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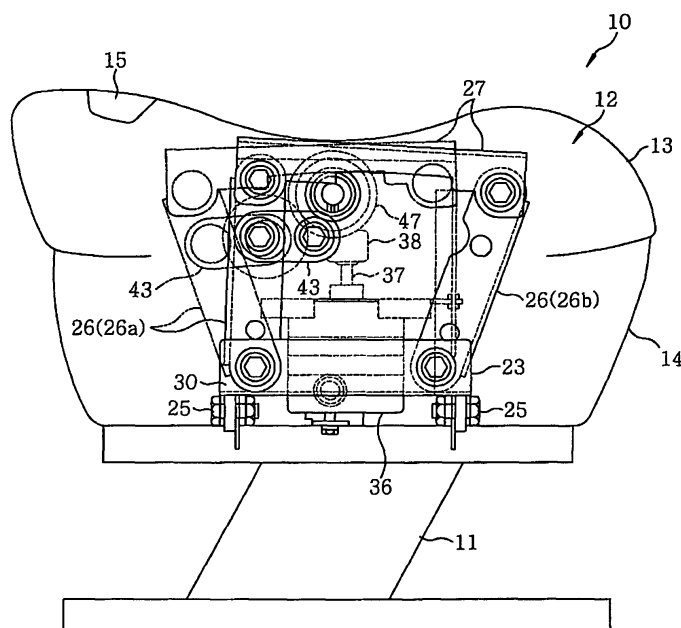
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(54) **Rocking-type exercise device**

(57) A rocking-type exercise device (10) includes a seat (13) on which a user can sit, a seat rocking unit (12) for reciprocating the seat at least in one direction, a control unit for controlling the seat rocking unit so as to reciprocate the seat, and a detector unit for detecting a user's exercise posture to obtain detected information.

The control unit includes a feedback stimulus output unit for comparing the detected information obtained by the detector unit with a target value and for outputting, if a difference exists between the detected information and the target value, a feedback stimulus by which to make the detected information come close to the target value.

FIG. 1



Description

Field of the Invention

[0001] The present invention relates to a rocking-type exercise device for applying an exercise load to a user sat on a seat by subjecting the seat to rocking movement.

Background of the Invention

[0002] Conventionally, there are proposed a variety of rocking-type exercise devices for applying an exercise load to a user sat on a seat by subjecting the seat to rocking movement. The rocking-type exercise devices are simple and convenient exercise machines that can be used by anybody from children to old persons. The rocking-type exercise devices have been spread to rehabilitation-purpose medical institutions and then to general households. One typical prior art example of the rocking-type exercise devices is disclosed in, e.g., Japanese Patent Laid-open Publication No. 2006-149468.

[0003] In the rocking-type exercise device disclosed in Japanese Patent Laid-open Publication No. 2006-149468, a pressure sensor or the like is provided in at least one of, e.g., the upper surface of the seat, the side surface of the seat (or the saddle flap) and the inside of the stirrup. The exercise posture of a user is determined from the information provided by the pressure sensor. In this rocking-type exercise device, the seat is configured to make reciprocating movement in response to the notification of an exercise posture based on the detected information or in response to the detected information itself.

[0004] Although the rocking-type exercise device cited above proposes a configuration in which a notification unit is used to urge a user to correct his or her posture, it fails to suggest a method for accurately leading the user's posture or motion to a target one. Thus, demand has existed for the development of a rocking-type exercise device capable of bringing the user's posture into close proximity to a target posture with increased accuracy.

Summary of the Invention

[0005] In view of the above, the present invention provides a rocking-type exercise device capable of accurately leading the user's exercise posture to a target exercise posture.

[0006] In accordance with a first aspect of the invention, there is provided a rocking-type exercise device including:

a seat on which a user can sit; a seat rocking unit for reciprocating the seat at least in one direction; a control unit for controlling the seat rocking unit so as to reciprocate the seat; and a detector unit for detecting a user's exercise posture to obtain detected

information, wherein the control unit includes a feedback stimulus output unit for comparing the detected information obtained by the detector unit with a target value and for outputting, if a difference exists between the detected information and the target value, a feedback stimulus by which to make the detected information come close to the target value.

[0007] With such configuration, by outputting the feedback stimulus by which to make the detected information come close to the target value depending on the difference between the detected information and the target value, it is possible to accurately lead the user's exercise posture to a target exercise posture corresponding the target value. The term "feedback stimulus" used herein denotes a stimulus for guiding the user's exercise posture by at least one of a sound, an image, a seat operation amount and a seat operation pattern. Hereinafter, the term "feedback stimulus" will be used in this sense.

[0008] The feedback stimulus output unit may be kept unchanged in meaning but changed in expression over time.

[0009] In this regard, description will be made on a sound as the feedback stimulus. In case where the user takes a target exercise posture, it may be conceivable to generate feedback stimuli identical in meaning but differing in expression, e.g., voices saying "good job", "it's OK" and "keep it up". By outputting the feedback stimuli identical in meaning but differing in expression over time, it becomes possible to avoid application of monotonous stimuli and to keep the user from getting weary. This makes it possible to keep the user motivated. Even in an instance where the user has a difficulty in understanding a specific feedback stimulus, it is possible to help the user understand the feedback stimulus by outputting a feedback stimulus of other expression. This assists in coping with the difference among individual users.

[0010] The feedback stimulus output unit may be configured to redefine the target value or the feedback stimulus based on the detected information, if the detected information fails to come close to the target value for a predetermined time period in spite of the outputting of the feedback stimulus by which to make the detected information come close to the target value.

[0011] With such configuration, it is possible to set a user-specific target value or to output a user-specific feedback stimulus. In addition, the above configuration makes it possible to reduce the target value or to output a safety-purpose feedback stimulus. As a result, the user can safely use the present device with no overwork even when the user has reduced physical strength or when the target value set at first is too high.

[0012] In the rocking-type exercise device, if the detected information is kept smaller than the target value for a predetermined time period, the feedback stimulus output unit may reduce the target value or output a safety-purpose feedback stimulus in order for the seat to safely make the reciprocating movement.

[0013] With such configuration, the user can safely use the present device with no overwork even when the user has reduced physical strength or when the target value set at first is too high.

[0014] In the rocking-type exercise device, the feedback stimulus output unit may be configured to stop outputting the feedback stimulus, if the detected information fails to come close to the target value for a predetermined time period in spite of the outputting of the feedback stimulus by which to make the detected information come close to the target value.

[0015] In other words, if the detected information fails to come close to the target value, it is determined that the target value is too high or the user gets tired. Thus, the feedback stimulus output unit ceases to output the feedback stimulus. This makes it possible for the user to safely perform an exercise in a favored posture with no overwork, instead of compelling the user to do an exercise at the target value.

[0016] In the rocking-type exercise device, the detector unit may include a plurality of posture detector units for detecting postures of different bodily parts of the user to get a plurality of detected posture information, and wherein the feedback stimulus output unit may be configured to output feedback stimuli reflecting the difference between the detected posture information and the target value in the order of greater deviation of the detected posture information from the target value.

[0017] In other words, depending on the difference between the detected information for the respective bodily parts and the target value, feedback stimuli are outputted one after another in the order of greater deviation of the detected information from the target value. By merely moving the bodily parts in response to the feedback stimuli thus outputted, the user can accurately take a target exercise posture (corresponding to the target value).

[0018] In the rocking-type exercise device, the detector unit may include a plurality of posture detector units for detecting postures of different bodily parts of the user, the posture detector units being given a priority order, and wherein the feedback stimulus output unit may be configured to output feedback stimuli in the priority order.

[0019] In other words, the posture detector units are given a priority order in which to output feedback stimuli regardless of the difference between the detected information of the posture detector units and the target value. By outputting feedback stimuli in the priority order, it is possible to urge the user to accurately take the target exercise posture without having to recognize the operation order which is important in leading the user to the target exercise posture.

[0020] In the rocking-type exercise device, the feedback stimulus output unit may include a notification unit through which to notify the user of the feedback stimulus or the feedback stimuli by at least one of a voice and an image, and wherein the feedback stimulus output unit may be configured to output, when notification is performed by the notification unit, the feedback stimulus or

the feedback stimuli together with incidental effects varying with the difference between the detected information and the target value.

[0021] In other words, at least one of the voice and the image is not merely outputted as the feedback stimulus or the feedback stimuli but outputted together with incidental effects varying with the difference between the detected information and the target value. This helps prevent the feedback stimulus or the feedback stimuli from becoming monotonous, which makes it possible to keep the user highly motivated.

[0022] In the rocking-type exercise device, the feedback stimulus output unit may be configured to output the feedback stimulus or the feedback stimuli after altering the emotion-appealing information contained in the feedback stimulus or the feedback stimuli depending on the difference between the detected information and the target value.

[0023] Use of this configuration helps prevent the feedback stimulus or the feedback stimuli from becoming monotonous, which makes it possible to keep the user highly motivated.

[0024] In the rocking-type exercise device, the feedback stimulus output unit may be configured to output the feedback stimulus or the feedback stimuli in such a way as to remind the user of the moving images of the bodily parts.

[0025] In this regard, description will be made on a sound as the feedback stimulus. In order to remind the user of the moving images of the bodily parts, the names of the user's bodily parts may be mentioned by, e.g., saying "bend the knees" or "stretch the legs" or a metaphor may be used by, e.g., saying "make round as if hugging the knees" or "stretch the legs straight". This makes it possible to accurately lead the user to the target exercise posture (corresponding to the target value). Accordingly, it is possible to draw the user's attention to the bodily parts at issue, which assists in effectively leading the user to the target exercise posture.

[0026] With the present invention, it is possible to provide a rocking-type exercise device capable of accurately leading the user's exercise posture to a target exercise posture.

