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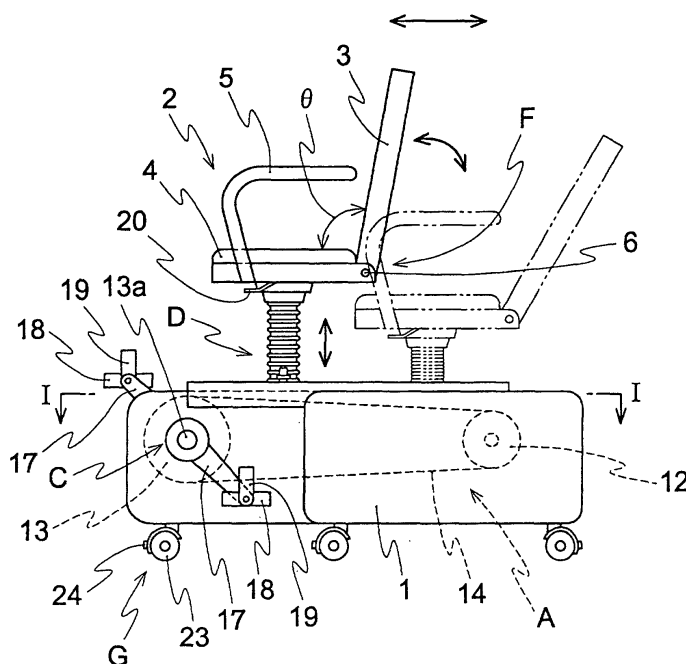
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(54) **TRAINING MACHINE FOR FUNCTION REINFORCEMENT**

(57) A functionality improving training machine comprising a main body, a rotating driving mechanism incorporated in the main body, a driving controller for controlling the rotating driving mechanism, a pedal mechanism for legs coupled to the rotating driving mechanism and a moving means for making the main body movable.

Physically weak people regardless of age or sex, convalescent people or athletes might use for rehabilitation purposes in which functionalities of the lower half of one's body might be improved in accordance with one's physical conditions through exercise ranging from soft exercise in which one's heart is hardly overload to hard exercise which causes one to sweat.

FIG. 1



Description

TECHNICAL FIELD

[0001] The present invention relates to a functionality improving training machine. More particularly, the invention relates to a functionality improving training machine with which it is possible to strengthen the lower half of the body of physically weak people, regardless of age or sex, or to perform auxiliary exercise or rehabilitation of handicapped persons with their handicap residing in the lower half of the body or of athletes, and particularly with which it is possible to perform training for improving functionalities of the lower half of the body of convalescent persons by strengthening their muscles through exercise which might be performed indoors in an easy manner and in a sitting posture, and which might be further utilized for rehabilitation for the purpose of eliminating paralysis of legs and arms that resulted from cerebral hemorrhage or degenerative diseases of the cerebellum.

BACKGROUND ART

[0002] One type of conventionally known training machines is used for pedaling exercise using both legs for people who have suffered from apoplexy and are presently in the phase of starting walking exercises after first taking standing postures and are made for rehabilitation purposes of exercise functions of their leg portions (see, for instance Japanese Unexamined Patent Publication No. 174666/1992). Such a training machine of bicycle type requires it to utilize one's own muscular power for rotating the pedals and is thus disadvantaged in that people who have not yet sufficiently recovered to an extent at which they might utilize their own muscular power for rotating the pedals for a long time or who are physically weak and thus be burdensome in view of their physical abilities. Moreover, since rotating positions of pedals are so arranged that they are located closer to the core (seat portion) of the human body, it is impossible to perform exercise of leg portions upon freely changing positions of the pedals and the position of the human body. Just to mention some rough reference values of a general bicycle, the distance between the core of the pedals and the seat portion is 65 cm, and the angle formed between a straight line connecting from the core of the pedals to the seat portion and a line horizontal thereto is 77°.

[0003] A tendency existed that automatically driven machines were considered to be useless since no load was applied to the body during driving; however, considering the fact that a long drive in a passenger car, for instance, make people who are merely sitting next to the driver in a reclined posture feel more fatigue rather than the driver owing to oscillation or the fact that it is more burdensome and tiring for those who are heavy-weighted than those who are light-weighted to simply walk the

same distance. The inventor of the present invention has thus paid attention to the idea that one's body might receive load under certain circumstances even though the person might not move on one's own, and has considered the necessity of improving effects of improving functionalities by using a training machine wherein pedals are automatically rotated, or positions of the pedals and positions of seat portions of the human body are arranged to be changeable.

[0004] It is further desired for a functionality training machine that might be used for rehabilitation of people with paralysis of legs and arms resulted from cerebral hemorrhage or degenerative diseases of the cerebellum and with which recovery of functionalities of both legs and arms might be easily performed.

[0005] The present invention has been made in view of the above facts, and it is an object of the present invention to provide a functionality improving training machine with which it is possible to strengthen the lower half of the body of physically weak people, regardless of age or sex, or to perform rehabilitation of handicapped persons with their handicap residing in the lower half of the body or of athletes, and particularly with which it is possible to perform training for improving functionalities of the lower half of the body of convalescent persons by strengthening their muscles through exercise which might be performed indoors in an easy manner and in a sitting posture and which might be further utilized for rehabilitation for the purpose of eliminating paralysis of legs and arms that resulted from cerebral hemorrhage or degenerative diseases of the cerebellum.

DISCLOSURE OF INVENTION

[0006] In accordance with a first aspect of the present invention, there is provided a functionality improving training machine comprising a main body, a rotating driving mechanism incorporated in the main body, a driving controller for controlling the rotating driving mechanism, a pedal mechanism for legs coupled to the rotating driving mechanism and a moving means for making the main body movable.

[0007] In accordance with a second aspect of the present invention, there is provided a functionality improving training machine comprising a main body, a seat mounted on a top portion of the main body, a rotating driving mechanism incorporated in the main body, a driving controller for controlling the rotating driving mechanism, a pedal mechanism coupled to the rotating driving mechanism, a sliding mechanism for making the seat movable in forward and rearward directions with respect to the main body, a reclining mechanisms for freely making a rear angle of a back portion of the seat variable, an ascending/descending mechanisms for freely ascending/descending the seat, and a moving means for making the main body movable.

[0008] In accordance with a third aspect of the present invention, there is provided a functionality improving

training machine comprising a main body, a rotating driving mechanism incorporated in the main body, a driving controller for controlling the rotating driving mechanism, a pedal mechanism for legs coupled to the rotating driving mechanism, a moving means for making the main body movable, a pedal mechanism for arms provided on a top portion of the pedal mechanism for the legs, and a rotation transmitting portion for the arms which connects the rotating driving mechanism with the pedal mechanism for the arms.

[0009] In accordance with a fourth aspect of the present invention, there is provided a functionality improving training machine comprising a main body, a seat mounted on a top portion of the main body, a rotating driving mechanism incorporated in the main body, a driving controller for controlling the rotating driving mechanism, a pedal mechanism for legs coupled to the rotating driving mechanism, a sliding mechanism for making the seat movable in forward and rearward directions with respect to the main body, a reclining mechanisms for freely making a rear angle of a back portion of the seat variable, an ascending/descending mechanisms for freely ascending/descending the seat, a moving means for making the main body movable, a pedal mechanism for arms provided on a top portion of the pedal mechanism for the legs, and a rotation transmitting portion for the arms which connects the rotating driving mechanism with the pedal mechanism for the arms.

BRIEF DESCRIPTION OF DRAWINGS

[0010]

Fig. 1 is a side view for illustrating a functionality improving training machine for the lower half of one's body according to a first embodiment of the functionality improving training machine of the present invention;

Fig. 2 is a sectional view taken along the line I-I of Fig. 1;

Fig. 3 is a front view of the functionality improving training machine for the lower half of one's body of Fig. 1;

Fig. 4 is a plan view of Fig. 1;

Fig. 5 is a perspective view for explaining a condition for use with the seat being shifted forward;

Fig. 6 is a perspective view for explaining a condition for use with the seat being shifted rearward;

Fig. 7 is a side view for illustrating a functionality improving training machine for the lower half of one's body according to a second embodiment of the functionality improving training machine of the present invention;

Fig. 8 is a side view for illustrating a functionality improving training machine for the lower half of one's body according to a third embodiment of the functionality improving training machine of the

present invention;

Fig. 9 is a sectional view taken along the line II-II of Fig. 8;

Fig. 10 is a side view for illustrating a functionality improving training machine for the lower half of one's body according to a fourth embodiment of the functionality improving training machine of the present invention;

Fig. 11 is a side view for illustrating the functionality improving training machine for the lower half of one's body with an outrigger for purposes of preventing tumbling being mounted on the main body; and

Fig. 12 is a front view of the functionality improving training machine for the lower half of one's body of Fig. 11.

BEST MODE FOR CARRYING OUT THE INVENTION

[0011] The functionality improving training machine according to the present invention will now be explained with reference to the accompanying drawings.

[0012] As illustrated in Figs. 1 to 4, the functionality improving training machine for the lower half of one's body according to the first embodiment is composed of a seat 2 mounted on a top portion of a rectangular main body 1, as well as a rotating driving mechanism A, a driving controller B, a pedal mechanism C, an ascending/descending mechanism D, a sliding mechanism E, a reclining mechanism F and a moving means G which are respectively incorporated in the main body 1.

