiment

[0144] FIGS. **9** and **10** illustrate a fitness device according to a third embodiment of the invention. Specifically, FIG. **9** is a schematic view illustrating a fitness device according to a third embodiment of the invention, and FIG. **10** is a block diagram illustrating functional blocks for elements of the fitness device according to the third embodiment of the invention.

[0145] As shown in FIGS. **9** and **10**, the fitness device according to the third embodiment includes an exercise equipment portion **301**, an air cylinder **310**, a position recognition sensor **320**, a load cell **330**, a timer **340**, a controller **350**, an electric pneumatic proportion control valve **360**, a compressor **410**, a solenoid valve **420**, an air tank **430**, a filter regulator **440**, and an on-off switch **450**.

[0146] The exercise equipment portion **301** includes general elements of the fitness device (for example, a chair for supporting, an exercise lever **302**, a supporter, and so on) besides above elements for providing exercise load. As shown in FIG. **9**, in the third embodiment of the invention, a shoulder press for exercising a deltoid muscle is used for the exercise equipment portion **301** as an example.

[0147] The air pressure inside the air cylinder **310** is maintained to air pressure according to exercise load value set by the controller **350**. By a reciprocal movement of a piston **313** at the air pressure, a user can exercise using constant exercise

load. The air cylinder **310** according to the third embodiment of the invention is a single-acting air cylinder. Between two air chambers (that is, a top air chamber and a bottom air chamber) divided by the head of the piston, an air is artificially inhaled or exhausted through only one air chamber where the exercise load is applied, and the air pressure can be maintained constantly, and the set exercise load can be applied. Also, the air pressure can be controlled by varying an inhale amount or an exhaust amount as necessary, and the exercise load can be controlled.

[0148] The piston **313** is connected to the exercise lever **302** and performs strokes having a reciprocal movement in the air cylinder **310**. The piston **313** performs first to third strokes in order to automatically set an initial exercise load value. Particularly, the piston **313** performs the first stroke for measuring a maximum exercise stroke, the second stroke for measuring a maximum muscular strength value, and the third stroke for compensating exercise load value.

[0149] The position recognition sensor **320** is installed at the air cylinder **310** or the piston **313**, and detects the exercise position of the piston **313** and generates an exercise position signal. That is, in the third embodiment of the invention, exercise stroke can be figured out by recognizing an initial point and a final point of the exercise of the piston **313** through using the position recognition sensor **320**. Also, the position of the piston **313** between the initial point and the final point of the exercise can be figured out in real time.

[0150] The load cell **330** is installed at a front or rear end of the head of the piston **313**, and detects the exercise load applied to the piston **313** and generates an exercise load signal. That is, a first load induced by the air pressure acting as the exercise load and a second load induced by repulsive power acting as weight lifting of the user are applied to the load cell **330**, and the sum of the first load and the second load becomes an exercise load value. Here, when the exercise load induced by the air pressure is eliminated from the exercise load value, muscular strength value of the user acting as the repulsive power can be known.

[0151] The timer **340** detects time of each stroke and generates an exercise time signal. The exercise time signal is used for measuring exercise speed of the piston **313**, along with the exercise position signal.

[0152] The controller **350** controls the electric pneumatic proportion control valve **360**. That is, the controller **350** supplies a voltage signal corresponding to the exercise load value to be set to the electric pneumatic proportion control valve **360**. Also, in order to automatically set a normal exercise load value suitable for the user, the controller **350** interworks with the first to third strokes of the piston **313**, sets the air cylinder **310** to a no load state, a maximum exercise load state, or a basic exercise load state, and collects various information from the position recognition sensor **320**, the load cell **330**, and the timer **340**. Particularly, in the first stroke, the air cylinder **310** is set to the no load value and the maximum exercise stroke is measured by using the exercise position signal. In the second stroke, the air cylinder **310** is set to the maximum load value and the maximum muscular strength value is measured by using the exercise load signal. In the third stroke, the air cylinder **310** is set to the basic exercise load value by using the maximum exercise stroke and the maximum muscular strength value. Also, the exercise speed is measured by using the exercise position signal and the exercise time signal of the third stroke. By compensating the basic exercise load value according to the exercise speed, the normal exercise load value can be set from the fourth stroke.