Brief Description of the Drawings

[0027] The objects and features of the present invention will become apparent from the following description of embodiments, given in conjunction with the accompanying drawings, in which:

Fig. 1 is a side view showing the overall configuration of a rocking-type exercise device in accordance with the present embodiment;

Fig. 2 is a side view of a seat rocking mechanism employed in the rocking-type exercise device;

Fig. 3 is a plan view of the seat rocking mechanism;

Fig. 4 is a front view of the seat rocking mechanism;

Fig. 5 is a view for explaining sensors employed in the rocking-type exercise device;

Fig. 6 is a block diagram illustrating a schematic system configuration of the rocking-type exercise device;

Fig. 7 is a flowchart for explaining a method of outputting a vocal feedback stimulus;

Fig. 8 is a view for explaining a feedback data selection table;

Figs. 9A and 9B are views for explaining feedback data selection tables in accordance with additional examples;

Fig. 10 is a view for explaining a feedback data selection table in accordance with a further additional example;

Fig. 11 is a view for explaining a feedback data selection table in accordance with a still further additional example;

Fig. 12 is a flowchart for explaining a method of outputting a vocal feedback stimulus in accordance with an additional example;

Fig. 13 is a flowchart for explaining a method of outputting a vocal feedback stimulus in accordance with a further additional example;

Fig. 14 is a view for explaining a feedback data selection table in accordance with an additional example;

Figs. 15A and 15B are views for explaining exercise postures in accordance with additional examples, and Fig. 15C is a view for explaining a feedback data selection table;

Figs. 16A, 16B and 16C are views for explaining feedback data selection tables in accordance with additional examples;

Figs. 17A, 17B and 17C are views for explaining exercise postures in accordance with additional examples;

Fig. 18 is a view for explaining a feedback data selection table in accordance with an additional example;

Fig. 19 is a view for explaining a feedback data selection table in accordance with a further additional example; and

Fig. 20 is a view for explaining a feedback data selection table in accordance with a still further additional example.

Detailed Description of the Preferred Embodiments

[0028] Hereinafter, one embodiment of the present invention will be described with reference to Figs. 1 through 9.

[0029] As shown in Fig. 1, the rocking-type exercise device 10 includes a leg 11 mounted on a floor surface not shown in the drawings, a seat rocking mechanism 12 as a seat rocking unit fixed to the top end of the leg 11, and a seat 13 fixed to the upper portion of the seat rocking mechanism 12. The seat 13, on which a user can sit, has

a shape imitating a horseback or a saddle. The seat rocking mechanism 12 is configured to cause back-and-forth and left-and-right rocking motions to the seat 13. The seat rocking mechanism 12 is covered with a cover 14 extending between the upper end of the leg 11 and the seat 13. The cover 14 is made of a pliable fabric or the like, thereby allowing the seat 13 to be rocked by the seat rocking mechanism 12. Alternatively, the cover 14 may be formed of plural kinds of other materials.

[0030] An operation unit 15 is arranged in the frontal portion (on the left side in Fig. 1) of the top surface of the seat 13. The startup, stoppage and operation state change of the seat rocking mechanism 12 are performed by operating switches (not shown) provided in the operation unit 15.

[0031] In the so-called saddle flap lying on the frontal side surface of the seat 13 and making contact with the inner part of a thigh, a pressure sensor α as a detector unit is arranged as shown in Fig. 5 to measure the pressure applied to the saddle flap. A so-called stirrup 16, on which the user's foot sole can be placed, is arranged in a rockable manner. An angle sensor β is arranged in the stirrup 16 to measure the angle of the stirrup 16 so that the angle of the knee can be estimated by a microcomputer 17 (see Fig. 6) set forth below.

[0032] Next, the seat rocking mechanism 12 will be schematically described with reference to Figs. 1 through 4.

[0033] As can be seen in Fig. 3, a base 21 of rectangular plate shape is fixed to the upper surface of the leg 11 shown in Fig. 1. Referring to Fig. 2, a pair of front and rear shaft-supporting plates 22 is installed upright in the base 21. A pair of connecting plates 24 depending from the front and rear end portions of a movable trestle 23 is arranged in an opposing relationship with the shaft-supporting plates 22. The shaft-supporting plates 22 and the connecting plates 24 are rotatably interconnected by pivot shafts 25 extending in the back-and-forth direction. The pivot shafts 25 are arranged at the transverse center of the base 21 and at two points spaced apart in the back-and-forth direction, thereby supporting the movable trestle 23 so that it can rotate in the transverse direction.

[0034] As shown in Fig. 2, a platform 27 for holding the seat 13 is arranged above the movable trestle 23 and is connected to the movable trestle 23 through connecting links 26 so that it can rock in the back-and-forth direction. More specifically, as shown in Fig. 4, a pair of side plates 30 extending in the back-and-forth direction is installed in the left and right portions of the movable trestle 23. As can be seen in Fig. 3, the connecting links 26 include a front link 26a arranged at the front side and a rear link 26b arranged at the rear side. Referring again to Fig. 2, the lower end portion of the front link 26a is pivotally attached to a lower pivot pin 31a provided in the front end portions of the side plates 30. The upper end portion of the front link 26a is pivotally attached to an upper pivot pin 32a provided in the front end portion of the platform 27. In addition, the lower end portion of the rear link 26b

is pivotally attached to a lower pivot pin 31b provided in the rear end portions of the side plates 30. The upper end portion of the rear link 26b is pivotally attached to an upper pivot pin 32b provided in the rear end portion of the platform 27. The front and rear lower pivot pins 31a and 31b constitute transverse shafts for supporting the connecting links 26 so that they can rotate about transverse axes. This enables the platform 27 to reciprocatingly rotate about the transverse shafts in the back-and-forth direction as indicated by an arrow M in Fig. 2. As shown in Fig. 4, the platform 27 is connected to the movable trestle 23 by the connecting links 26 and is swung in the transverse direction together with the movable trestle 23. Therefore, the platform 27 can be reciprocatingly rotated about the pivot shafts 25 in the transverse direction as indicated by an arrow N in Fig. 4.

[0035] The distance between the front and rear lower pivot pins 31a and 31b is set shorter than the distance between the front and rear upper pivot pins 32a and 32b. Therefore, the rear link 26b makes a specified angle with respect to the base 21 when the front link 26a makes a generally right angle relative to the base 21 as indicated by solid lines in Fig. 2. As a result, the rear end of the platform 27 becomes lower than the front end thereof, meaning that the platform 27 is tilted backwards. In contrast, the front link 26a makes a specified angle with respect to the base 21 when the rear link 26b makes a generally right angle relative to the base 21 as indicated by phantom lines in Fig. 2. As a consequence, the front end of the platform 27 becomes lower than the rear end thereof, meaning that the platform 27 is tilted forwards. Consequently, the seat 13 fixed to the platform 27 is caused to make tilting movement forwards and backwards.

[0036] A drive unit 35 is accommodated between the base 21 and platform 27. The drive unit 35 includes a motor 36 fixed to the base 21 so that the output shaft 37 thereof can protrude upwards. A motor gear 38 is fixed to the output shaft 37. A first gear 40 engages with the motor gear 38. The first gear 40 is coaxially fixed to a first shaft 39 whose transverse ends are pivotally supported on the platform 27. An eccentric crank 41 is connected to one end portion of the first shaft 39. The first end portion of an arm link 43 is pivotally attached to the eccentric crank 41 by a pivot pin 42, while the second end portion of the arm link 43 is pivotally attached to the front link 26a by a pivot pin 44. As the eccentric crank 41 makes eccentric circular movement with respect to the first shaft 39 upon rotation of the motor 36, the front link 26a reciprocates in the back-and-forth direction X and the seat 13 makes rocking movement in the direction indicated by the arrow M in Fig. 2. As can be seen in Figs. 2 and 3, the motor 36 (the output shaft 37), the motor gear 38, the first shaft 39, the first gear 40, the eccentric crank 41 and the arm link 43 constitute a first drive unit.

[0037] As shown in Fig. 3, an interlocking gear 45 is fixed to the first shaft 39 engages with a second gear 47

which is fixed to a second shaft 46 pivotally supported on the movable trestle 23. The upper end of an eccentric rod 48 is connected to one end (the right end in Fig. 4) of the second shaft 46 by a pivot pin 49 in an eccentric relationship with the rotational axis of the second shaft 46. The lower end of the eccentric rod 48 is rotatably connected to a connecting bracket 50 by a pivot pin 51. The connecting bracket 50 is fixed to the base 21. As the upper end of the eccentric rod 48 makes eccentric circular movement by the rotation of the second shaft 46, the movable trestle 23, namely the platform 27 and the seat 13, makes rocking movement in the direction indicated by the arrow N in Fig. 4. As can be seen in Figs. 2 through 4, the motor 36 (the output shaft 37), the motor gear 38, the first gear 40, the first shaft 39, the second shaft 46, the second gear 47 and the eccentric rod 48 constitute a second drive unit.

[0038] The gear ratios of the respective gears in the first drive unit and the second drive unit are set to ensure that the seat 13 reciprocates twice in the back-and-forth direction while reciprocating once in the transverse direction. Therefore, the seat 13 is rocked in such a way as to describe the numeral "8" when the rocking-type exercise device 10 is seen from above, consequently reproducing an operation just like horse riding.

[0039] By the first and second drive units configured as above, the seat 13 is rocked in the direction indicated by the arrow M in Fig. 2 and in the direction indicated by the arrow N in Fig. 4. As a result of this combined rocking movement, the seat 13 is rocked in the θX direction around an X-axis, the θY direction around a Y-axis and the θZ direction around a vertical axis (or a Z-axis). This enables a user to train a body balance function and an exercise function. Furthermore, three motions can be performed by a single motor 36, which assists in reducing the number of motor. This leads to ease of control and reduction in cost and size. In addition, the output shaft 37 of the motor 36 protrudes in one direction and the motor 36 is installed in vertical orientation. This makes it possible to achieve size reduction by narrowing the installation space of the seat rocking mechanism 12 including the motor 36. The seat rocking mechanism 12 is stored between the base 21 and the platform 27, which makes it possible to faithfully reproduce the desired horse riding operation.

