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(54) Training machine for strengthen training and rehabilitation

Trainingsmaschine für besseres Training und bessere Rehabilitierung

Machine d'entraînement à des fins de réadaptation et de développement de la force physique

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EP 1 928 562 B1

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Description

[0001] The present invention is related to a training machine for strengthen training and rehabilitation of the kind which is defined in the pre-characterising portion of claim 1.

[0002] At many already known training machines for anaerobic training the user exercises intended muscles of the body by performing pre-determined movements so that a weight package of a weight stack is lifted or lowered. At efficient training with single-joint movements, as by means of a biceps curl machine or a leg extension machine, as well as with multiple-joint movements, as by means of a rowing machine, a bench press machine or a leg press machine, it is important that the user of the machine can perform a number of positive and negative working cycles intended for the personal capacity of the training person. The positive work means that weights are being lifted and the negative work means that weights are being lowered.

[0003] In US-A-4,648,594 and GB-A-2 227 676 machines are previously known, at which the load increases during of the positive movement and is reduced to its original value at the end of the negative movement.

[0004] By instead varying the load so that, during the same total movement cycle, the positive working cycle becomes easier to perform, i.e., less force is required to lift the selected weight package than to lower it, the training person can lift a greater weight package than what was possible with a normal machine or alternatively perform more movements during one and the same workout session.

[0005] A machine of the type defined above is shown and described in US-A-4,563,003. This machine has a rod which is pressed against the weight package during the negative movement to increase the load when the weight package moves downwards. To provide a constantly increased load during the negative movement an influence of the rod must occur directly dependent on the movement of the training person during the whole negative movement. If the training person increases or decreases the movement rate during the negative work the speed of the rod must be amended in the same proportion. Such a regulation is very complex and difficult to perform in practise.

[0006] DE 4419883 discloses a training machine with the features of the preamble of claim 1. Further, a selected number of weights can be moved hence and force along a rail. The rail can be inclined by means of a hydraulic or pneumatic piston assembly. The inclination of the rail is computer controllable.

[0007] The object of the present invention is to provide a training machine of the type mentioned above which sets aside the above mentioned problem.

[0008] The object is achieved by means of a training machine having the characteristics defined in claim 1.

[0009] Preferred embodiments of the invention have been given the characteristics which are apparent in the

sub claims.

[0010] When a person lowers and lifts the same number of weights of a weight package, no consideration is taken to the fact that the negative, i.e., lowering, force of the person is greater than the positive, i.e., lifting, force of the person. Therefore, the effect of the training machine is limited. At training with conventional training machines the number of weights must be selected with regard to the weaker, lifting strength of the training person. The same number of weights is thereafter lowered at the negative part of the movement. Hence, this number of weights is not on a level with the negative strength.

[0011] With the training machine according to the invention the negative strength can be trained with a more optimal weight mass in the selected weight package. The result will be that the fatigue rate of the trained muscle will increase. With this invention it is possible to stimulate capacity improvement with less training amount than at training with conventional training machines. Scientific studies have shown that training where the selected weight package is adapted to the negative strength provides faster and greater strength growth than training where the weight package is adapted to the positive strength.

[0012] The invention is described in the following with reference to the appended drawings showing a preferred embodiment.

- Fig. 1 shows a front view of an embodiment of a training machine for strength training and rehabilitation according to the invention.
- Fig. 2 shows the training machine in Fig. 1 where a person who uses the machine has been deleted and where a seat with supporting frame is shown with broken lines for clarity.
- Fig. 3 shows the training machine of Fig. 1 in a positive movement position.
- Fig. 4 shows the training machine of Fig. 1 in a negative movement position.
- Fig. 5 shows a section along the line V-V in Fig. 2, where the machine is situated in a position for a positive movement.
- Fig. 6 shows a view like that in Fig. 5 of the machine, where the machine is situated in a position to perform a negative movement.
- Fig. 7 shows a side view of the training machine of Fig. 1 in a position of rest.
- Fig. 8 shows a side view similar to that in Fig. 7 where the person is performing either a positive or a negative movement.
- Fig. 9 shows a partial view from above of another embodiment of the machine in which the weight guides have another design.
- Fig. 10 is a partial side view of the embodiment shown in Fig. 9
- Fig. 11 shows a partial view from above of yet another embodiment of the machine in which the weight guides have yet another design.