[0153] The electric pneumatic proportion control valve **360** maintains the air pressure value of the air cylinder **310** in proportion to the exercise load value set by the controller **350**. That is, the electric pneumatic proportion control valve **360** is connected to only one chamber of air chambers of the air cylinder **310** divided by the head of the piston **313**. Thus, the enter of the exit of the air is controlled to have same air pressure value at same exercise load value although the position of the piston **313** is changed.

[0154] That is, in the third embodiment of the invention, the exercise load value supplied from the controller **350** to the electric pneumatic proportion control valve **360** corresponds to the signal having a predetermined voltage value, and the air pressure of the air cylinder **310** acting as the exercise load corresponds to the air pressure in proportion to the voltage signal. Thus, in the third embodiment of the invention, by employing the electric pneumatic proportion control valve **360**, the air pressure value is maintained according to the exercise load value, and thus, the precise exercise load can be provided. As necessary, the air pressure can increase or decrease to have the wanted value.

[0155] On the other hand, when blackout is induced, the electric pneumatic proportion control valve **360** according to the third embodiment of the invention maintains opening degree of the valve in a state just before the blackout. Thus, the electric pneumatic proportion control valve **360** can maintain the air pressure of the air cylinder **310** for a period of time, and can prevent an accident. Accordingly, the fitness device according to the third embodiment of the invention is safer than a fitness device having the conventional metal weight type.

[0156] The compressor **410** compresses the air for providing the air pressure to the air cylinder **310**. The compressor **410** employs a low-noise (42 dB) and compact compressor usually used for a refrigerator so that the fitness device according to the third embodiment of the invention can be used at home or at a gym.

[0157] The solenoid valve **420** is connected to the compressor **410**, and opens air pressure flow from the compressor **410** to the air tank **430** and shuts the air pressure flow. Also, the solenoid valve **420** is connected to the compressor **410**, and prevents oil leak and exhausts remain pressure.

[0158] The air tank **430** is connected to the solenoid valve **420** and stores the compressed air. Since the fitness device repeats instant movements, it is difficult to directly provide the air pressure from the compressor **410** according to the movements of the fitness device. Therefore, in the third embodiment of the invention, the air pressure can be provided smootyly by the air tank **430** for storing the compressed air.

[0159] The filter regulator **440** is connected between the air tank **430** and the electric pneumatic proportion control valve **360**, controls the air pressure discharged from the air tank **430**, and filters the air. Specifically, the air pressure between the air tank **430** and the electric pneumatic proportion control valve **360** is adjusted, and the air provided to the electric pneumatic proportion control valve **360** is filtered, thereby eliminating impurities.

[0160] The on-off switch **450** provides external power (220V) to the controller **130**, the compressor **410**, and the solenoid valve **420**, or shuts the external power. Accordingly, when the user switches on the on-off switch **450** before the exercise, the fitness device is operated. When the user

switches off the on-off switch **450** after the exercise, the fitness device is stopped. Also, as necessary, the fitness device may be ended by force.

[0161] FIG. **11** illustrates a structure of the air cylinder and the position recognition sensor attached to the piston according to the third embodiment of the invention.

[0162] As shown in (a) of FIG. **11**, the position recognition sensor **320** according to the third embodiment of the invention may include a magnetic element **321** mounted on the head of the piston **313** and magnetic switches **322** installed at an outer wall of the air cylinder **310** to have regular intervals in a longitudinal direction. The magnetic switches **322** are operated by an approach of the magnetic element **321**, and thus, the position of the piston **313** can be known by the operation of the magnetic switch **322**.

[0163] Also, as shown in (b) of FIG. **11**, the position recognition sensor **320** according to the third embodiment of the invention may include a roller **323** and an encorder **324**. The roller **323** is in close contact with a rod of the piston **313**, and rotates while interworking with the movement of the rod. The encorder **324** is connected to the roller **323** and detects the position of the piston **313** according to a rotation number and a rotation direction. The encorder **324** is a sensor for accurately detecting the rotation degree. The encorder **24** can precisely detect the position of the piston **313** by a structure that the encorder **324** rotates while interworking with the piston **313**. In the third embodiment of the invention, in order to enhance reliability and degree of precision, the roller **323** and the encorder **324** may be used, along with the magnetic element **321** and the magnetic switch **322**.