[0040] Fig. 6 is a block diagram illustrating a system configuration of the rocking-type exercise device 10. A power supply unit 61 carried by a circuit board 60 is designed to convert a commercial alternating current inputted through a power supply plug (not shown) to a direct current of 140V or 15V and then to supply the direct current to individual circuits provided in the circuit board 60. A control circuit 62 as a control unit is mounted to the circuit board 60. The control circuit 62 includes a micro-computer 17 as a feedback stimulus output unit and a memory 63 which stores drive operation patterns and the like. The control circuit 62 is connected to a sensor unit 64, which includes the angle sensor β and the pressure

sensor α , a voice signal processing IC 65 and a database 66.

[0041] As mentioned above, the angle sensor β detects the angle of the stirrup 16. Based on the result of detection of the angle sensor β , the microcomputer 17 estimates the knee angle of a user. The pressure sensor α detects the pinching force of the user's thigh and outputs the result of detection to the microcomputer 17.

[0042] A voice data storage unit 67 and a speaker 68, which constitutes the feedback stimulus output unit and the notification unit, are connected to the voice signal processing IC 65. Thus, the voice signal processing IC 65 can notify the speaker 68 of, e.g., music data pre-stored in the voice data storage unit 67.

[0043] Tables corresponding to various kinds of operation patterns, such as a feedback data selection table group 69 and the like, are stored in the database 66.

[0044] Next, one example of the output of a vocal feedback stimulus in the rocking-type exercise device 10 of the present embodiment will be described with reference to Figs. 6 and 7.

[0045] The pinching force (pressure) of the user's thigh is detected by the pressure sensor α and the result of detection is outputted from the pressure sensor α to the microcomputer 17 of the control circuit 62 (step S100). The microcomputer 17 acquires the result of detection (step S200). After sampling the detection results for a specified time, the microcomputer 17 calculates a representative value S_n , i.e., an average value of the detection results outputted from the pressure sensor α (step S300).

[0046] Then, the microcomputer 17 compares the representative value S_n with threshold values pre-divided into a plurality of steps (five steps in the present embodiment) as illustrated in Fig. 8 (step S400). Based on a specified data selection table (see Fig. 8) within the feedback data selection table group 69 of the database 66 shown in Fig. 6, the microcomputer 17 selects the feedback voice data stored in the voice data storage unit 67 through the voice signal processing IC 65 (step S500). In the present embodiment, the threshold values are set in the order of 1V, 2V, 3V, 4V and 5V from the lower side, and the target value indicative of a target exercise posture is set equal to 3V. The feedback voice data outputted depending on the representative value S_n are also shown in Fig. 8. If the representative value S_n is equal to the threshold value 1V, the microcomputer 17 selects the data of "with far greater force.wav" which is a voice record saying "with far greater force". If the representative value S_n is equal to the threshold value 2V, the microcomputer 17 selects the data of "with a little greater force.wav" which is a voice record saying "with a little greater force". If the representative value S_n is equal to the threshold value 3V (or the target value), the microcomputer 17 selects the data of "it's OK.wav" which is a voice record saying "it's OK". If the representative value S_n is equal to the threshold value 4V, the microcomputer 17 selects the data of "relax a little bit.wav" which is a voice record saying "relax a little bit". If the representative value S_n is

equal to the threshold value 5V, the microcomputer 17 selects the data of "relax.wav" which is a voice record saying "relax".

[0047] Then, the microcomputer 17 allows the speaker 68 to output the feedback voice data selected in step S500 (step S600). Thereafter, the microcomputer 17 is operated to repeat step S100 through step S600.

[0048] By employing the afore-mentioned configuration in which a voice as a feedback stimulus is outputted from the speaker 68 depending on the difference between the target value 3V and the representative value S_n , i.e., the average value of the detection results outputted from the pressure sensor α , the user can recognize the difference between the target posture and the current posture. This makes it possible to lead the user's posture so that the representative value S_n can become equal to the target value 3V. Thus, it becomes possible to rapidly and accurately lead the user's exercise posture to the target posture.

[0049] Next, description will be made on the advantageous effects specific to the present embodiment.

[0050] The control circuit 62 as a control unit includes the pressure sensor α as a detector unit for detecting the exercise posture of the user who sits on the seat 13, and the microcomputer 17 as a feedback stimulus output unit that makes comparison between the detected information (representative value S_n) obtained in the pressure sensor α and the target value (or the threshold values 3V). Depending on the difference between the detected information and the target value, the microcomputer 17 outputs through the speaker 68 a voice for making the representative value S_n come close to the target value. By outputting the voice for making the representative value S_n come close to the target value depending on the difference between the detected information and the target value, it is possible to rapidly and accurately lead the user's exercise posture to the target exercise posture corresponding the target value.

[0051] The embodiment of the present invention may be modified as follows.

[0052] Although only one feedback data selection table is used to apply a vocal feedback stimulus to the user in the foregoing embodiment, the present invention is not limited thereto. As an alternative example, a plurality of feedback data selection tables may be used as shown in Figs. 9A and 9B.

[0053] At this time, a posture/operation determination algorithm 70 stored in the database 66 may be called out by the microcomputer 17 so that the algorithm 70 can change the feedback data selection tables of the feedback data selection table group 69 over time. In this case, it may be possible to employ a configuration in which only the wording of the voice data applied to the user is changed over time without changing the meaning thereof. More specifically, it may be conceivable to employ a configuration in which the data of "it's OK.wav" selected in case of the threshold value 3V in the foregoing embodiment is changed to the data of "keep it up.wav" which

is a voice record saying "keep it up" as illustrated in Fig. 9A and then the changed data is outputted from the speaker 68. Thereafter, the data of "keep it up.wav" is changed to the data of "good.wav" which is a voice record saying "good" as illustrated in Fig. 9B and then the changed data is outputted from the speaker 68. By outputting the vocal feedback stimuli identical in meaning but differing in expression over time, it becomes possible to avoid application of monotonous stimuli and to keep the user from getting weary. This makes it possible to keep the user motivated. Even in an instance where the user has a difficulty in understanding a specific feedback stimulus (e.g., the data of "it's OK.wav"), it is possible to help the user understand the feedback stimulus by outputting a feedback stimulus of other expression (e.g., the data of "keep it up.wav"). This assists in coping with the difference among individual users.

[0054] Although the target value is set equal to the threshold value 3V in the foregoing embodiment, the present invention is not limited thereto. As shown in Fig. 10, the threshold values 2V and 3V may be used as target values without having to limit the target value to a single one.

[0055] The configuration noted above is effective in broadening the width of target value by setting the threshold values 2V and 3V as target values, in such an instance where the representative value S_n fails to reach the target value even when a voice as a feedback stimulus has been outputted from the speaker 68 as a feedback stimulus output unit while the user using the rocking-type exercise device 10 for a predetermined time period. The broadened target value allows a user with a weak muscular force to safely use the rocking-type exercise device 10 with no overwork. By changing the target value depending on the detected information (or the representative value S_n) in this manner, it becomes possible to set a user-specific target value.

[0056] Although the voltages of 1V through 5V are used as the threshold values in the foregoing embodiment, the present invention is not limited thereto. In the feedback data selection table illustrated in Fig. 8, the threshold values are set into five steps of 1V, 2V, 3V (target value), 4V and 5V. During the course of using the rocking-type exercise device 10, the threshold values may be changed to five steps of, e.g., 0.5V, 1V, 1.8V (target value), 2.5V and 3.5V, as illustrated in Fig. 11.

[0057] The configuration by which to reduce the threshold values in the course of using the rocking-type exercise device 10 can be effectively used in such an instance where the detected information from the sensors (e.g., the pressure sensor α) fails to reach the target value (namely, in case where the detected information is smaller than the target value) even when a voice as a feedback stimulus has been outputted from the speaker 68 as a feedback stimulus output unit while the user using the rocking-type exercise device 10 for a predetermined time period. The reduction in the target value results in a reduction in exercise amount and sets a user free from

excessive burdens. Even if the target value set at first is too high, the user can safely use the rocking-type exercise device 10 with no overwork. By changing the target value depending on the detected information (or the representative value S_n) in this manner, it becomes possible to set a user-specific target value.

[0058] Alternatively, a configuration in which only the target value is changed may be employed as illustrated in Fig. 12. In the configuration shown in Fig. 12, steps for lowering the target value are added between step S300 and step S400 of the flowchart illustrated in Fig. 7. More specifically, the microcomputer 17 temporarily stores in the memory 63 the representative values, i.e., the average values of the detected information successively supplied from the pressure sensor α , as S_n , S_{n-1} and S_{n-2} in the order of latest occurrence. The microcomputer 17 compares the representative values S_n , S_{n-1} and S_{n-2} with the target value (step S301). If the representative values S_n , S_{n-1} and S_{n-2} are smaller than the target value (or if YES in step S301), the target value is multiplied by a predetermined numerical value (of smaller than 1), thereby reducing the target value into a new target value (step S302). Then, the flow proceeds to step S400 already described in respect of the foregoing embodiment. If the representative values S_n , S_{n-1} and S_{n-2} are equal to or greater than the target value (or if NO in step S301), the microcomputer 17 does not change the target value and the flow proceeds to step S400 already described in respect of the foregoing embodiment. By changing the target value depending on the detected information (or the representative value S_n) in this manner, it becomes possible to set a user-specific target value. In addition, if the detected information supplied from the detector unit (or the representative value S_n) is kept smaller than the target value for a predetermined time period, the target value is set smaller so that the rocking operation can be performed in a safe way. As a result, the user can safely use the present device 10 with no overwork even when the user has reduced physical strength or when the target value set at first is too high.