[0013] The seat 2 is composed of a backrest portion 3, a seat portion 4 and armrest portions 5, and the rear angle θ of the backrest portion 3 is arranged to be freely changeable through the reclining mechanism F. Notches are formed on the right and left of a front portion of the seat portion 4 for enabling easy movements of the knees or thighs. The reclining mechanism F might be actuated either as a manual type or automatic type. In the case of a manual type, it is possible to employ a ratchet mechanism utilizing a ratchet wheel (not shown) which is fixed to a supporting shaft 6 of the backrest portion 3 coupled to a rear end of the seat portion 4. Such a ratchet mechanism enables it to incline the backrest portion 3 by pulling an operating handle 7 frontward and to maintain the inclined position of the backrest portion 3 as it is by releasing the operating handle 7. In the case of an automatic type, it is possible to employ a gearing mechanism in which a group of gears and a gearing motor which are connected to the supporting shaft 6 of the backrest portion 3 are actuated through switches of an operating pendant 8 for inclining the backrest portion 3.

[0014] The rotating driving mechanism A might be composed of a rotation transmitting portion 9, a driving motor 10 capable of performing forward and rearward rotation, and a clutch mechanism 11 such as an electromagnetic clutch. The rotation transmitting portion 9 might be of belt-gearing type or chain-gearing type while

one of a belt-gearing type is preferred in view of the fact that it does not require any lubricating oil and is thus more convenient of maintaining its periphery clean, and might be particularly composed of a driving pulley 12, a following pulley 13 and a belt 14. Examples of such belts 14 are flat belts, V belts and synchronous belts, and outer peripheral shapes of the driving pulley 12 and the following pulley 13 shall be selected depending on the type of the belt which is actually used. The driving pulley 12 is supported in a freely rotating manner by the clutch mechanism 11 and by a bearing 15 with its supporting shaft 12a being mounted to the main body 1. The following pulley 13 is supported in a freely rotating manner by two bearings 16 with its supporting shaft 13a being mounted to the main body 1. The pedal mechanism C is coupled to both ends of the supporting shaft 13a. The pedal mechanism C is composed of pedal levers 17 provided on the right and left and of pedals 18. It is preferable that the pedals 18 are provided with clamp fittings such as those employed for freely attaching and detaching ski boots so that foothold belts 19 might be attached in a freely attachable/detachable manner. In the present embodiment, the clutch mechanism 11 is turned ON (actuated) by operating a switch of the operating pendant 8 for starting the driving motor 10 whereupon the supporting shaft 12a and the driving pulley 12 are rotated through the clutch mechanism 11. Thereafter, the following pulley 13 and supporting shaft 13a are rotated upon transmission of force from the driving pulley 12 through the belt 14. The rotating driving force of the driving motor 10 is transmitted to the pedals 18 through the pedal levers 17. Upon turning the clutch mechanism 11 OFF (terminating), it is possible to switch to neutral. In such a neutral mode, it is possible to perform forward and reverse rotating movements by using one's own power.

[0015] The driving controller B is a controller which is applicable to both, 50 Hz and 60 Hz, and includes various control circuits for controlling the rotation driving mechanism A. It might be composed with at least a switching circuit for enabling switching of the clutch mechanism 11, a rotating driving circuit for performing forward rotation and reverse rotation of the driving motor 9, and a transmission circuit for making the rotating speed of the driving motor 9 variable. These control circuits enable it to suitably combine forward and reverse rotation. It is also possible to alternately repeat half-rotation of forward and reverse rotation as it is the case with washing machines. It is further preferable that an overload preventing circuit is connected to the rotating driving circuit for safety purposes, that a timer is connected for automatically terminating the driving motor 9 by interrupting supply of electric power to the driving motor 9 upon elapse of a specified time, or that a load adjusting circuit is connected for adjusting load of rotation in the neutral condition as to suit the physical ability of the user. It should be noted that it is preferable to include a mechanism synchronizing circuit in case the ascending/descending mechanism D, the sliding mechanism E

and the reclining mechanism F are of automatic type for making the respective mechanisms D, E and F actuate in a synchronous manner.

[0016] The ascending/descending mechanism D might also be of manual type or of automatic type. One of manual type might be a generally used a gas-pressure lifting arrangement employing a gas cylinder for adjusting the height of the seat. In such a gas-pressure lifting arrangement, a lift master of gas cylinder type might be operated by actuating a lever 20 provided on a front left position on the rear side of the seat portion 4 for freely ascending/descending the seat 2. It is alternatively possible to arrange the mechanism with a jack-screw for ascending/descending the seat 2 upon rotating a handle, a rack-driven type jack or a hydraulic jack, and a stopper for maintaining the ascended/descended position of the seat 2. In case the mechanism is of automatic type, it is possible to employ a jackscrew, a rack-driven type jack or a hydraulic jack which might be actuated upon supply of electric power.

[0017] The sliding mechanism E might also be of manual type as well as of automatic type. In one example of the manual type, a handle (not shown) which is connected to a screw (not shown) screwed to a moving base 21 for supporting the ascending/descending mechanism D of the seat 2 might be rotated either rightward or leftward for making the seat 2 move in a frontward or rearward direction with respect to the main body 1, and upon terminating rotation of the handle, the seat might be fixed at the position to which it has been moved. In the case of one of automatic type, the mechanism might be composed of the moving base 21 for supporting the ascending/descending mechanism D of the seat 2, a pair of guide rails 22 for guiding and supporting both ends of the moving base 21 through balls or rollers, a ball screw unit or ball spline (neither of these are illustrated in the drawings) coupled to a lower portion of the moving base 21 and simultaneously supported at a central portion in a longitudinal direction of the guide rails 22, and a motor (now shown) for rotating a screw shaft or splined shaft.

[0018] The moving means G is not limited to any particular type as long as the main body 1 might be freely movable through the same, and might be composed of casters 23 as those generally used. In the present first embodiment, 5 casters are attached to a lower surface of the main body 1 in a freely rotating manner. These casters 23 are preferably provided with stoppers 24 for maintaining the casters stable after they have been used for moving the main body to a specified location.

[0019] According to the first embodiment, the backrest portion 3 is so arranged that the rear angle θ is freely variable depending on the distance between the core of the human body (the core of the seat 2) and the pedals 18, and the height of the seat 2 is also freely variable. With these arrangements, the user can freely select a suitable angle, distance and height in view of his or her own proportion (size of physique) and posture of exer-

cise. Thus, upon respectively varying angular positions for the height of one's body or extent of distance with respect to the pedals, one can perform exercise of functionalities of one's lower half of the body. Such angles, distances and heights might be set in a following manner, and one example of their mutual relationship is illustrated in Table 1.

- (1) The angle is variable in a range from 77° to 28°.
- (2) The distance between the core of the human body (core of the seat) and the pedals might range from approximately 100 to 450 mm. It should be noted that a distance enabling free rotation of the thighs and knees without the leg portions hitting the seat portion when rotating the legs upon approaching the seat to the pedal (that is, the minimum distance with which the pedals might be freely rotated) is 100 mm from the core of the seat to the core of the pedals, and calculations have been based on this value of 100 mm.
- (3) The height is set in a range of 250 to 400 mm.

[0020] It should be noted that the respective uppermost values of Table 1 denote numeric values of a general bicycle which have been listed as a reference, and respective values listed in the second column and on are examples of numeric values which might be variously changed in the training machine of the present invention.

TABLE 1

| Height | Distance | Angle |
|--------|----------|-------|
| 650 | 150 | 77° |
| 400 | 100 | 77° |
| 400 | 200 | 63° |
| 325 | 200 | 58° |
| 400 | 300 | 53° |
| 400 | 400 | 45° |
| 250 | 250 | 45° |
| 325 | 400 | 38° |
| 250 | 350 | 35° |
| 250 | 400 | 32° |
| 250 | 450 | 28° |

[0021] Owing to the fact that the weight applied on the pedals might be varied by simply varying the rear angle for either inclining or increasing the distance to the human body, and the fact that large amount of load is applied when trying to pedal in a remote posture, it is simply impossible to make any movements upon inclination to an angle of not more than 45°. However, physical effects might be achieved since the entire leg from the tips

of the toes, knees and the thighs can be largely moved with the help of automatic force. In other words, the larger the angle of the back becomes, the more the movements of the legs change from vertical movements to longitudinal and up-and-down movements, and load which might not achieved through one's own power functions to exhibit stretching effects through the automatic force to thereby improve efficiency of exercise.

[0022] According to the first embodiment, the user M seats on the seat 2 and puts his or her feet Ma onto the pedals 18 as illustrated in Fig. 5 whereupon the driving motor is actuated through a switch of the operating pendant. The pedals 18 then rotate in a forward or rearward direction at a specified rotating speed so that the leg portions of the user M are moved through force other than his or her own force while being seated on the seat 2. Stepless shifting of the rotating speed for the pedals can be performed upon switching speed switches of the operating pendant.