[0164] The operation property of the fitness device having the above structure according to the third embodiment of the invention will be described.

[0165] First, when the user sits on the fitness device and switches on the on-off switch **450**, the power is supplied to the fitness device. The power supplied by the on-off switch **450** operates the controller **350**, the compressor **410**, and the solenoid valve **420**. The air pressure generated from the compressor **410** is finally provided to the air cylinder **310** through the solenoid valve **420**, the air tank **430**, the filter regulator **440**, and the electric pneumatic proportion control valve **360**.

[0166] Next, the controller **350** controls the electric pneumatic proportion control valve **360** and maintains the air cylinder **310** in a no-load state. In this state, the user pulls up the exercise lever **302**, and then, a first stroke where the piston **313** enters inside the air cylinder **310** is performed. In the state that the exercise lever **302** is maximally pulled up, by recognizing the position of the head of the piston **313** through the position recognition sensor **320**, the controller **350** measures the maximum exercise stroke according to physique of the user. After that, the piston **313** is returned to perform a next operation.

[0167] Next, the controller **350** controls the electric pneumatic proportion control valve **360** and maintains the air cylinder **310** in a maximum exercise load state. In this state, the user pulls up the exercise lever **302**, and then, a second stroke where the piston **313** enters inside the air cylinder **310** is performed. Here, in the second stroke, the piston **313** does not need to enter inside the air cylinder **310** by a degree same as a degree in the first stroke. It is sufficient to provide maximum repulsive force against the maximum exercise load. In the state that the maximum exercise load is applied, by detecting the exercise load applied to the piston **313** through the load cell **330**, the controller **350** can measure the maximum muscular strength value according to physique of the user. After that, the piston **313** is returned to perform a next operation.

[0168] Next, the controller **350** sets a basic exercise load value suitable for the user by using the maximum exercise stroke and the maximum muscular strength value. For example, the basic exercise load value is set to the value corresponding to 30~50% of the maximum muscular strength value in a stroke range corresponding to the maximum exercise stroke. In the case of patients in rehabilitation or the old and the infirm, about 30% is preferable. In the case of general users, about 50% is preferable. The ratio may be varied as necessary, and the range beyond 30%~50% may be possible.

[0169] Next, the controller **350** controls the electric pneumatic proportion control valve **360** and maintains the air cylinder **310** in an initial exercise load state. In this state, the user pulls up the exercise lever **302**, and then, a third stroke that the piston **313** enters inside the air cylinder **310** is performed. In this time, by using an exercise stroke from an initial point to a final point and exercise time from the initial point to the final point, the exercise speed in each stroke is measured.

[0170] Next, the controller **350** compares the measured exercise speed information with the predetermined exercise speed information. When the measured exercise speed is smaller than the predetermined exercise speed, the compensation for decreasing the basic exercise load value is performed. When the measured exercise speed is larger than the predetermined exercise speed, the compensation for increasing the basic exercise load value is performed. After that, the piston **313** is returned to perform a next operation. The compensated basic exercise load value becomes a normal exercise load value. From the fourth stroke, the set normal exercise load value is provided and the normal exercise is performed.

[0171] Accordingly, the exercise load suitable for the user can be automatically set. Also, the users that cannot set the exercise load (for example, the blind, the old and the infirm, patients in rehabilitation, and so on) can conveniently set the exercise load without an additional input of the exercise load value.

[0172] FIG. **12** is a graph of the muscular strength value with respect to the exercise position in each stroke of the fitness device according to the third embodiment of the invention.

[0173] As shown in FIG. **12**, the fitness device according to the third embodiment of the invention includes a pneumatic system, and a position recognition sensor **320** and a load cell **330** mount on the pneumatic system. Thereby, the muscular strength value according to the exercise positions in each stroke can be easily measured. Accordingly, in the third embodiment of the invention, since the muscular strength value according to the exercise position in each stroke is stored as a data after the third stroke, exercise information of the user can be generated. That is, it is used for information for the muscular strength enhancement, and information for exercise habit in each stroke, information for muscle damage or activation. Specifically, in the case of patients in rehabilitation, it may be used for experts as treatment and prescription data.