[0059] Although not specifically mentioned in the foregoing embodiment, the target value may be kept unchanged in order to safely perform the reciprocating movement, if the detected information supplied from the pressure sensor α as a detector unit remains smaller than the target value (or the threshold value 3V) for a predetermined time period. For example, it may be conceivable to employ a configuration by which to output a voice data of "it's OK.wav" or other voice data as a safety-purpose feedback stimulus through the speaker 68. Employment of this configuration helps prevent a user from taking an overload posture, thereby enabling the user to safely use the present device 10.

[0060] Although not specifically mentioned in the foregoing embodiment, it may be conceivable to employ a configuration in which, if the representative value S_n as the detected information supplied from the pressure sensor α does not come close to or gets away from the target

value (or the threshold value 3V), the feedback control is stopped by not outputting the voice as a feedback stimulus through the speaker 68, namely by ceasing to output the feedback stimulus.

[0061] More specifically, as illustrated in Fig. 13, the microcomputer 17 temporarily stores in the memory 63 the representative values, i.e., the average values of the detected information successively supplied from the pressure sensor α , as S_n , S_{n-1} and S_{n-2} in the order of latest occurrence. The microcomputer 17 calculates the difference U_n between S_n and S_{n-1} which precedes S_n , and the difference U_{n-1} between S_{n-1} and S_{n-2} which precedes S_{n-1} (step S310). Then, the microcomputer 17 determines whether the differences U_n and U_{n-1} are all smaller than zero (step S320). If the differences U_n and U_{n-1} are all determined to be smaller than zero (or if YES in step S320), a voice saying "don't overstrain if tired" is outputted through the speaker 68 (step S330). If the differences U_n and U_{n-1} are all determined to be equal to or greater than zero (or if NO in step S320), the microcomputer 17 proceeds to step S400 already described in respect of the foregoing embodiment. At the end of step S330, the microcomputer 17 asks the user, e.g., through the speaker 68, whether to terminate the feedback control for guiding the exercise posture by a voice (step S340). If the user selects the termination of feedback control using a switch not shown (or if YES in step S340), the microcomputer 17 ceases to output the voice as a feedback stimulus and stops the feedback control for guiding the exercise posture by a voice (step S350). In contrast, if the user does not select the termination of feedback control (or if NO in step S340), the flow proceeds to step S400 already described in respect of the foregoing embodiment.

[0062] As set forth above, if the detected information fails to come close to the target value, it is determined that the target value is too high or the user got tired. Thus, the microcomputer 17 ceases to output the feedback stimulus (or the voice). This makes it possible for the user to safely perform an exercise in a favored posture with no overwork, instead of compelling the user to do an exercise at the target value.

[0063] In the foregoing embodiment, only one sensor (i.e., the pressure sensor α) is used when the voice as a feedback stimulus is outputted through the speaker 68 depending on the difference between the detected information and the target value. Alternatively, a plurality of sensors (e.g., the pressure sensor α and the angle sensor β) may be used in outputting the voice as a feedback stimulus through the speaker 68.

[0064] In addition to the above, it may be conceivable to employ a configuration in which voices as feedback stimuli are outputted one after another through the speaker 68 in the order of greater deviation or badness of the detected information (or the representative value S_n) from the target value. More specifically, if the target values of the pressure sensor α and the angle sensor β are all 3V as illustrated in Fig. 14 and if the detected infor-

mation (or the representative value S_n) of the pressure sensor α is 1V with the detected information (or the representative value S_n) of the angle sensor β being 2V or 3V, the microcomputer 17 may output feedback stimuli (e.g., voices) for improving the detected information of the pressure sensor α as illustrated in Fig. 14. In other words, depending on the difference between the detected information (or the representative value S_n) for the respective bodily parts and the target value, feedback stimuli (e.g., voices) are outputted one after another in the order of greater deviation of the detected information for the respective bodily parts from the target value. By merely moving the bodily parts in response to the feedback stimuli thus outputted, the user can accurately take a target exercise posture (corresponding to the target value).

[0065] It may also be conceivable to employ a configuration in which a priority order is applied to the respective sensors α and β and voices as feedback stimuli are outputted through the speaker 68 in the priority order. For example, the user may be urged to change his or her posture from the state illustrated in Fig. 15A in which the lower half of the user's body (or the legs) is stretched and propped to the state illustrated in Fig. 15B in which the lower half of the user's body (or the legs) is bent. In this case, it is necessary to urge the user to reduce the angle of the knees prior to reducing the pinching force of the thighs. If the knee angle is not equal to the target value "small" as shown in Fig. 15C, a voice as a feedback stimulus for improving the detected information (or the representative value S_n) of the angle sensor β is outputted through the speaker 68, thereby urging the user to pay attention to the knee angle. Once the knee angle becomes equal to the target value "small", a voice as a feedback stimulus for improving the detected information (or the representative value S_n) of the pressure sensor α is outputted through the speaker 68. In other words, the pressure sensor α and the angle sensor β are given a priority order in which to output feedback stimuli (e.g., voices) regardless of the difference between the detected information of the respective sensors and the target value. By outputting feedback stimuli (e.g., voices) in the priority order, it is possible to urge the user to accurately take the target exercise posture without having to recognize the operation order which is important in leading the user to the target exercise posture.

[0066] Although not specifically mentioned in the foregoing embodiment, it may be conceivable to employ a configuration in which the emotion-appealing information of a voice is altered by changing the voice data to the ones showing encouragement or appreciation for the user's efforts. More specifically, the feedback data selection table shown in Fig. 16A may be changed to a feedback data selection table illustrated in Fig. 16B, which indicates the voice data containing the emotion-appealing information for encouragement, or a feedback data selection table depicted in Fig. 16C, which indicates the voice data containing the emotion-appealing information

for appreciation. In this case, it is preferred that the content of the emotion-appealing information is changed depending on the difference between the target value and the detected information (or the representative value S_n). Use of this configuration helps prevent the feedback stimulus from becoming monotonous, which makes it possible to keep the user motivated.

[0067] Although not specifically mentioned in the foregoing embodiment, it may be conceivable to employ a configuration by which to output a feedback stimulus specifying the names of components making contact with the user's bodily parts. For example, it may be possible to employ a configuration in which the voice data of "let's lower the stirrup.wav", i.e., a voice record saying "let's lower the stirrup", is selected when the user's posture is to be changed from the state illustrated in Fig. 17A, in which the legs are stretched, to the state shown in Fig. 17B, in which the shins are oriented vertically downwards.

[0068] Although not specifically mentioned in the foregoing embodiment, it may be conceivable to employ a configuration by which to output a feedback stimulus mentioning the user's bodily parts. For example, it may be possible to employ a configuration in which the voice data of "further stretch the knees.wav" illustrated in Fig. 19, i.e., a voice record saying "further stretch the knees", is selected when the user's posture is to be changed from the state illustrated in Fig. 17C, in which the shins are bent, to the state shown in Fig. 17B, in which the knees are stretched to some extent. Alternatively, it may be possible to employ a configuration by which to select the voice data of "stretch the knees slowly.wav" illustrated in Fig. 20, i.e., a voice record saying "stretch the knees slowly". By mentioning the names of the user's bodily parts in this manner, it is possible to lead the user to the target exercise posture (corresponding to the target value) and to draw the user's attention to the bodily parts at issue. This makes it possible to effectively lead the user to the target exercise posture.

[0069] Although the feedback stimulus is outputted in the form of a voice according to the foregoing embodiment, the present invention is not limited thereto. For example, the feedback stimulus may be a sound such as background music or the like rather than the voice. As a further alternative, the feedback stimulus may be outputted in the form of an image or the like. For example, as illustrated by dot lines in Fig. 6, it may be conceivable to employ a configuration in which the image data pre-stored in an image data storage unit 72 are outputted to an LCD 73 and notified to the user by an LCD driver 71 connected to the control circuit 62. In addition, it may be conceivable to employ a configuration by which to output a feedback stimulus regarding the change in the operation pattern or operation amount of the seat 13. For example, as indicated by dot lines in Fig. 6, it may be conceivable for the control circuit 62 to control the seat rocking mechanism 12 in such a manner as to reduce the operation speed of the seat 13 or to make the rocking

operation angle of the seat 13 substantially horizontal, thereby lessening the exercise load. This may be notified to the user by a voice or through the display of an image or the like.

[0070] Although not specifically mentioned in the foregoing embodiment, it may be conceivable to employ a configuration by which to output a feedback stimulus together with incidental effects. One example of the incidental effects is to change the sound volume, sound quality, sound pitch and peak frequency of a voice or background music outputted as a feedback stimulus. It is preferred that the degree of these effects varies with the difference between the target value and the detected information (or the representative value S_n). Use of this configuration helps prevent the feedback stimulus from becoming monotonous, which makes it possible to keep the user highly motivated.

[0071] Although the pressure sensor α and the angle sensor β are used as detector units in the embodiment and modified examples described above, the detector units may include, e.g., an image sensor γ indicated by a dot line in Fig. 6.

[0072] In the foregoing embodiment, the representative value S_n refers to the average value obtained by sampling, for a specified time period, the detected information outputted from the pressure sensor α . However, the present invention is not limited thereto. As an alternative example, the representative value S_n may be a peak value rather than the average value.

[0073] In the foregoing embodiment, the seat 13 is operated in such a way as to describe the numeral "8", consequently performing a rocking motion just like horse riding. However, the present invention is not limited thereto. As an alternative example, it may be possible to employ a configuration in which the seat 13 is allowed to make rocking motions only in the back-and-forth direction or the transverse direction.