[0013] In Fig. 1-8 an embodiment of a training machine 1 for strength training and rehabilitation according to the invention is shown, which machine comprises a weight stack section 2 and a training section 3, which are fixed connected to each other by means of inclined beams 4 and 5 as well as beams 6 and 7 which are arranged in a horizontal plane and fixed connected at the lower part of said sections 2 and 3. The weight stack section 2 has an inner substantially rectangular frame portion 8 (see Fig. 5 and 6), which is turnably journaled in pivot pins 9 and 10 within an outer substantially rectangular frame part portion 11. A horizontal beam 12 is via vertical beams 12a, 12b fixed connected between beam 7 and the frame construction 13 of the training section. The lower end of the inclined beam 5 is fixed connected to the beam 12. The portions comprised in the frame construction of the training machine 1, which portions are fixed connected to each other, are advantageously welded to each other to achieve a solid construction, which shall be able to stand high loads concerning pull and press loads as well as vibrations.

[0014] Between the upper and lower horizontal beams of the inner frame portion 8 guide rods 14 and 15 are fastened. Along these guide rods 14 and 15 weights 16 of a weight stack are arranged to slide. The weights have besides holes 14a and 15a for the guide rods 14 and 15, respectively, also a central hole for a lifting rod 17 (see Fig. 5), whereby a package 18 containing a pre-determined number of selected number of weights can be lifted by introducing a pin 19 through a hole 20 normal to the central hole through both the lowest weight 16a in the package 18, which is to be lifted, and a corresponding hole 21 in the lifting rod 17. Such corresponding holes 21 are arranged in front of all substantially horizontal holes 20 through the weights 16 of the weight stack, when the frame is vertical. Bearings (not shown), preferably ball or roller bearings, can be mounted in the holes 14a and 15a for the control rods 14 and 15 to reduce the friction at the displacement of the weights along the rods when the inner frame is inclined, which is to be described below. Lifting and lowering of the weight package 18 is performed by means of a non-elastic belt 22, preferably made by the material Kevlar®, which belt passes via pulleys 23 and 24 arranged on the upper beam of the inner frame portion 8. After the pulley 24 the belt extends along the side beam of the inner frame and is turned 90° to thereafter pass over and abut another pulley 25. From the pulley 25, which is arranged substantially on the same level as the pivot pins 9 and 10, the belt turns off obliquely downwards towards a pulley 26 mounted on the beam 12 (see Fig. 1-4). The pulley 26 has been mounted substantially on the same level as the pivot pins 9 and 10 so that the tension in the belt will not influence the movement of the inner frame 8, which is described below. From the pulley 26 the path of the belt extends substantially horizontal towards a further pulley 27 mounted on the beam 12 and runs thereafter upwards through a pulley 28 of an equalisation device 29 to an attachment 30 which is

provided on a protrusion on the beam 12b. The equalization device 29 comprises besides the pulley 28 a further pulley 31, which as the pulley 28 is journaled in freely hanging linkage arms 32 and 33. A further non-elastic belt 34, preferably made by the material Kevlar®, is mounted at its end by means of fastening devices 35 to the lower ends of arcuately extending turning arms 36 and 37, respectively. The equalisation device with the further belt 34 has been mounted in a well known way to equalize the power from the arms of the training person at loading towards the arms 42 and 43 which accordingly do not need to be moved away from the person the same distance to achieve effect because a person in most cases is not equal strong in both right and left arm.

[0015] At the opposite upper ends of the arms 36 and 37 linkage arms 38 and 39 are mounted, which are moveable in all directions, e.g., by means of a ball-and-socket joint. The arms 38 and 39 are in turn at their other ends in all directions freely moveably connected to couplings 40 and 41 mounted on pull and press arms 42 and 43, which in turn are freely turnably journaled at their upper ends on the frame construction 12 at 44 and 45, respectively. Handles 46 are provided at the lower ends of the arms 42 and 43. The turning arms 36 are journaled on a common through shaft 47 fastened at the frame construction 13. The turning arms 36 are freely journaled independently of each other on said shaft 47. A stop 47a restrains the movements of the turning arms in one direction of rotation.