[0174] On the other hand, as shown in FIG. **12**, when the user exercises the muscles using the fitness device, generally, the muscular strength values of the stroke at the initial point and the final point are low and the muscular strength value of the stroke at the middle point is high. It is because, for

example, in the case of press-ups, the relatively low muscular strength is generated at the both end portions of a biceps and the relatively high muscular strength is generated at the middle portion of the biceps. That is, the exercise position at the each stroke practically corresponds to the muscular portion of the user, and, in this case, the muscular strength value is generated at the corresponding muscular portion.

[0175] Therefore, the third embodiment of the invention may be used as shown in FIG. **13**.

[0176] FIG. **13** is a graph of the exercise load with respect to the exercise position in each stroke of the fitness device according to the third embodiment of the invention.

[0177] As shown in FIG. **13**, in the third embodiment of the invention, the normal exercise load value can be controlled and set according to the exercise position in the each stroke after the third stroke. That is, unlike the conventional fitness device, the fitness device according to the third embodiment of the invention can freely control the exercise load at every exercise portion during even one stroke using the air cylinder **310**, the position recognition sensor **320**, the controller **350**, and the electric pneumatic proportion control valve **360**.

[0178] By using this, in the fitness device according to the third embodiment of the invention, the exercise portion of the piston **313** in each stroke corresponds to the muscular portion that is exercised. And thus, the normal exercise load value can increase at an exercise position corresponding to a muscular portion to be activated.

[0179] For example, the patient in rehabilitation having the damaged middle portion of the biceps can be effectively rehabilitated as follows. That is, the exercise load value is set according to the curve (a) or (c) of FIG. **13**, and thus, the muscular portions at both sides of the damaged muscular portion are activated. And then, the damaged muscular portion is activated according to the curve (b) of FIG. **13**. In this time, the exercise according to the curve (a) of FIG. **13** and the curve (c) of FIG. **13** are done respectively or are done at the same time.

[0180] In this time, the rehabilitation uses the muscular strength value data according to the exercise position in each stroke shown in FIG. **12**, and thus, the degree and the result of the rehabilitation can be easily evaluated.

[0181] In addition, the fitness device according to the third embodiment of the invention further includes an input panel for adjusting the normal exercise load value. Experts such as doctors or rehabilitation therapists can easily give exercise prescription such as curves (a) to (c) of FIG. **13** using the input panel. On the input panel, the muscular strength value data, the exercise number data, the exercise time data, and so on can be displayed.

[0182] Therefore, the fitness device according to the third embodiment of the invention can activate the muscle with consideration of the damaged portion of the muscle.

[0183] On the other hand, the fitness device according to the third embodiment of the invention further includes an emergency stopping button (not shown) for inducing an emergency stop of the exercise. When the emergency stopping button is pressed, the controller **350** can rapidly change the normal exercise load value provided from the fourth stroke to a no load value. Accordingly, when the emergency stopping button is pressed, the exercise load of the air cylinder **310** rapidly becomes zero (0) and the air pressure is instantly eliminated. That is, the fitness device according to the third embodiment of the invention is safer than a fitness device using the conventional metal weight.

[0184] On the other hand, the operations of the first to third strokes are guided by a display panel. Particularly, for the blind, the operations of the first to third strokes are preferably guided by a voice. Also, the emergency stopping button may be guided also.

Fourth Embodiment

[0185] FIG. **14** illustrates an exercise management system according to a fourth embodiment of the invention.

[0186] As shown in FIG. **14**, an exercise management system according to a fourth embodiment of the invention includes a fitness device **500**, a central server device **600**, and a terminal device **700**.

[0187] The fitness device **500** includes a single-acting air cylinder, an electric pneumatic proportion control valve, a position recognition sensor, and a controller. The single-acting air cylinder provides an inner air pressure as exercise load. The electric pneumatic proportion control valve is connected to the air cylinder and controls the exercise load of the air cylinder according to an input voltage value. The position recognition sensor detects a number of a reciprocal movement of a piston of the air cylinder. The controller converts the input voltage value and the number of the reciprocal movement of the piston to exercise load information and exercise number information.

[0188] Here, the electric pneumatic proportion control valve inhales or exhausts by interworking with the reciprocal position of the piston so that the exercise load can be constantly maintained according to the input voltage value. Thus, the air pressure of the air cylinder can be constantly controlled.