[0023] Thereafter, the ascending/descending mechanism, the sliding mechanism and the reclining mechanism are actuated either by the user M or an attendant for moving the seat 2 to a rearward position as illustrated in Fig. 6. When the driving motor is actuated through a switch of the operating pendant, similar to the case of the above-described moving operations, the pedals 18 start to rotate in a forward or rearward direction at a specified rotating speed whereupon the leg portions of the user M might be moved through force other than his or her own while lying on the seat 2 to perform exercise of functionalities of the lower half of the user's body.

[0024] While it is impossible to utilize leg portions through one's own force in an exercise posture which is remote from the pedals, the arrangement of the present first embodiment being arranged such that it is possible to vary the height and rear angles for the human body, the smaller the angle becomes, the more larger the lower half of one's body can be moved at an increased rotating speed than compared to specified movements just like with a bicycle. Moreover, upon performing reverse rotation, which had so far been impossible, effects of exercise might be even more improved since various muscles of the leg portions are moved in opposite directions. In such a case, when the pedals are at the remotest positions, there can be observed remarkable reactions that muscles located on the rear of the right and left leg portions get tight the moment the pedals move up from below.

[0025] By further arranging the length of the pedal shafts to be variable, it is possible to adjust the amount of exercise in accordance with the length of the pedal shafts. The position of the seat is also adjustable in view of the physique of the user for varying the distance between the seat and the pedal shafts, the arrangement can be used regardless of the size of proportion of the user (that is, regardless of the standard of proportion).

[0026] In case of arranging data of users to be preliminarily stored in a microcomputer of the driving controller

to cope with forms for rehabilitation of each user, it is possible to provide suitable forms of exercise and amount of exercise for each user through control of the microcomputer. It is also possible to make the microcomputer store fuzzy control functions. In this manner, effective rehabilitation might be performed by increasing or decreasing the speed of a single rotation of the pedal in accordance with the form of rehabilitation of a particular user or by enabling free exercise such as half-rotation in forward and rearward directions which is close to walking movements or one full rotation of a circular movement followed by another rotation in a reverse direction.

[0027] In case the user has troubles with his or her knees so that he or she cannot perform exercises in which the knees are bent to a large degree, positions for mounting the right and left pedal levers with respect to the supporting shaft might be varied such that the pedals are directed forward and both pedal levers become substantially horizontal with respect to the floor surface. When performing up-and-down movements of the pedals in an alternating manner while swinging the pedal levers at slight angles in this condition, exercise can be performed while keeping the knees in an easy condition, for instance, being straightly extended so that it is possible to strengthen the muscles around the knees.

[0028] While the positions of the pedals with respect to the pedal levers are fixed in the present first embodiment, the present invention is not limited to this arrangement and the positions of the pedals can be varied between e.g. four positions depending on the form of rehabilitation. In case the four positions of the pedals are denoted as A (a distance formed between the pedals and the supporting shaft being e.g. 75 mm), B (a distance formed between the pedals and the supporting shaft being e.g. 120 mm), C (a distance formed between the pedals and the supporting shaft being e.g. 160 mm) and D (a distance formed between the pedals and the supporting shaft being e.g. 200 mm), position C might be defined as a position of the pedals for ordinary use and the pedals are arranged such that they might be mounted by screwing mounting screws of the pedals to screw holes which are formed at position B and position A, sequentially approaching from the reference position C to the supporting shaft in this order. Pedals which are mounted to position B or position A are identical to one which had been mounted to position C. Upon varying positions of the pedals from position C to position B and further to position A, the rotating torque from the supporting shaft increases accordingly. Particularly in case the core of position A is set to be remote from the core of the supporting shaft of pedals by 75 mm, the force with which the pedals at position A are pressed down can be set to be equivalent to a degree necessary for walking up and down stairs of a height of e.g. 15 cm, and it is thus possible to perform movements similar to walking stairs up and down while being seated on the

seat. In case of employing pedal shafts which make positions of the pedals variable, the pedal shafts shall preferably be formed with tapered surfaces and become thinner in thickness in approaching from the supporting shaft side to the tip end so as to prevent side portions of the pedal shaft from contacting or hitting legs when rotating pedals at position D which is a position remote from the supporting shaft. It is also possible to provide a strong supporting cage as a separate member with which the user might support his or her own body for the purpose of performing exercise while resting his or her own weight thereon in performing the above-described up-and-down walking exercise in a standing posture. Such a supporting cage assumes a substantially U-shaped flat surface and includes at least armrest portions. When in use, the case shall be disposed around the seat.

[0029] While the training machine of the first embodiment is provided with a seat, the present invention is not limited to this arrangement and it might also be a training machine comprising no seat but being especially designed for the legs as illustrated in Fig. 7. A main body 25 of the training machine according to the second embodiment of the present invention is composed of a rotation driving mechanism A, a driving controller B, a pedal mechanism C and a moving means G similar to those of the first embodiment illustrated in Fig. 2. A pocket 26 for accumulating the operating pendant 8 therein is provided on a front surface of the main body 25 for enabling easy operation. When using the training machine of the second embodiment 2, a seat 27 is provided in front of the main body 25 so as not to shift. Upon operation of the operating pendant 8 for setting, the user puts his or her feet on the pedals 18 and starts actuation for performing exercise for improving functionalities of the legs in accordance with rehabilitation programs for the user.

[0030] According to the present invention, it is also possible to provide pedals for arms so that the machine might be utilized not only as a training machine for improving functionalities of the legs but also as a training machine for rehabilitation in case a person cannot move his or her arms and legs owing to paralysis of arms and legs resulting from cerebral hemorrhage or degenerative disease of the cerebellum. According to the third embodiment, it is possible to provide an arrangement as exemplarily illustrated in Fig. 8 wherein the training machine 1 of the first embodiment is provided with an extension portion 1a to which a pedal mechanism C1 for the arms is mounted. Thus, the training machine according to the third embodiment as illustrated in Figs. 8 and 9 is composed of a rotation driving mechanism A, driving controller B, pedal mechanism C and moving means G as illustrated in Fig. 2 as well as of a rotation transmitting portion for the arms, and the pedal mechanism C1 including right and left pedal levers 28 and pedals 29. The rotation transmitting portion for the arms might include the followings: a supporting shaft 30 which

is connected to the pedal levers 28 and is also supported in a freely rotating manner by a bearing (not shown) mounted to the extension portion 1a; an upper following pulley 31 fixedly attached to the supporting shaft 30; a switching clutch mechanism 32 connected to the supporting shaft 13a; a lower following pulley 33 and a following pulley 34 connected to the clutch mechanism 32; a driving pulley 36 connected to the supporting shaft 12a through the clutch mechanism 35; a reverse rotation mechanism 37 disposed between the driving pulley 36 and following pulley 34; a belt 38 wound around the upper and lower following pulleys 31, 33; and belts 39, 40 wound around the following pulley 34, driving pulley 36 and the reverse rotation mechanism 37. The switching clutch mechanism 32 might be composed of a first clutch disposed between the supporting shaft 13a and the following pulley 33 and of a second clutch disposed between the following pulley 33 and the following pulley 34. The reverse rotation mechanism 37 includes a pair of supporting shafts 42 supported in a freely rotating manner by bearing portions 41 which are mounted to the main body 1, intermediate pulleys 43, and gears 44. The reverse rotation mechanism can be omitted in case a bidirectional clutch is employed as the switching clutch mechanism.

[0031] According to the third embodiment, the first clutch of the switching clutch mechanism 32 is turned ON (actuated) while the second clutch is turned OFF (terminated) and the clutch mechanism 35 is also turned OFF (terminated) whereupon driving force for performing forward rotation transmitted from the driving pulley 12 and the following pulley 13 is directly transmitted to the following pulley 33. In this manner, the pedals 18 for the legs and the pedals 29 for the arms might be simultaneously rotated in a forward rotating direction. On the other hand, in case the first clutch of the switching clutch mechanism 32 is turned OFF (terminated) while the second clutch is turned ON (actuated) and the clutch mechanism 35 is also turned ON (actuated) whereupon driving force for performing forward rotation transmitted from the driving pulley 12 and the following pulley 13 is directly transmitted to the following pulley 33 and the driving force of the driving pulley 36 is transmitted to the following pulley 34 and the following pulley 32 through the reverse rotation mechanism 32. In this manner, the pedals 18 for the legs can be rotated in a forward rotating direction. Further, since the rotation of the driving pulley 36 in a forward rotating direction is made to be a rotation in a reverse direction through the reverse rotating mechanism 37, a rotating driving force in a reverse rotating direction is transmitted to the following pulley 34 and the following pulley 32, and the pedals 29 for the arms are accordingly rotated in a reverse rotating direction. It is therefore possible to make the pedals 18 for the legs and the pedals 29 for the arms rotate either in the same or opposite direction by switching the switching clutch mechanism 32 and the clutch mechanism 35 ON or OFF such that the user might perform functionality improving

training on one's own while being seated on the seat 2 with the arms and legs rotating either in the same or opposite directions. Exercise of muscles one does not use in daily life can be performed by simply placing one's feet on the pedals 18 and the arm on the pedals 29. In case the upper following pulley 31 is provided with a clutch and this and other clutches are turned OFF, the training machine can be set to a neutral condition so that one can perform forward or reverse rotation of the pedals 18 for the legs and the pedals 29 for the arms with his or her own force.