[0074] Although the values of the threshold and the target and the like are exemplified in the embodiments described above, but the present invention is not limited thereto. The threshold value and the target value and the like may be varied as necessary.

[0075] While the invention has been shown and described with respect to the embodiments, it will be understood by those skilled in the art that various changes and modification may be made without departing from the scope of the invention as defined in the following claims.

Claims

1. A rocking-type exercise device comprising:

- a seat on which a user can sit;
- a seat rocking unit for reciprocating the seat at least in one direction;
- a control unit for controlling the seat rocking unit

- so as to reciprocate the seat; and
a detector unit for detecting a user's exercise posture to obtain detected information, wherein the control unit includes a feedback stimulus output unit for comparing the detected information obtained by the detector unit with a target value and for outputting, if a difference exists between the detected information and the target value, a feedback stimulus by which to make the detected information come close to the target value.
2. The device of claim 1, wherein the feedback stimulus outputted by the feedback stimulus output unit is kept unchanged in meaning but changed in expression over time.
 3. The device of claim 1 or 2, wherein the feedback stimulus output unit is configured to redefine the target value or the feedback stimulus based on the detected information, if the detected information fails to come close to the target value for a predetermined time period in spite of the selecting and outputting of the feedback stimulus by which to make the detected information come close to the target value.
 4. The device of claim 3, wherein, if the detected information is kept smaller than the target value for a predetermined time period, the feedback stimulus output unit reduces the target value or outputs a safety-purpose feedback stimulus in order for the seat to safely make the reciprocating movement.
 5. The device of claim 1 or 2, wherein the feedback stimulus output unit is configured to stop outputting the feedback stimulus, if the detected information fails to come close to the target value for a predetermined time period in spite of the selecting of the feedback stimulus by which to make the detected information come close to the target value.
 6. The device of claim 1, wherein the detector unit includes a plurality of posture detector units for detecting postures of different bodily parts of the user to get a plurality of detected posture information, and wherein the feedback stimulus output unit is configured to output feedback stimuli reflecting the difference between the detected posture information and the target value in the order of greater deviation of the detected posture information from the target value.
 7. The device of claim 1, wherein the detector unit includes a plurality of posture detector units for detecting postures of different bodily parts of the user, the posture detector units being given a priority order, and wherein the feedback stimulus output unit is configured to output feedback stimuli in the priority order.
 8. The device of claim 1, wherein the feedback stimulus output unit includes a notification unit through which to notify the user of the feedback stimulus or the feedback stimuli by at least one of a voice and an image, and wherein the feedback stimulus output unit is configured to output, when notification is performed by the notification unit, the feedback stimulus or the feedback stimuli together with incidental effects varying with the difference between the detected information and the target value.
 9. The device of claim 1, wherein the feedback stimulus output unit is configured to output the feedback stimulus or the feedback stimuli after altering the emotion-appealing information contained in the feedback stimulus or the feedback stimuli depending on the difference between the detected information and the target value.
 10. The device of claim 1, wherein the feedback stimulus output unit is configured to output the feedback stimulus or the feedback stimuli in such a way as to remind the user of the moving images of the bodily parts.