[0189] Also, the position recognition sensor is a proximity sensor or a piezoelectric sensor for detecting the reciprocal movement of the piston.

[0190] Therefore, the fitness device **500** according the fourth embodiment of the invention has structure, function, and operation same as or similar to the fitness devices according to the first to third embodiments of the invention.

[0191] By the above structure, the input voltage value is converted to the exercise load information and the number of the reciprocal movement of the piston is automatically detected and converted to the exercise number information. Accordingly, the fitness device **500** according to the fourth embodiment of the invention can accurately and simply generate exercise data without a record of the user or a personal trainer.

[0192] On the other hand, the fitness device **500** includes a plurality of fitness devices having different exercise types. Each fitness device is equipped with a MD reader (not shown, it may be built in the controller). Thus, by using RFID tag (not shown) possessed by the user, the user of the fitness device and the used fitness device can be identified, and the exercise time can be checked. That is, by employing a RFID system, the exercise data including member information of the user, type information of the fitness device, and the exercise time information can be generated simply and accurately.

[0193] Accordingly, the exercise management system according to the fourth embodiment of the invention can collect the exercise data regarding the user of the fitness device accurately and reliably.

[0194] The central server device **600** receives the exercise data including the exercise load information and the exercise number information from the fitness device **500**, and generates exercise statistical data. Also, the central server device

600 compares the exercise statistical data and the predetermined exercise management data, and generates exercise prescription data.

[0195] The exercise statistical data is data that the exercise load information, the exercise number information, the member information of the user, the typ information of the fitness device, and the exercise time information included in the exercise data are itemized and organized according to the user's request.

[0196] In addition, the exercise management data is at least one of management information of the fitness device, management information of a member, management information of exercise of a member, management information of muscular strength of the member in the fitness device of respective type. That is, the exercise management data includes overall information regarding the user. This information is continuously managed between the first used point and the finally used point, and is stored and managed at the central server device. Particularly, if an initial physical condition of the user and an exercise goal are entered, the management information of the exercise of the member including a future exercise method (such as, an exercise period, an exercise type, an exercise weight, an exercise number and so on) is automatically set according to the input information. The management information of the exercise of the member is stored at the central server device for each user. The management information of the exercise of the member is exercise management data being a basis that is compared with the exercise statistical data.

[0197] Also, the exercise prescription data is data prescribed by comparing the exercise statistical data and the exercise management data. The exercise prescription data informs an insufficiently exercised portion or an excessively exercised portion by comparing an actual exercise amount and a goal exercise amount, and prescribes future exercise goal and method.

[0198] Therefore, by the central server device **600**, the exercise management of the user can be carried out systematically.

[0199] The terminal device **700** receives the exercise statistical data, the exercise management data, and the exercise prescription data from the central server device **600** and displays them. The terminal device **700** is composed of a computer, a smart phone, and so on, and the user can confirm the above data.

[0200] On the other hand, in the exercise management system according to the fourth embodiment of the invention, exercise control data for compulsively controlling the exercise load and the exercise number of the fitness device **500** according to the exercise prescription data may be input through the terminal device **700**, and may be transmitted to the central server device **600**.

[0201] In addition, the fitness device **500** receives the exercise control data from the central server device **600**, and controls the input voltage value of the electric pneumatic proportion control valve to maintain the exercise load of the exercise control data until the exercise number of the exercise control data is achieved. After the exercise number of the exercise control data is achieved, the fitness device **500** eliminates the air pressure of the air cylinder and ends the exercise control, thereby safely ending the exercise control.

[0202] Accordingly, the exercise management information can be provided to the user, and the exercise amount and the exercise load can be easily controlled according to the exercise prescription information without a trainer. That is, the exercise of the user can be compulsively controlled according to the exercise prescription. Thus, it is suitable for the user not recognizing the prescribed exercise amount accurately or the weak-willed user who is difficult to perform the prescribed exercise amount. In addition, it may be preferably applied to a patient in rehabilitation who can not control the exercise amount or the exercise load arbitrarily and is needed to be controlled.