[0032] According to the third embodiment, in case a seat 45 is fixedly provided in front of the main body 1 such that it does not move, a user sitting on the seat 2 can use the lower pedals 18 for the legs while another user sitting on the seat 45 can use the upper pedals 29 for the arms. In this manner, the arrangement of the third embodiment might be used either by a single person for performing functionality improving training or by two persons for simultaneously performing functionality improving training of their legs and arms, respectively. It should be noted that while the rotation transmitting portion according to the third embodiment includes a switching clutch mechanism, the present invention is not limited to this arrangement, and it is also possible to omit the switching clutch mechanism to provide separate training machines especially designed for forward or reverse rotation including pedals for the legs and pedals for the arms.

[0033] While the training machine of the third embodiment is provided with a seat, the present invention is not limited to this arrangement, and it is alternatively possible to provide a training machine comprising no seat as illustrated in Fig. 10. A main body 46 of the training machine according to the fourth embodiment is composed, similarly to that of the third embodiment, of a rotation driving mechanism A, a driving controller, pedal mechanisms C, C1, a moving means G and a rotation transmitting portion for the arms.

[0034] A pocket 26 for accumulating the operating pendant 8 therein is provided on a front surface of the main body 46 for enabling easy operation. When using the training machine of the fourth embodiment, a seat 45 is provided in front of the main body 46 so as not to move. Upon operation of the operating pendant 8 for setting, the user puts his or her feet on the pedals 18 and the arms on the pedals 29 and starts actuation for performing exercise for improving functionalities of the arms and the legs in accordance with rehabilitation programs for the user.

[0035] It should be noted that the length of the main body can be shortened and made compact in size in the above-described second and fourth embodiments since no seat is provided on the main body. It is further possible to arrange a main body of which rear portion is large in width so that it is possible to mount a television or a radio thereon and to accumulate spare pedals or exchange tools therein.

[0036] It is further preferable that an emergency stop function memory is provided in the microcomputer of the driving controller in the present embodiment for safety purposes. It is alternatively possible to provide a column member for preventing tumbling such as an outrigger 51 as illustrated in Figs. 11 and 12. By provision of such an outrigger 51, leg portions 52 of the outrigger 51 are descent when using the training machine so that the leg portions 52 contact the floor surface 53 for supporting the main body of the training machine. When moving the training machine to a location at which it shall be used or at which it shall be stored, the leg portions 52 of the outrigger 51 are raised, and by securing a clearance between the same and the floor surface 53, the casters 23 are enabled to rotate.

[0037] As explained so far, the present invention provides an arrangement with which physically weak people regardless of age or sex, convalescent people or athletes might use for rehabilitation purposes in which functionalities of the lower half of one's body might be improved in accordance with one's physical conditions through exercise ranging from soft exercise in which one's heart is hardly overload to hard exercise which causes one to sweat.

[0038] It is consequently possible to obtain an exercise tool which is more advantaged than conventional ones, with which it is possible to vary one's posture at a variety of angles and to utilize rotation in a reverse direction for changing points to which load is applied on the human body, to cope with a larger scope of moving bodies than compared to general exercise, to cope with strong or weak rotation (both forward and reverse), and to cope with various conditions for exercise. When used in the automatic mode, movements one could not perform on his or her own can be supported for performing stretching in a more effective manner.

[0039] The arrangement of the present invention providing pedals for the arms makes it possible to easily use the machine for rehabilitation purposes in case one cannot move his or her arms and legs due to paralysis of the arms and legs resulting from cerebral hemorrhage or degenerative disease of the cerebellum.

[0040] The training machine of the present invention can be used not only for the above-described rehabilitation purposes but also by healthy people who are eager to make up for their usual lack of exercise or for shape-up purposes. It is possible to perform exercise with which one's heart or respiratory are hardly burdened, for instance, aerobic exercise (dynamic exercise) with an amount of oxygen intake ranging from 40 to 60 %.

INDUSTRIAL APPLICABILITY

[0041] The present invention provides an arrangement with which physically weak people regardless of age or sex might strengthen the lower half of one's body and with which handicapped persons with their handi-

cap residing in the lower half of their bodies or athletes might use for rehabilitation purposes, and particularly with which it is possible to perform training of convalescent persons by strengthening their muscles through exercise that might be performed indoors in an easy manner and in a sitting posture for purposes of rehabilitation by strengthening muscles, and which might be further utilized for rehabilitation for the purpose of eliminating paralysis of legs and arms that resulted from cerebral hemorrhage or degenerative diseases of the cerebellum.

Claims

1. A functionality improving training machine comprising a main body, a rotating driving mechanism incorporated in the main body, a driving controller for controlling the rotating driving mechanism, a pedal mechanism for legs coupled to the rotating driving mechanism and a moving means for making the main body movable.
2. A functionality improving training machine comprising a main body, a seat mounted on a top portion of the main body, a rotating driving mechanism incorporated in the main body, a driving controller for controlling the rotating driving mechanism, a pedal mechanism coupled to the rotating driving mechanism, a sliding mechanism for making the seat movable in forward and rearward directions with respect to the main body, a reclining mechanisms for freely making a rear angle of a back portion of the seat variable, an ascending/descending mechanisms for freely ascending/descending the seat, and a moving means for making the main body movable.
3. A functionality improving training machine comprising a main body, a rotating driving mechanism incorporated in the main body, a driving controller for controlling the rotating driving mechanism, a pedal mechanism for legs coupled to the rotating driving mechanism, a moving means for making the main body movable, a pedal mechanism for arms provided on a top portion of the pedal mechanism for the legs, and a rotation transmitting portion for the arms which connects the rotating driving mechanism with the pedal mechanism for the arms.
4. A functionality improving training machine comprising a main body, a seat mounted on a top portion of the main body, a rotating driving mechanism incorporated in the main body, a driving controller for controlling the rotating driving mechanism, a pedal mechanism for legs coupled to the rotating driving mechanism, a sliding mechanism for making the seat movable in forward and rearward directions with respect to the main body, a reclining mechanism

nisms for freely making a rear angle of a back portion of the seat variable, an ascending/descending mechanisms for freely ascending/descending the seat, a moving means for making the main body movable, a pedal mechanism for the arms provided on a top portion of the pedal mechanism for the legs, and a rotation transmitting portion for the arms which connects the rotating driving mechanism with the pedal mechanism for the arms.

5. The functionality improving training machine of any one of Claims 3 to 4, wherein the rotation transmitting portion for the arms includes a switching clutch mechanism for switching the pedal mechanism for the legs and the pedal mechanism for the arms, and a reverse rotation mechanism for reversing rotation of the pedal mechanism for the legs and the pedal mechanism for the arms. 5 10
6. The functionality improving training machine of any one of Claims 1 to 5, wherein the rotating driving mechanism comprises a rotation transmitting portion, a driving motor and a clutch mechanism. 15 20
7. The functionality improving training machine of Claim 6, wherein the driving controller comprises a switching circuit for enabling switching of the clutch mechanism of the rotation driving mechanism, a rotating driving circuit for performing forward rotation and reverse rotation of the driving motor, and a transmission circuit for making the rotating speed of the driving motor variable. 25 30
8. The functionality improving training machine of Claim 7, wherein the driving controller includes a mechanism synchronizing circuit for interlocking the sliding mechanism, the ascending/descending mechanism and the reclining mechanism. 35
9. The functionality improving training machine of any one of Claims 2 and 4, wherein the sliding mechanism comprises a moving base for supporting the seat, a guide rail for guiding the moving base, a screw screwed to the moving base, and a handle for rotating the screw. 40 45
10. The functionality improving training machine of any one of Claims 2 and 4, wherein the ascending/descending mechanism comprises a moving base for supporting the seat, and a jack attached to the moving base. 50
11. The functionality improving training machine of any one of Claims 1 to 10, wherein attaching positions of right and left pedal levers in the pedal mechanism for the legs are variable with respect to the supporting shaft. 55

12. The functionality improving training machine of any one of Claims 1 to 11, wherein positions of the pedals to be provided to right and left pedal levers in the pedal mechanism for the legs are variable depending on the form of rehabilitation.

13. The functionality improving training machine of any one of Claims 1 to 12, wherein the main body includes a column member for preventing tumbling.