FIG. 1

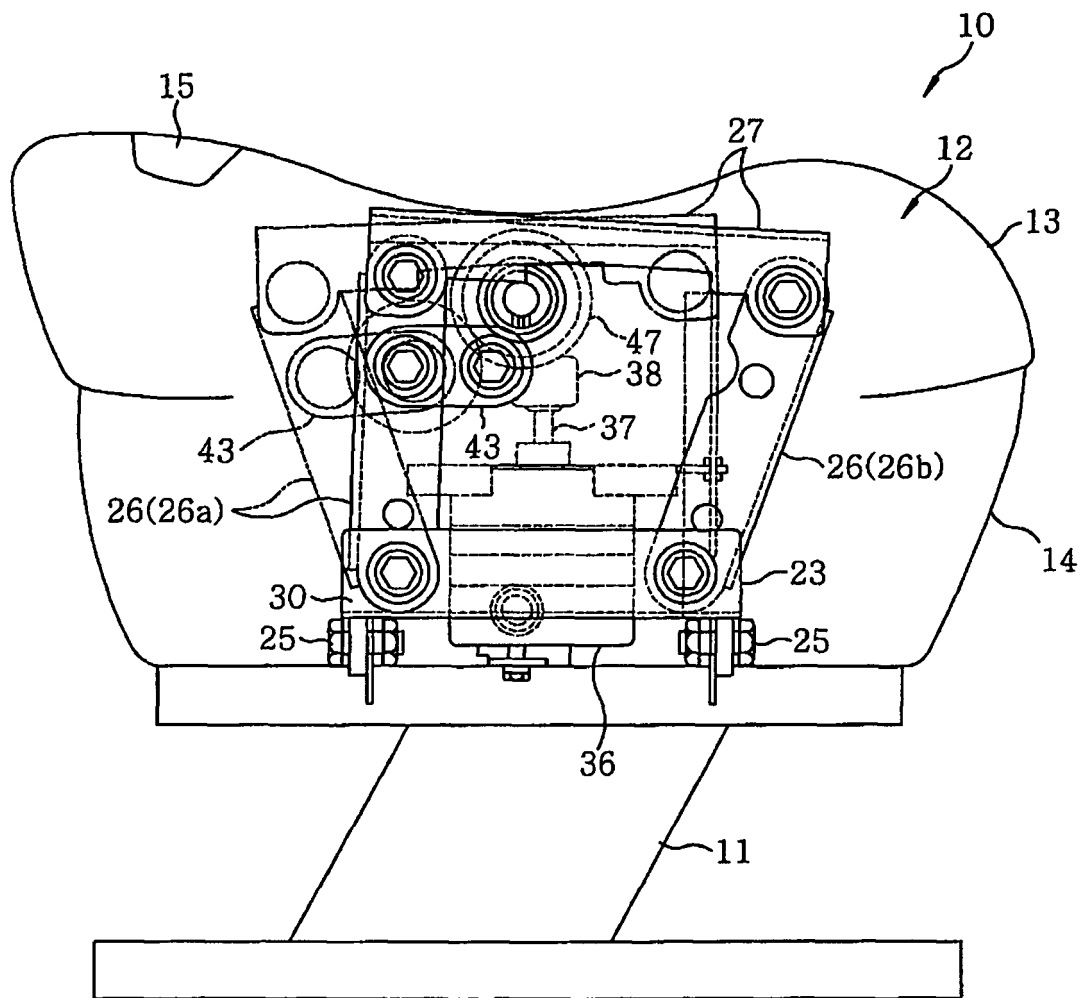


FIG. 2

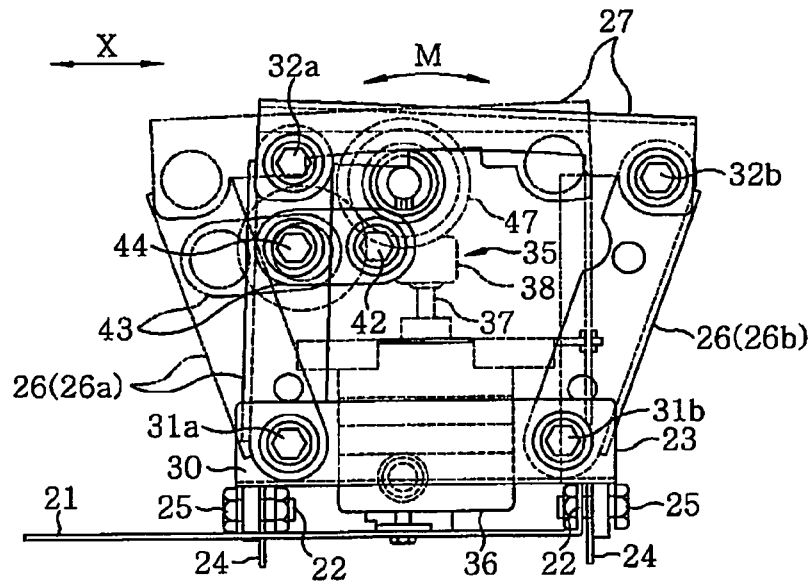


FIG. 3

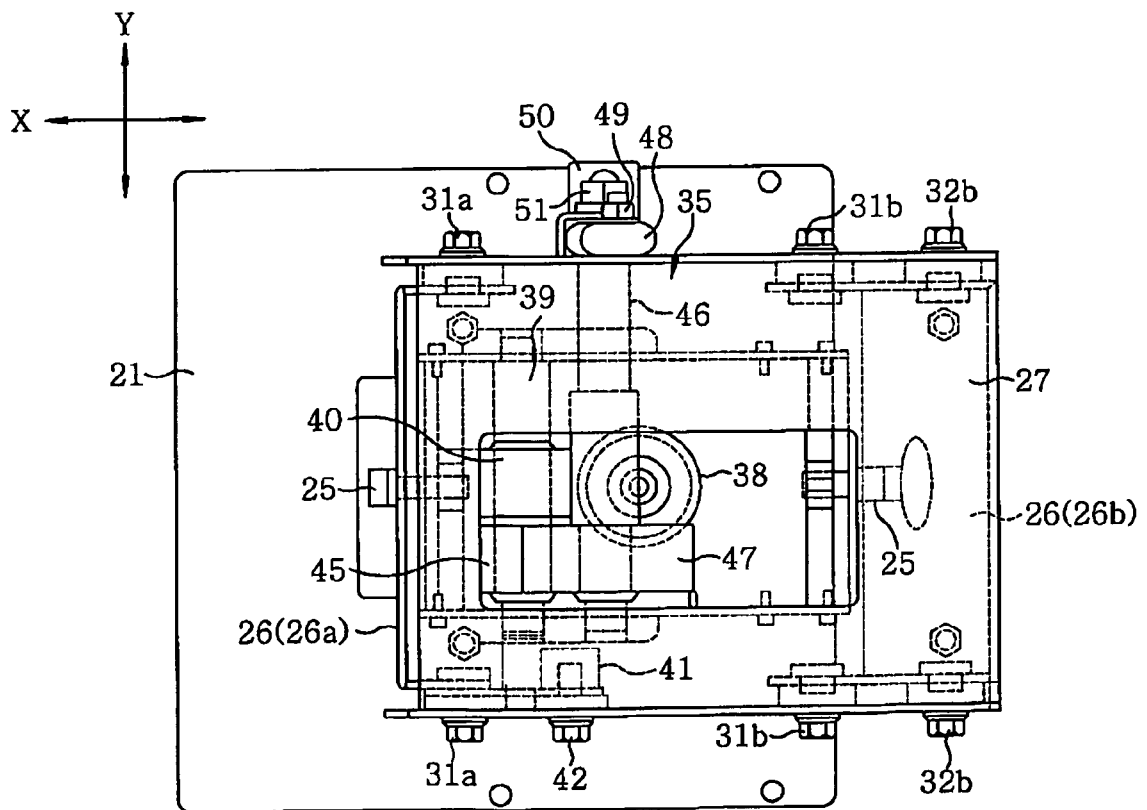


FIG. 4

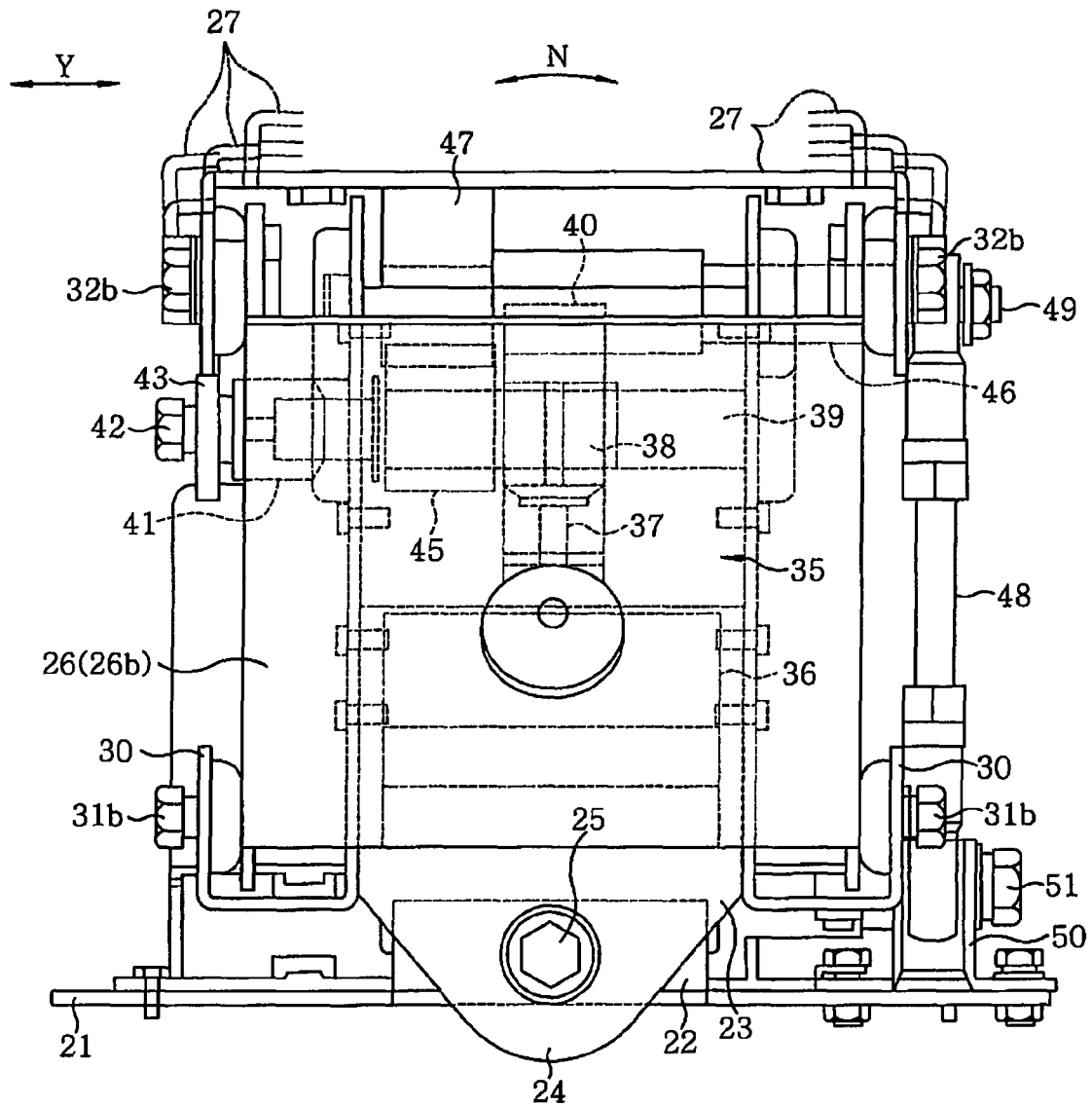


FIG. 5

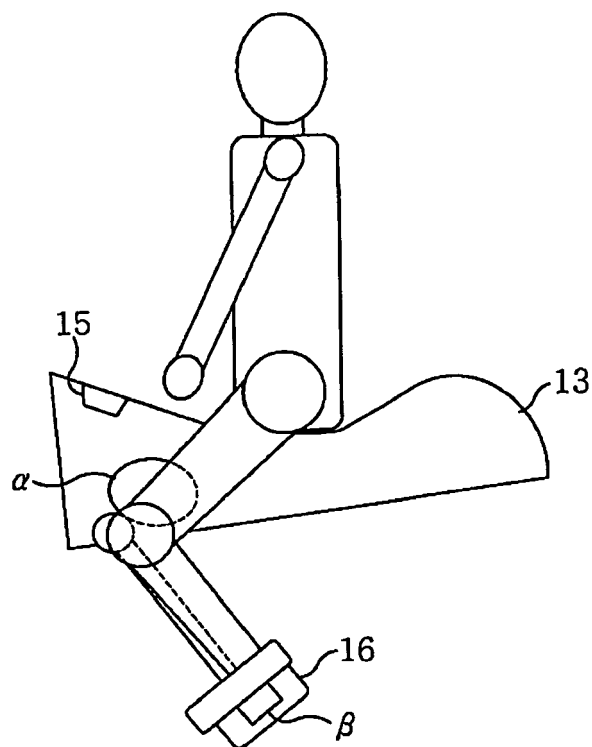


FIG. 6

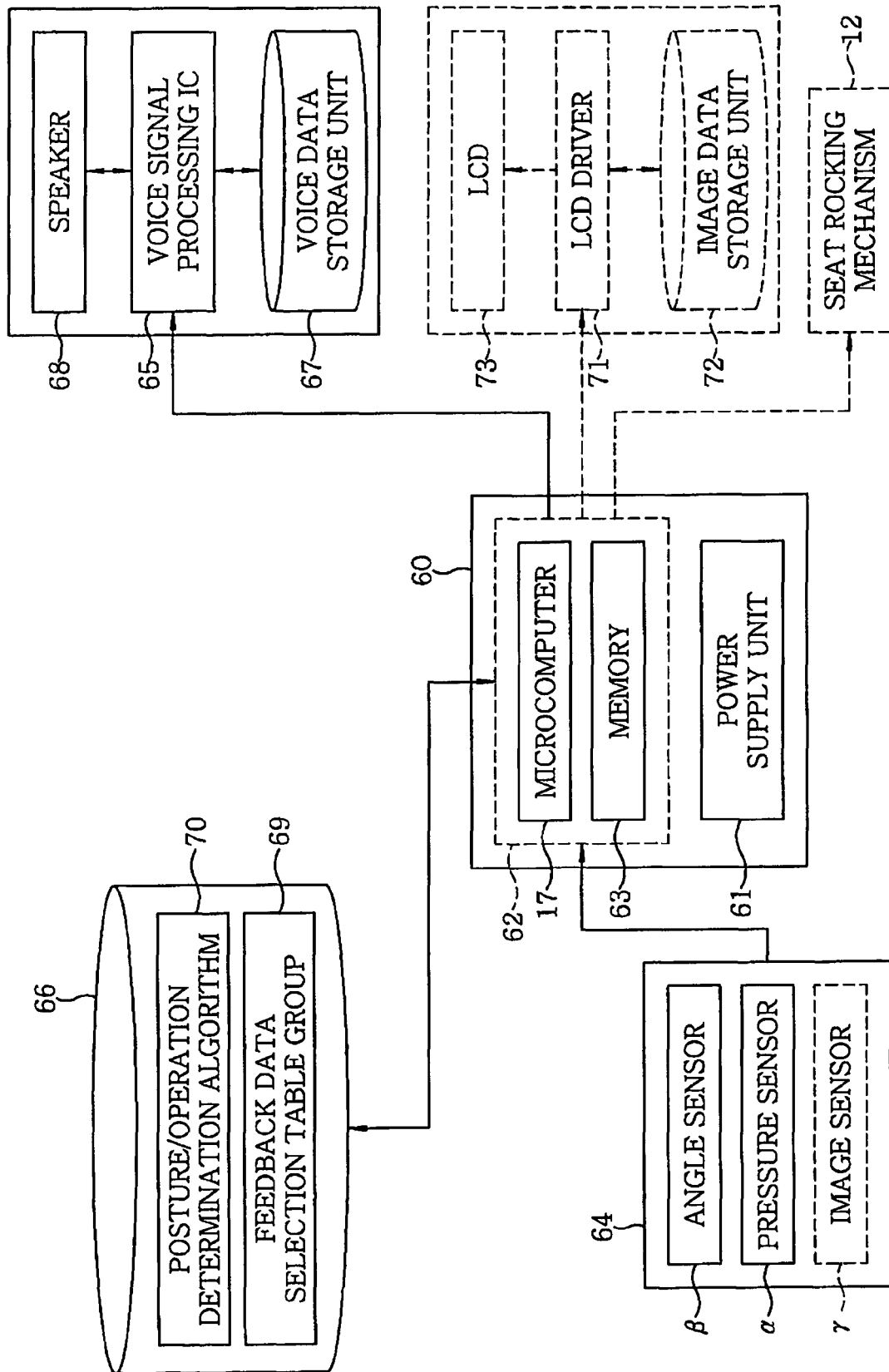
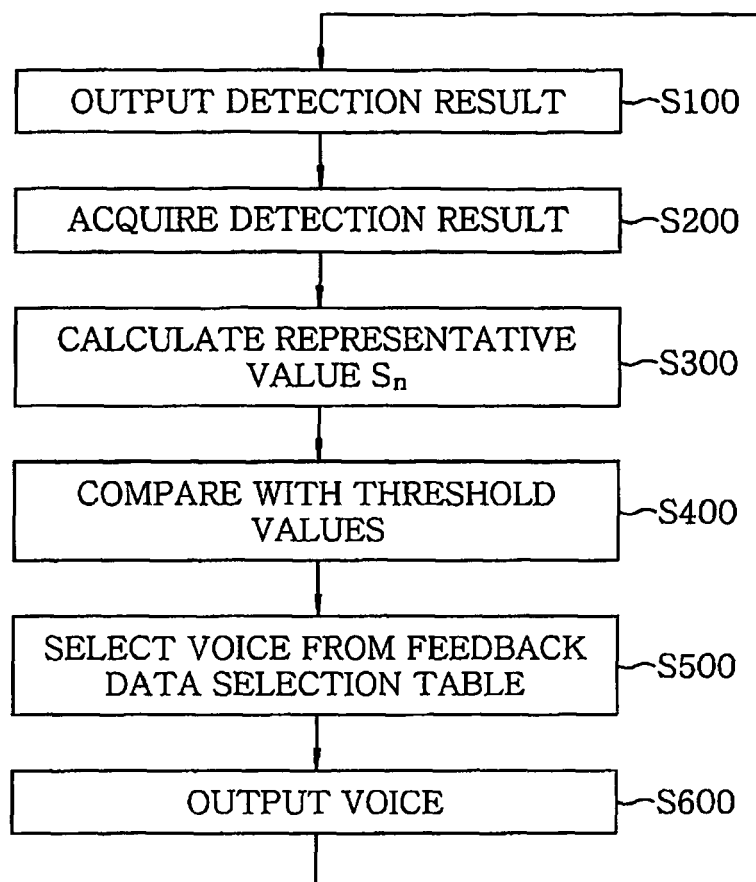