[0203] In the conventional exercise management, the exercise amount is recorded, the exercise is prescribed, and the exercise amount is controlled (as necessary) by the personal trainer. Various techniques for an automatization using a digital system have been attempted. However, since the actual fitness device is an analog device, it is difficult to apply a digital device to the analog fitness device. On the other hand, in the fourth embodiment of the invention, the operation and the control of the fitness device are digitalized on the whole, and thus, the above problems can be solved. Thus, the fitness device of the fourth embodiment of the invention can be easily grafted onto the exercise management system. Also, in the fourth embodiment of the invention, the exercise management information and the exercise prescription information are generated and displayed. In addition, the fitness device can be also controlled in order to direct control the exercise amount of the user.

[0204] FIG. **15** is a flow chart illustrating an exercise management method according to the fourth embodiment of the invention.

[0205] First, a plurality of fitness devices for different exercise types are equipped. Each of the fitness devices includes a single-acting air cylinder, an electric pneumatic proportion control valve, a position recognition sensor, and a controller. The single-acting air cylinder provides an inner air pressure as exercise load. The electric pneumatic proportion control valve is connected to the air cylinder and controls the exercise load of the air cylinder according to an input voltage value. The position recognition sensor detects the number of a reciprocal movement of the piston of the air cylinder. The controller converts the input value and the number of the reciprocal movement of the piston to the exercise load information and the exercise number information. Also, each fitness device is equipped with a RFID reader. Thus, by using MD tag possessed by the user, the user of the fitness device and the used fitness device are identified and the exercise time is checked (S**610**). Accordingly, exercise data is collected.

[0206] Next, a central server device receives the exercise data including at least one of the member information of the user, the type information of the fitness device, the exercise load information, the exercise number information, or the exercise time information, and generates exercise statistical data (S**620**).

[0207] Next, an exercise prescription data is generated by comparing the exercise statistical data and the predetermined exercise management data, and the exercise prescription data, the exercise statistical data, and the predetermined exercise management data are displayed on a terminal device (S**630**).

[0208] Specifically, for example, when it is supposed that a number of members of a health club (gym) or fitness center is about 100 and a number of the fitness devices is 15, the above equipment can be realized by one host computer (the central server device), one antenna-integrated RFID reader, and one hundred MID tags for every member. First, the RFID tag of a card shape is provided to each user. The user uses the RFID

tag to open own locker door. In this time, the time for starting the use of the health club is checked. Next, the user is positioned on the wanted fitness device. Next, the exercise number of the repeat exercises is calculated by an exercise number sensor of the air cylinder. Next, the user moves to another fitness device and exercises. Next, after finishing all exercise, the user closes the locker door and sets. The exercise amount of the user is checked during the exercise without realizing it, and is calculated and organized according to each fitness device and each date. Thus, it can act as roles of a trainer that suggests an exercise goal and/or a method according to the exercise tendency through the organized data.

[0209] On the other hand, after the above steps, based on exercise prescription data displayed on the terminal device, it is determined whether the exercise is compulsively controlled or not (S**640**).

[0210] Next, when a compulsive control is selected, exercise control data for compulsively controlling the exercise load and the exercise number of the fitness device according to the exercise prescription data is input through the terminal device (S**650**).

[0211] Next, the fitness device receives the exercise control data. And then, the fitness device controls the input voltage value of the electric pneumatic proportion control valve and maintains the exercise load of the exercise control data until the exercise number of the exercise control data is achieved (S**660**).

[0212] Next, after achieving the exercise number, the air pressure of the air cylinder is eliminated and the exercise control is ended (S**670**).

Other Embodiments

[0213] (A) A fitness device according to an embodiment of the invention can prevent overload, which is generated by an increase of air pressure, by additionally installing an overload protective valve between a compressor and a solenoid valve.

[0214] (B) Since a fitness device according to an embodiment of the invention is used at home or at a gym, a silencer to an air entrance may be attached. Thus, the noise generated from the air entrance positioned at a side that is open and the air discharged therethrough can be reduced.

[0215] Therefore, the above technical features of the invention may be achieved through other specific embodiments by skilled person in the art to which the invention pertains without changing the technical features or necessary property

[0216] Therefore, the above embodiments are just illustrative, and the invention is not limited thereto. The scope of the invention is represented by the appended claims. Thus, various modifications of the embodiments are possible within the scope of the invention defined by the appended claims.