14. The functionality improving training machine of Claim 13, wherein the column member is a liftable outrigger.

FIG. 1

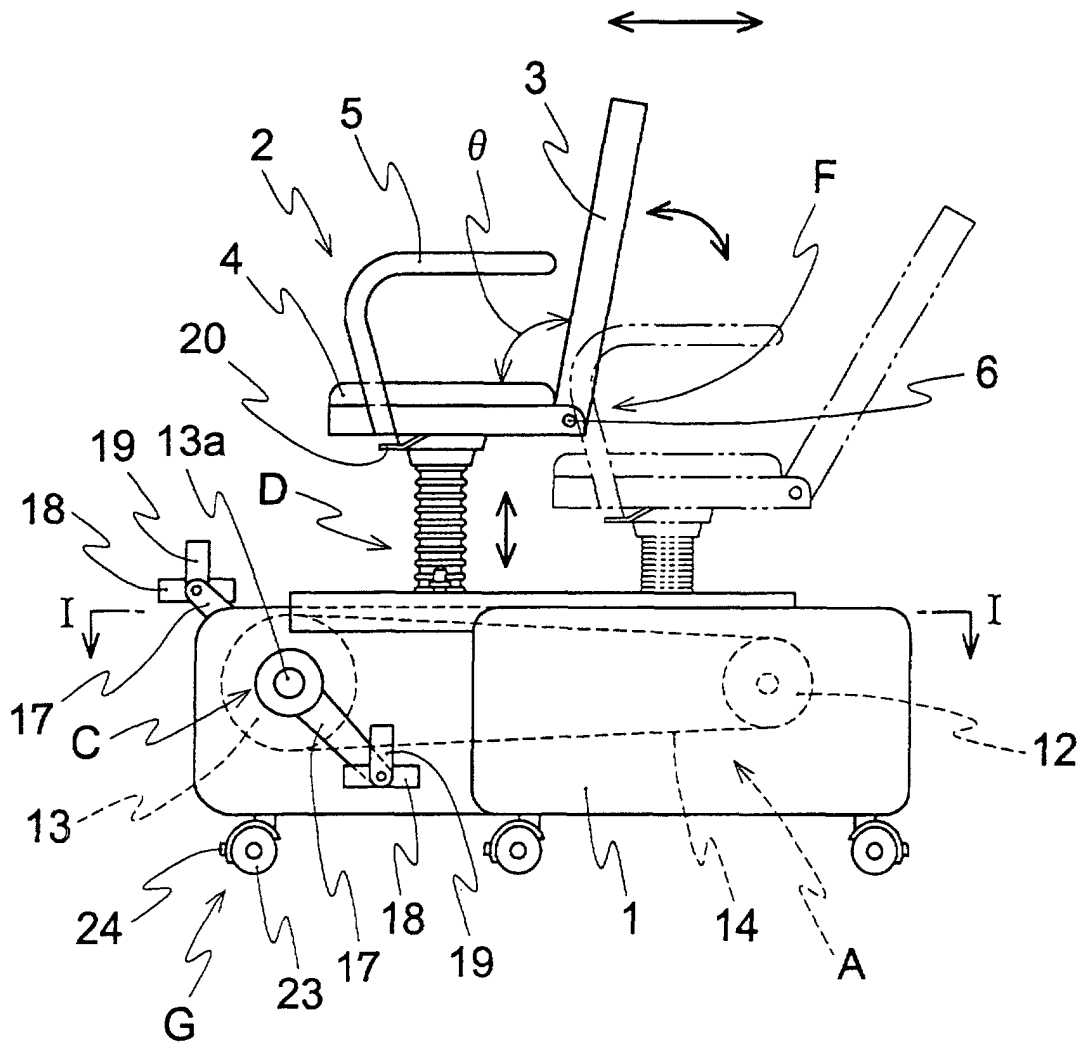


FIG. 2

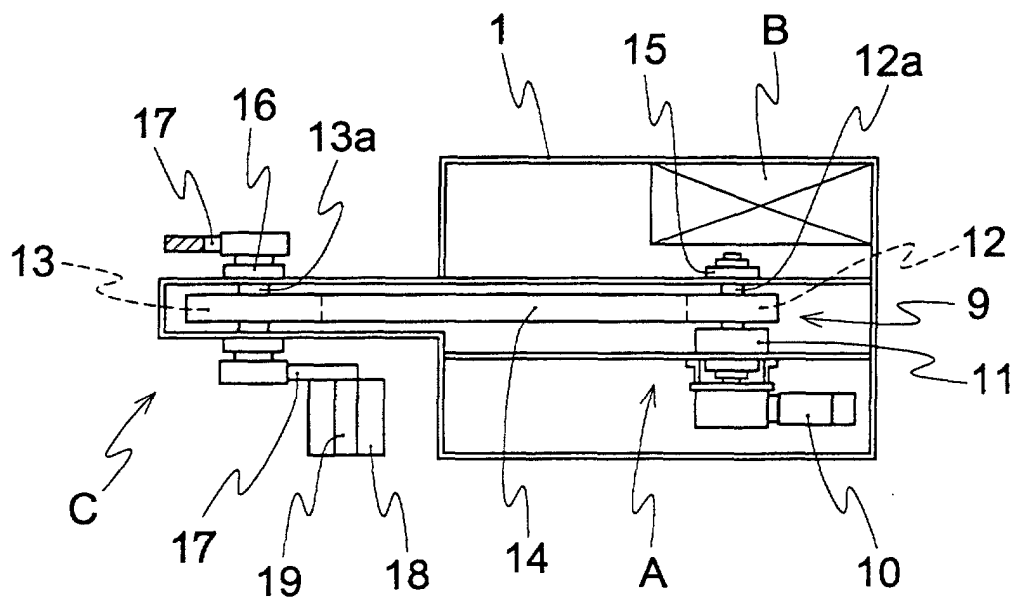


FIG. 3

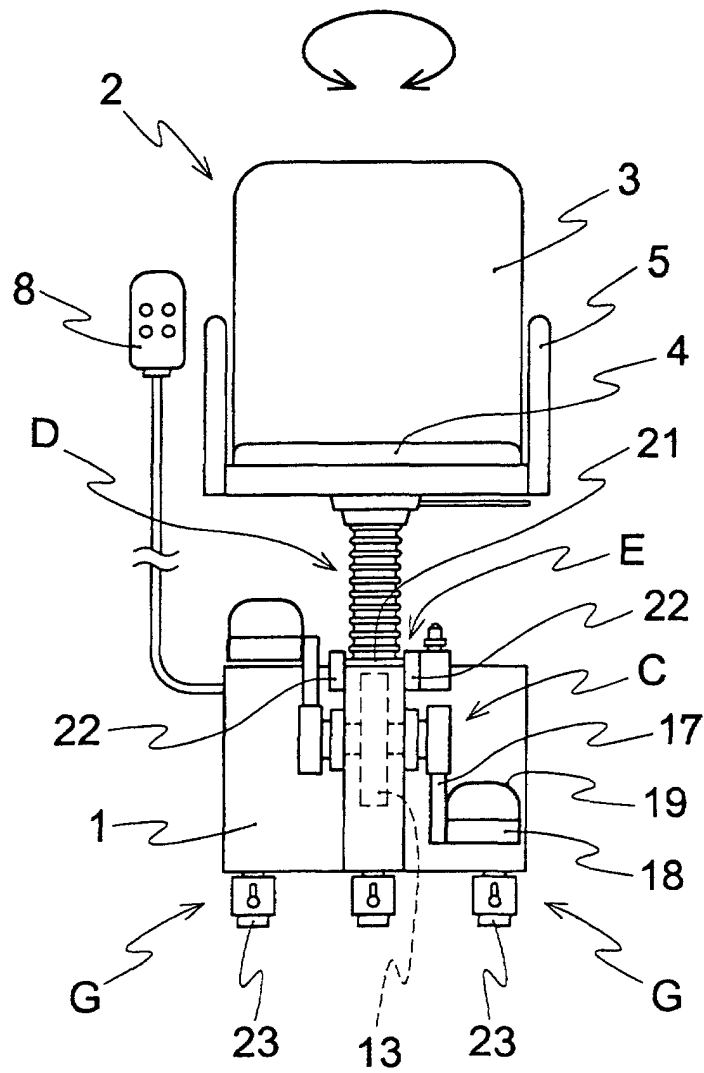


FIG. 4

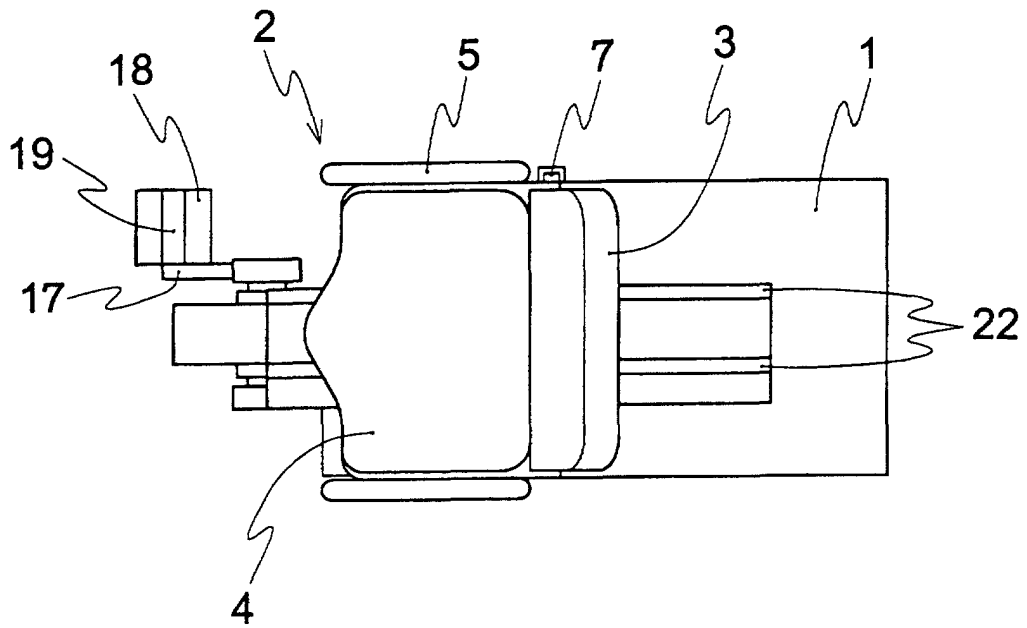


FIG. 5

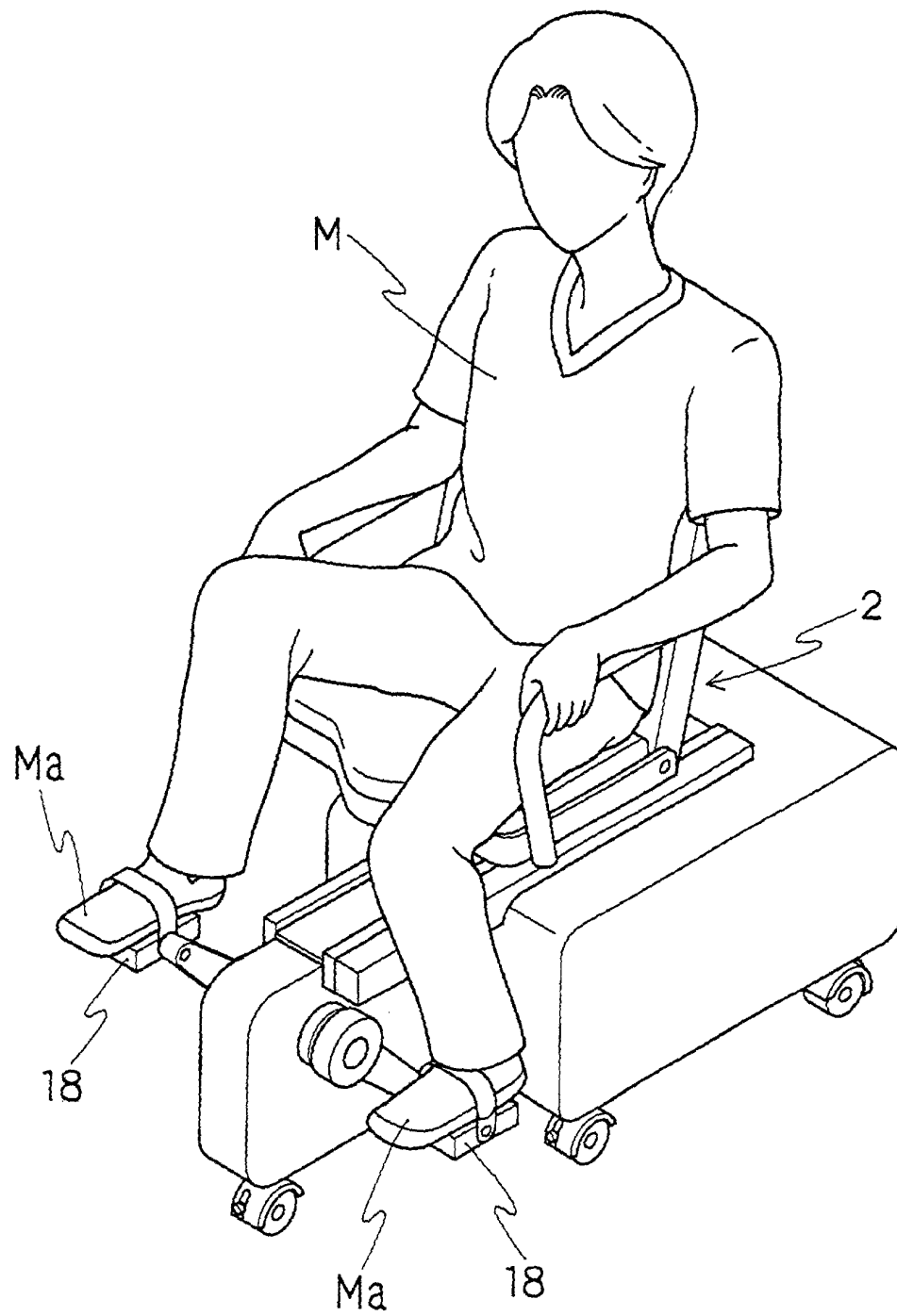


FIG. 6

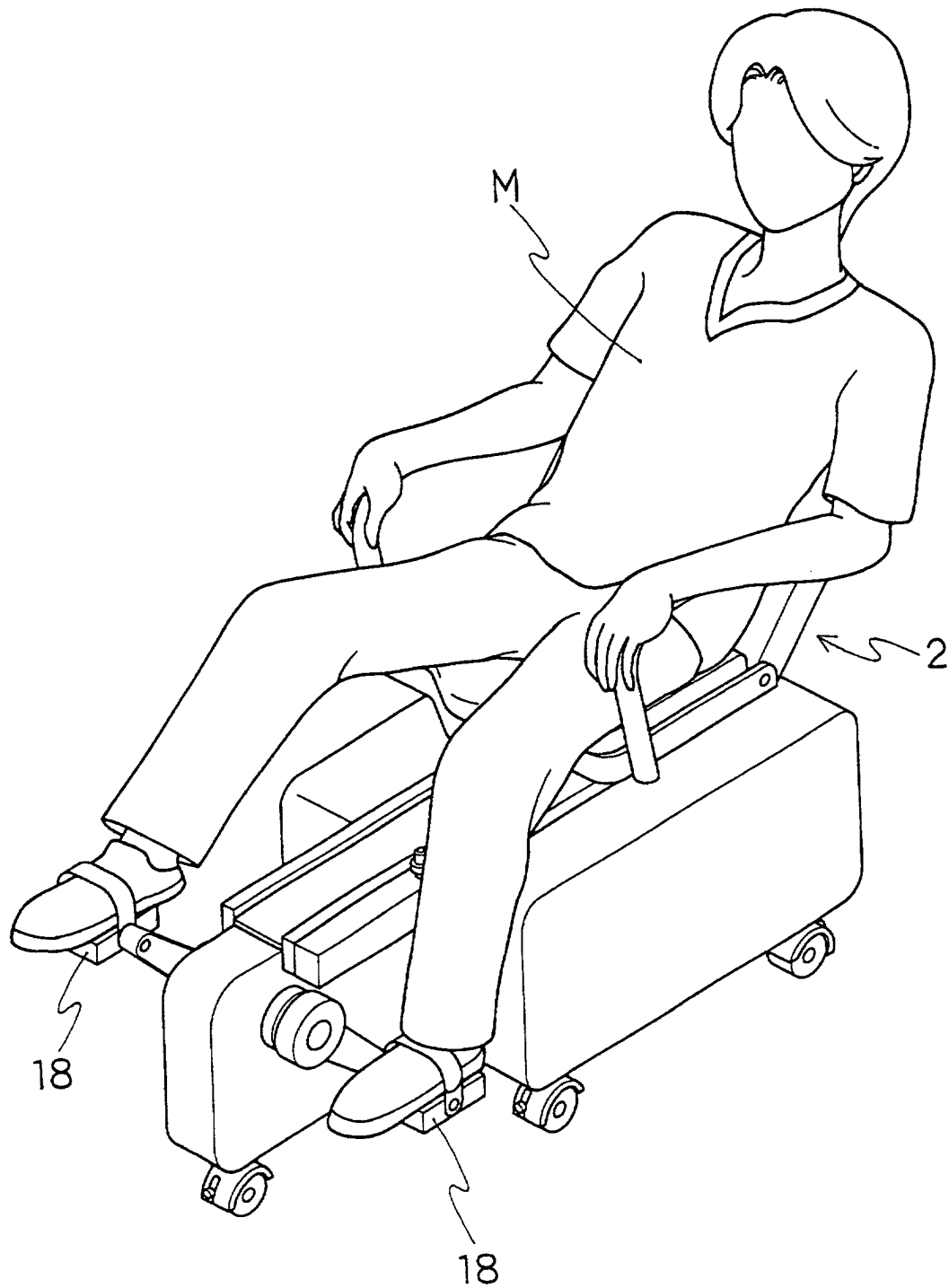


FIG. 7

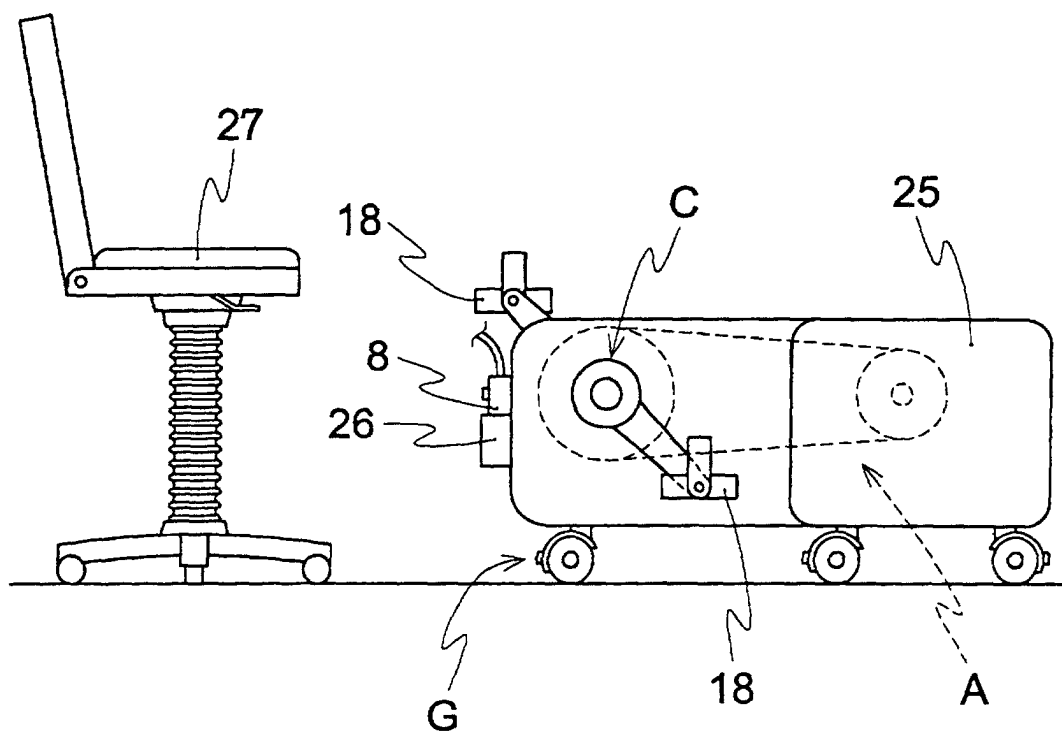


FIG. 8

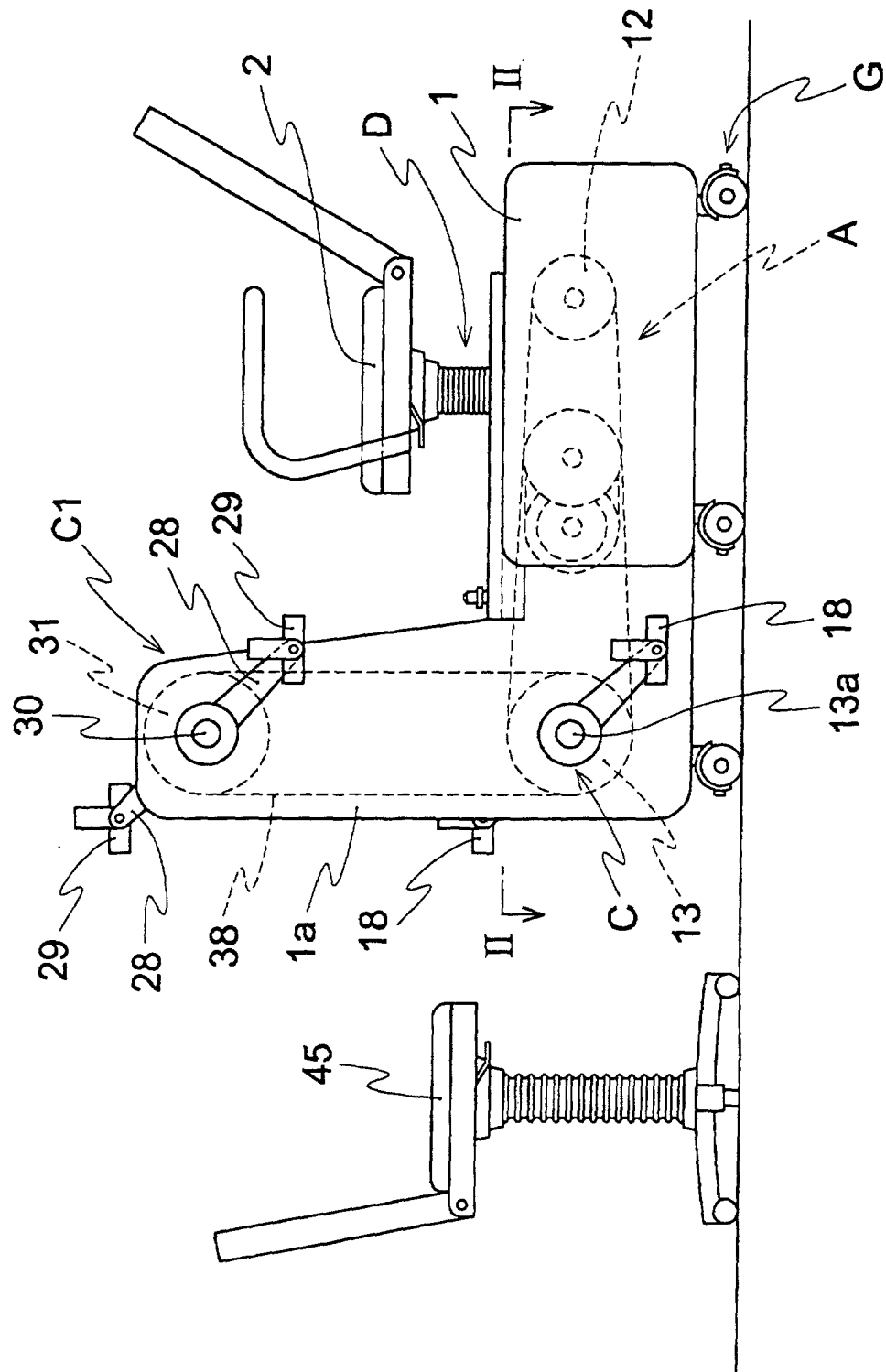


FIG. 9

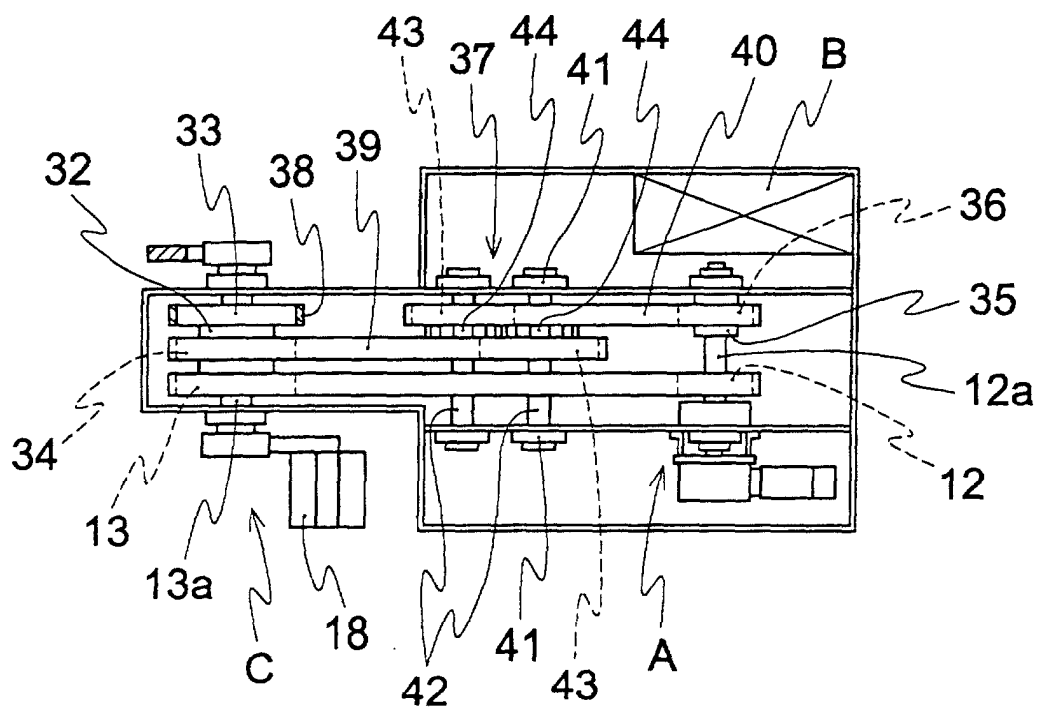


FIG. 10

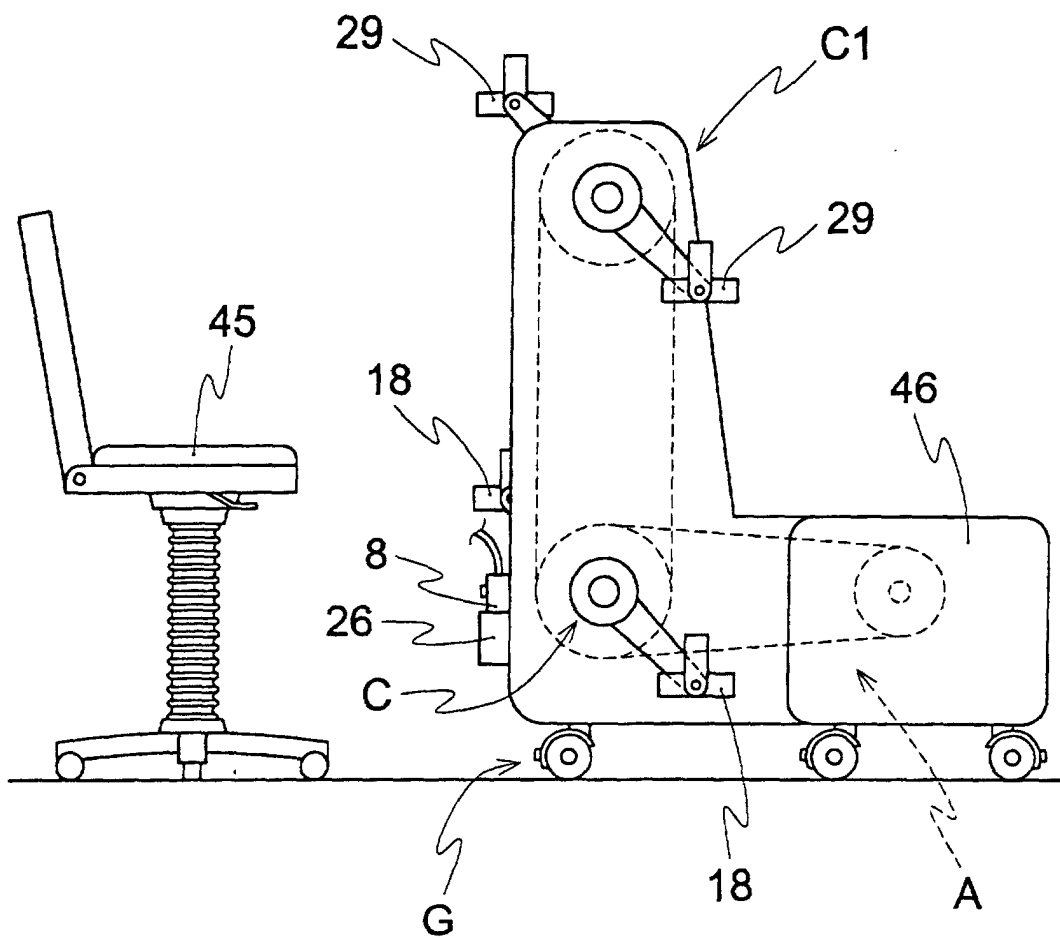


FIG. 11

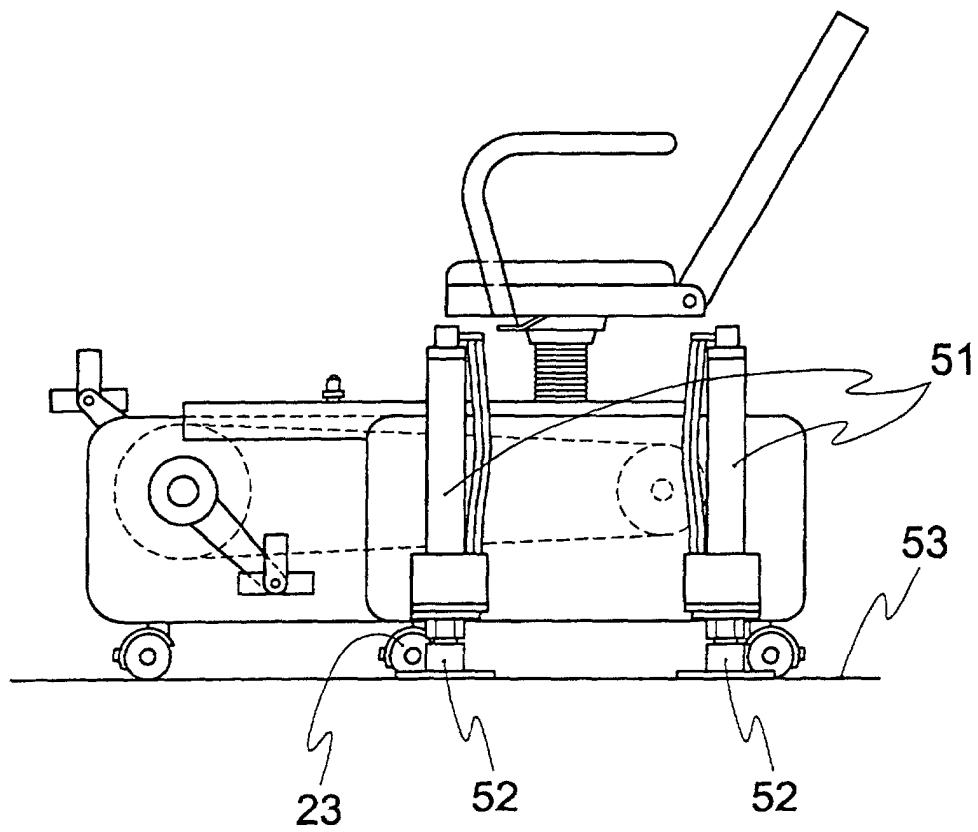
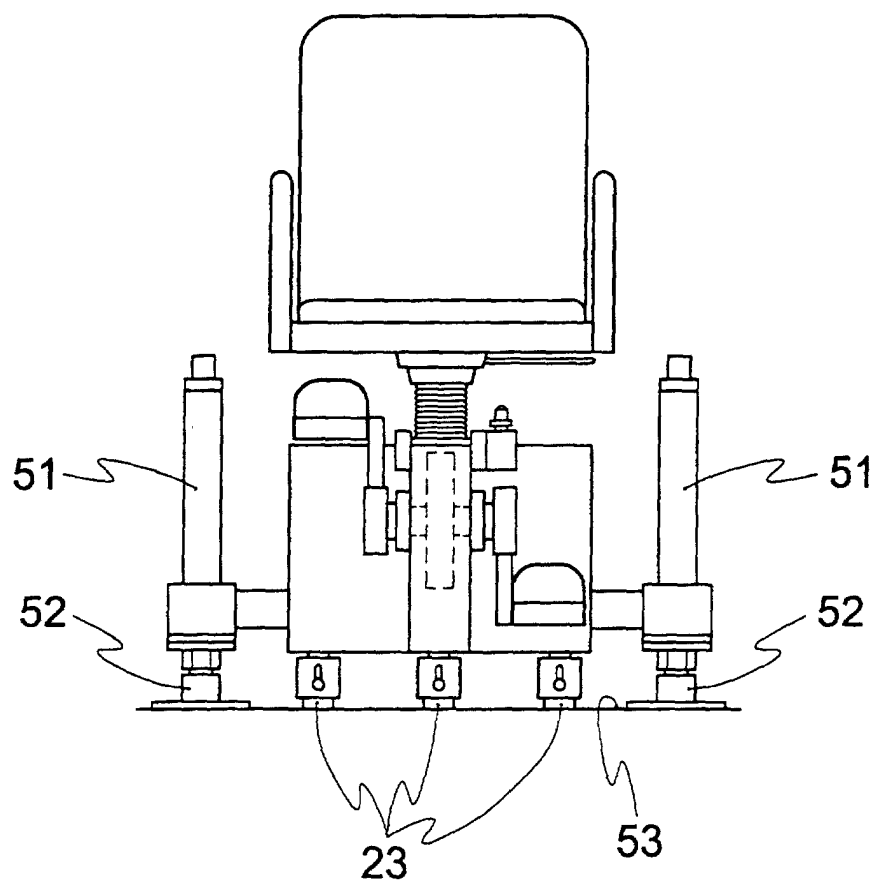


FIG. 12