FIG. 7*FIG. 8*

THRESHOLD VALUE & TARGET VALUE(◎)		FEEDBACK DATA (VOICE DATA)
SENSOR INFORMATION α	5V	Loosen.wav
	4V	Further loosen.wav
	◎3V	It's OK.wav
	2V	With far greater force.wav
	1V	With a little greater force.wav

FIG. 9A

THRESHOLD VALUE & TARGET VALUE(◎)		FEEDBACK DATA (VOICE DATA)
SENSOR INFORMATION α	5V	Remove force.wav
	4V	Relax.wav
	◎3V	Keep it up.wav
	2V	Further more.wav
	1V	Try harder.wav

FIG. 9B

THRESHOLD VALUE & TARGET VALUE(◎)		FEEDBACK DATA (VOICE DATA)
SENSOR INFORMATION α	5V	Reduce strength.wav
	4V	Loosen more.wav
	◎3V	Good.wav
	2V	With more strength.wav
	1V	Try a little harder.wav

FIG. 10

THRESHOLD VALUE & TARGET VALUE(◎)		FEEDBACK DATA (VOICE DATA)
SENSOR INFORMATION α	5V	Don't overwork.wav
	4V	Too strong.wav
	◎3V	It's OK, keep trying.wav
	◎2V	So good.wav
	1V	Try more at your pace.wav

FIG. 11

THRESHOLD VALUE & TARGET VALUE(◎)		FEEDBACK DATA (VOICE DATA)
SENSOR INFORMATION α	3.5V	Reduce strength.wav
	2.5V	Loosen more.wav
	◎1.8V	Good.wav
	1.0V	With more strength.wav
	0.5V	Try a little harder.wav