What is claimed is:

1. A fitness device, wherein the fitness device using air pressure of a cylinder as an exercise load, comprising:

an air cylinder in which air pressure is maintained according to an exercise load value;

a position recognition sensor for generating a position recognition signal when a piston of the air cylinder approaches a set position of a load increase of a top or a bottom of cylinder;

a controller for generating a load increase signal for increasing exercise load according to the position recognition signal; and

an electric pneumatic proportion control valve for maintaining air pressure value of the air cylinder according to the exercise load value set by the controller and for increasing the air pressure of the air cylinder by 10~20% for a predetermined time by receiving the load increase signal.

2. The fitness device according to claim **1**, wherein the air cylinder is a single-acting air cylinder, and

wherein the electric pneumatic proportion control valve is connected to one air chamber of air chambers divided by a head of the piston, and controls air entered or exited in each stroke to have sane air pressure value at same exercise load value although a position of the piston changes.

3. The fitness device according to claim **1**, wherein the controller comprises:

a load setting portion where the exercise load value is set,

a load-increase-signal generating portion for generating the load increase signal,

a type changing portion for changing a type of exercise, and

an emergency stopping portion for inducing an emergency stop of the exercise.

4. The fitness device according to claim **1**, wherein the electric pneumatic proportion control valve maintains the air pressure of the air cylinder by keeping opening degree at blackout to have opening degree before the blackout.

5. The fitness device according to claim **1**, further comprising an electric pneumatic bidirectional solenoid valve,

wherein one end of the electric pneumatic bidirectional solenoid valve is connected to the electric pneumatic proportion control valve and the other end of the electric pneumatic bidirectional solenoid valve is connected to each of air entrances of the air chambers divided by the piston of the air cylinder, and

the electric pneumatic bidirectional solenoid valve connects from the electric pneumatic proportion control valve to one chamber of the air chambers selectively and provides bidirectional exercise load.

6. The fitness device according to claim **1**, further comprising:

a compressor for compressing air;

a solenoid valve connected to the compressor, the solenoid valve preventing oil leak and exhausting remain pressure;

an air tank connected to the solenoid valve, wherein the air tank for storing the compressed air;

a filter regulator connected between the air tank and the electric pneumatic proportion control valve, wherein the filter regulator for controlling the air pressure of the air discharged from the air tank and for filtering the air; and

an on-off switch for supplying an external power to the controller, the compressor, and the solenoid valve or for shutting the external power.

7. A fitness device, comprising:

an air cylinder for providing an inner air pressure as exercise load;

a piston connected to an exercise lever, wherein a first stroke of the piston being for measuring a maximum exercise stroke, a second stroke of the piston being for measuring a maximum muscular strength value, and a third stroke of the piston being for compensating an exercise load value;

a position recognition sensor installed at the air cylinder or the piston, wherein the position recognition sensor for

detecting an exercise position of the piston and generating an exercise position signal;

a load cell installed at a head of the piston, wherein the load cell for detecting the exercise load applied to the piston and generating an exercise load signal;

a timer for detecting time of each stroke and generating an exercise time signal;

a controller, wherein the controller for setting the air cylinder to a no load value and measuring the maximum exercise stroke by the exercise position signal during the first stroke, the controller for setting the air cylinder to a maximum load value and measuring the maximum muscular strength value by the exercise load signal during the second stroke, the controller for setting the air cylinder to a basic exercise load value by using the maximum exercise stroke and the maximum muscular strength value during the third stroke, and the controller for setting a normal exercise load value from the fourth stroke by compensating the basic exercise load value by using exercise speed measured by the exercise position signal and the exercise time signal of the third stroke; and

an electric pneumatic proportion control valve for maintaining the air pressure value of the air cylinder in proportion to the exercise load value set by the controller.

8. The fitness device according to claim **7**, wherein the position recognition sensor comprises a magnetic element mounted on the head of the piston, and magnetic switches mounted to have regular intervals in a longitudinal direction at the air cylinder and are operated by an approach of the magnetic element.

9. The fitness device according to claim **7**, wherein the position recognition sensor comprises a roller being in close contact with a rod of the piston and being rotated by interworking with an movement of the rod, and an encorder being connected to the roller and detecting a position of the piston according to a rotation number and a rotation direction.