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP01/03293

| A. CLASSIFICATION OF SUBJECT MATTER Int.Cl. ⁷ A63B22/06, A61H 1/02 | | |
|---|---|--|
| According to International Patent Classification (IPC) or to both national classification and IPC | | |
| B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) Int.Cl. ⁷ A63B22/06, A63B21/00, A63B23/00, A61H 1/02 | | |
| Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1922-1996 Toroku Jitsuyo Shinan Koho 1994-2001 Kokai Jitsuyo Shinan Koho 1971-2001 Jitsuyo Shinan Toroku Koho 1996-2001 | | |
| Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) | | |
| C. DOCUMENTS CONSIDERED TO BE RELEVANT | | |
| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
| X | JP, 57-59534, A (Miki YAMAMOTO), | 1 |
| Y | 09 April, 1982 (09.04.82), | 3-4 |
| A | Full text; all drawings (Family: none) | 6-14 |
| Y | JP, 1-165058, U (Sakai Iryo K.K.), | 2 |
| A | 17 November, 1989 (17.11.89), Full text; all drawings (Family: none) | 6-14 |
| Y | JP, 11-155978, A (Mitsubishi Electric Corporation, et al.), | 2, 4 |
| A | 15 June, 1999 (15.06.99), Full text; all drawings (Family: none) | 6-14 |
| Y | JP, 60-34467, A (JII OO Giken K.K.), | 3-4 |
| A | 22 February, 1985 (22.02.85), Full text; all drawings (Family: none) | 6-14 |
| A | JP, 10-305113, A (Kawashima Tekko K.K.), 17 November, 1998 (17.11.98), Full text; all drawings (Family: none) | 6-14 |
| <input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex. | | |
| * Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family | | |
| Date of the actual completion of the international search 27 June, 2001 (27.06.01) | | Date of mailing of the international search report 10 July, 2001 (10.07.01) |
| Name and mailing address of the ISA/ Japanese Patent Office | | Authorized officer |
| Facsimile No. | | Telephone No. |

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP01/03293

| C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT | | |
|---|--|-----------------------|
| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
| A | JP, 7-308405, A (Marutaka Iryoki K.K.), 28 November, 1995 (28.11.95), Full text; all drawings (Family: none) | 5-14 |

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