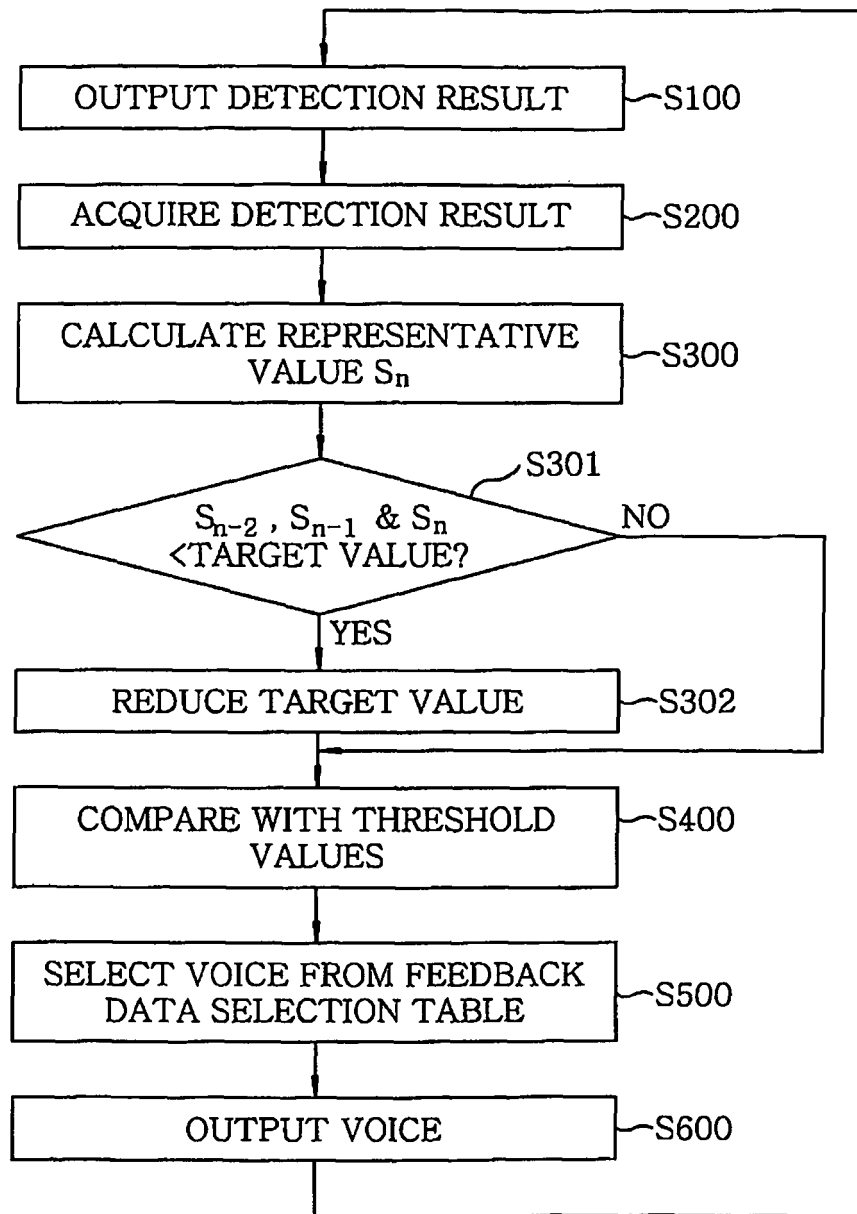
FIG. 12

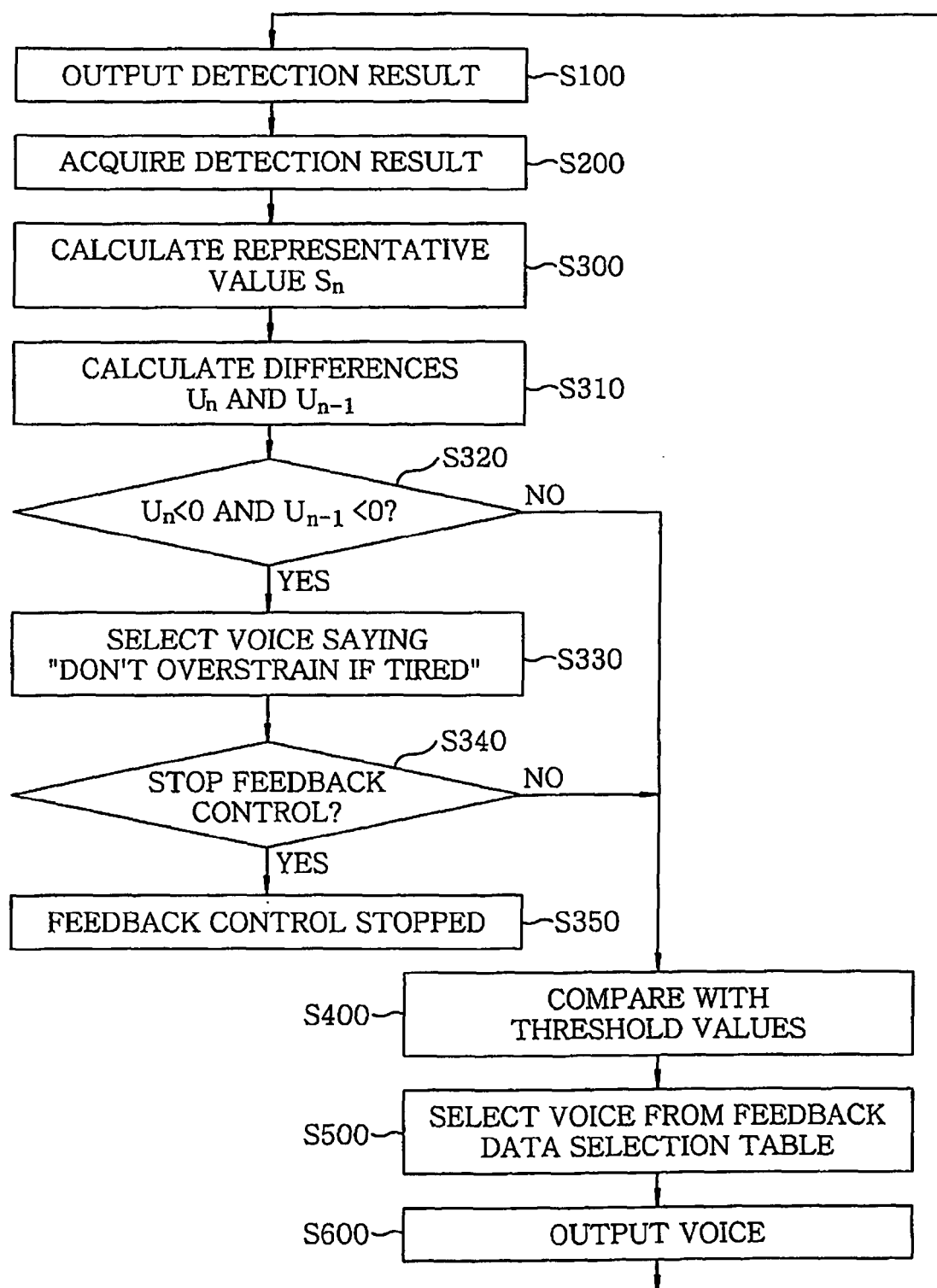
FIG. 13

FIG. 14

		β		
		1V	2V	©3V
α	1V	Output stimulus to improve information of α or β	Output stimulus to improve information of α	Output stimulus to improve information of α
	2V	Output stimulus to improve information of β	Output stimulus to improve information of α or β	Output stimulus to improve information of α
	©3V	Output stimulus to improve information of β	Output stimulus to improve information of β	Output stimulus to maintain information of α and β

FIG. 15A

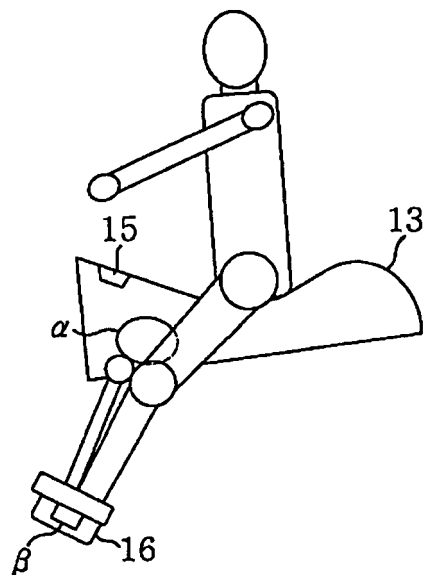


FIG. 15B

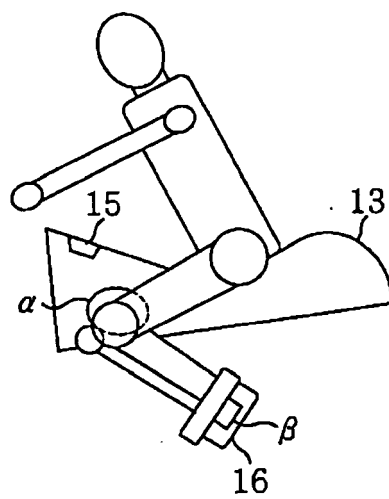


FIG. 15C

		β Knee Angle		
		©Small	Medium	Large
THIGH PINCHING FORCE	Weak	Output stimulus to improve information of α	Output stimulus to improve information of β	Output stimulus to improve information of β
	Medium	Output stimulus to improve information of α	Output stimulus to improve information of β	Output stimulus to improve information of β
	©Strong	Output stimulus to maintain information of α and β	Output stimulus to improve information of β	Output stimulus to improve information of β

FIG. 16A

THRESHOLD VALUE & TARGET VALUE(◎)		FEEDBACK DATA (VOICE DATA)
SENSOR INFORMATION α	5V	Reduce strength.wav
	4V	Loosen more.wav
	◎3V	Good.wav
	2V	With more strength.wav
	1V	Try a little harder.wav

FIG. 16B

THRESHOLD VALUE & TARGET VALUE(◎)		EMOTION	FEEDBACK DATA (VOICE DATA)
SENSOR INFORMATION α	5V	Encouraging	Relax whole body.wav
	4V	Encouraging	Loosen using muscle.wav
	◎3V	Encouraging	Keep it up.wav
	2V	Encouraging	More strongly.wav
	1V	Encouraging	Not enough, with greater force.wav

FIG. 16C

THRESHOLD VALUE & TARGET VALUE(◎)		EMOTION	FEEDBACK DATA (VOICE DATA)
SENSOR INFORMATION α	5V	Comfort	Gently reduce strength.wav
	4V	Comfort	Keep reducing strength.wav
	◎3V	Comfort	It's very good.wav
	2V	Comfort	Yes, more strongly.wav
	1V	Comfort	Gently add strength.wav

FIG. 17A

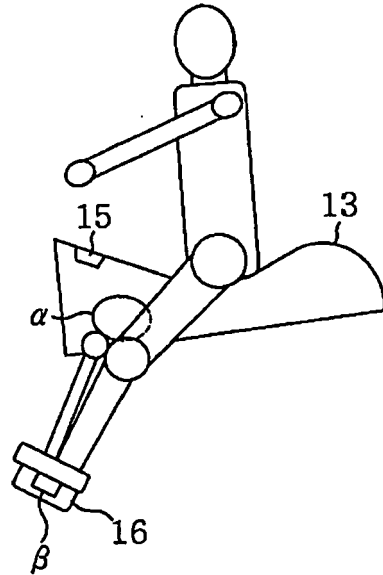


FIG. 17B

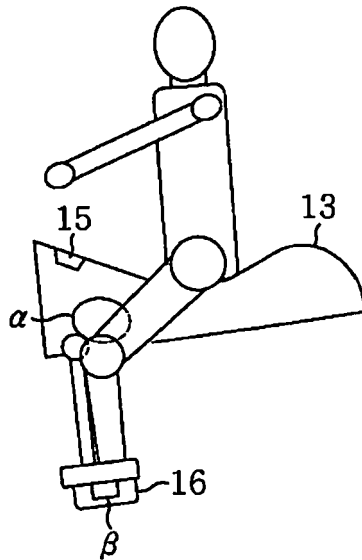


FIG. 17C

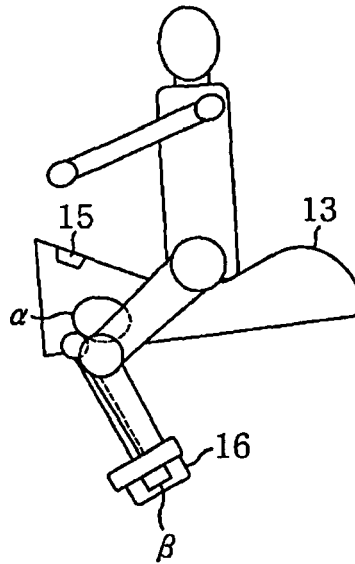


FIG. 18

THRESHOLD VALUE & TARGET VALUE(◎)		FEEDBACK DATA (VOICE DATA)
SENSOR INFORMATION α	5V	Lower stirrup.wav
	4V	Further lower stirrup.wav
	◎3V	Keep stirrup as it is.wav
	2V	Further raise stirrup.wav
	1V	Raise stirrup.wav

FIG. 19

THRESHOLD VALUE & TARGET VALUE(◎)		FEEDBACK DATA (VOICE DATA)
SENSOR INFORMATION α	5V	Bend legs fully.wav
	4V	Make knees round.wav
	◎3V	Keep it unchanged.wav
	2V	Further spread knees.wav
	1V	Stretch legs forward.wav

FIG. 20

THRESHOLD VALUE & TARGET VALUE(◎)		FEEDBACK DATA (VOICE DATA)
SENSOR INFORMATION α	5V	Bend legs fully.wav
	4V	Make knees round as if hugging.wav
	◎3V	Go ahead as it is.wav
	2V	Spread knees slowly.wav
	1V	Stretch legs straight.wav



EUROPEAN SEARCH REPORT

Application Number
EP 09 01 4378

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X,D	JP 2006 149468 A (MATSUSHITA ELECTRIC WORKS LTD) 15 June 2006 (2006-06-15) * paragraph [0023] * * paragraph [0042] * * paragraph [0063] * * paragraph [0045] *	1-10	INV. A63B69/04 A63B23/02
A	----- US 4 957 444 A (ARMEN SETH A [US]) 18 September 1990 (1990-09-18) * column 1, line 26 - line 49 * * column 2, line 36 - line 56 * * claim 1 *	1-10	
A	----- US 4 713 010 A (VEILLAS PAUL [FR]) 15 December 1987 (1987-12-15) * the whole document *	1-10	
			TECHNICAL FIELDS SEARCHED (IPC)
			A63B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 18 January 2010	Examiner Lundblad, Hampus
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 09 01 4378

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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18-01-2010

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