10. The fitness device according to claim **7**, wherein the fitness device stores muscular strength values according to the exercise positions of every stroke as data, after the third stroke.

11. The fitness device according to claim **7**, wherein the fitness device controls and sets the normal exercise load value according to the exercise position of every stroke, after the third stroke.

12. The fitness device according to claim **11**, wherein the exercise position of the piston in each stroke corresponds to an exercised muscle area, and the normal exercise load value increase at the exercise position corresponding to a muscle area to be activated.

13. The fitness device according to claim **11**, further comprising:

an input panel for controlling the normal exercise load value.

14. The fitness device according to claim **7**, further comprising:

an emergency stopping button for inducing an emergency stop of the exercise,

wherein the controller rapidly changes the normal exercise load value supplied from the fourth stroke to a no load value when the emergency stopping button is operated.

15. An exercise management system, comprising:

a fitness device comprising a single-acting air cylinder for providing an inner air pressure of the air cylinder as exercise load, an electric pneumatic proportion control valve being connected to the air cylinder and controlling the exercise load of the air cylinder according an input voltage value, a position recognition sensor for detecting a number of a reciprocal movement of a piston of the air cylinder, and a controller converting the input voltage value and the number of the reciprocal movement of the piston to exercise load information and exercise number information;

a central server device for generating exercise statistical data by receiving exercise data comprising the exercise load information and the exercise number information from the fitness device and for generating exercise prescription data by comparing the exercise statistical data and predetermined exercise management data; and

a terminal device for receiving the exercise statistical data, the exercise management data, and the exercise prescription data from the central server device and displaying them.

16. The exercise management system according to claim **15**, wherein the fitness device comprises a plurality of fitness devices of different exercise types, and each of the fitness devices comprises a RFID reader, and

a user of the fitness device is identified, the used fitness device is identified, and exercise time is checked by identifying a MID tag possessed by the user.

17. The exercise management system according to claim **15**, wherein the exercise data comprises at least one of member information of a user, type information of the fitness device, or exercise time information.

18. The exercise management system according to claim **15**, wherein the exercise management data comprises at least one of management information of the fitness device, member management information, exercise management information of the member, or muscular strength management information according s type of the fitness device.

19. The exercise management system according to claim **15**, wherein the terminal device receives an exercise control data for compulsively controlling the exercise load and the exercise number of the fitness device according to the exercise prescription data and transmits the exercise control data to the central server device, and

the fitness device receives the exercise control data from the central server device, and controls the input voltage value of the electric pneumatic proportion control valve and maintains the exercise load of the exercise control data until the exercise number of the exercise control data is accomplished, and ends the exercise control by eliminating the air pressure of the air cylinder after the exercise number is accomplished.

20. An exercise management method, comprising steps of

identifying a user and a used fitness device and checking exercise time by identifying a FRID tag possessed by the user of the fitness device, wherein the fitness device comprising a single-acting air cylinder providing an inner air pressure as exercise load, an electric pneumatic proportion control valve being connected to the air cylinder and controlling the exercise load of the air cylinder according an input voltage value, a position recognition sensor for detecting a number of a reciprocal movement of a piston of the air cylinder, and a controller for converting the input voltage value and the number of the reciprocal movement of the piston to exercise load information and exercise number information, wherein the

fitness device comprises a plurality of fitness devices of different exercise types, and each of the fitness devices comprises a RFID reader, and

generating exercise statistical data by a central server device through receiving at least one of member information of the user, type information of the fitness device, the exercise load information, the exercise number information, or the exercise time information; and

generating the exercise prescription data by comparing the exercise statistical data and predetermined exercise management data and displaying the exercise statistical data, the exercise management data, and the exercise prescription data on a terminal device.

21. The exercise management method according to claim **20**, further comprising steps of:

entering an exercise control data for compulsively controlling the exercise load and the exercise number of the fitness device according to the exercise prescription data;

maintaining the exercise load of the exercise control data by controlling the input voltage value of the electric pneumatic proportion control valve until the exercise number of the exercise control data is accomplished, and

ending the exercise control by eliminating the air pressure of the air cylinder after the exercise number is accomplished.

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