[0016] In Fig. 1-6 a hydraulic cylinder device 48 is shown which at its one end 49 is mounted on a beam (not shown) which is fixed connected between the beams 6 and 7. The other end 50 of the cylinder device 48 is journaled at the lower cross beam 51 of the inner frame part 8. By activating the cylinder device 48, the inner frame 8 of the weight magazine portion 2 is arranged to rotate about the pivot pins 9 and 10, as is best evident from Fig. 3 and 5. The hydraulic cylinder device 48 is shown as an example of a device to turn the inner frame 8 in relation to the outer frame 11. Other known devices to perform this work can of course be used within the frame of the appended claims, as, e.g., a linear electro motor etc.

[0017] A person who shall train using the strength training device 1 according to the invention sets on the chair 52 and then grips the handles 46 on the arms 42 and 43, as is evident from Fig. 1. To facilitate the positive movement, i.e., the person presses the arms 42 and 43 outwardly from the body, the inner frame is turned according to Fig. 3 so that the power which is required to lift the upper weight package 1 is reduced by the inclination of the inner frame 8, whereas the upper weight package 18 slides on the controller rods 14 and 15 and a reduction of the power which is required to press the handles forwards can be reduced with up to over 50%. The positive power which is required to lift the weights will be substantially less than the negative force, i.e., in the order of more than 30%, more precisely about 40%. When the

person begins the negative movement, i.e., the person moves the arms 42 and 43 inwardly towards the body to a stop/start position where the stop 47a abuts against the frame construction 13, the inner frame 8 is turned back to its original vertical position in which the person achieves full load from the weight package 18. Turning the inner frame by means of the cylinder device 48 occurs automatically by means of a control unit (not shown) which via sensors sensing the movement of the belt 22 and turning the inner frame against the position in Fig. 3 when the belt is moved in the direction of the arrows 53 and against the position in Fig. 4 when the belt moves in the direction of the arrows 54.

[0018] As described above, the inner frame portion 8 is turnably journaled in pivot pins 9 and 10 so that the frame can be tilted to different positions depending on the difference in loads to be achieved at the negative or positive movements, as described above. The suspension of the inner frame portion 8 in pivot pins shown in the drawings is not a limitation to such a suspension, the importance is actually that the frame portion 8 is tiltable around a substantially horizontal axis. Instead of pivot pins a single shaft can be provided, preferably extending outside the main outline of the inner frame portion 8.

[0019] At a further embodiment of the training machine according to the invention as can be seen in Fig. 9 and 10, the weights 14 are guided by means of opposite guide rollers 61 at both short ends thereof. Each roller 61 is mounted on a shaft 62 and is arranged to be movable hence and forth in tracks 63 provided on the tiltable frame 8 of the machine and at each side thereof. The guide rollers 61 can be firm knobs of preferably a low friction material or coated with such a material. The rollers 61 can also be small wheels which are movable in the tracks 63. The lifting rod 17 extends through the central hole 14a in the weights 14.

[0020] At an embodiment not shown in the drawings the guide rollers of figs. 9 and 10 can be provided at other sites of the weights, e.g., both rollers can be provided on anyone of the long side of the weight instead of on the opposite short sides. In this case the tracks are not mounted on the tiltable frame, but across the long sides of the weights and fastened to the frame.

[0021] A further development of the training machine according to the invention, wherein the weight package with rollers as shown in figs. 9 and 10 is made as short as possible with respect to the height thereof, yet another embodiment is illustrated in Fig. 11. In this embodiment, the weights 14 are guided by means of two guide rollers 71 at each end thereof, said rollers being mounted in such a way that on one weight the rollers are mounted on opposite ends, but at diametrically opposite corners, whereby next weight is turned 180 degrees so that the rollers of two succeeding weights are partially overlapped. Each roller 71 is mounted on a shaft 72 and is arranged to be movable hence and forth in two parallel tracks 73 and 74 provided on the tiltable frame 8 of the machine and at each side thereof. The guide rollers 71

can be firm knobs of preferably a low friction material or coated with such a material. The rollers 71 can also be small wheels which are movable in the tracks 73. A longitudinal recess can be provided in the inner side wall of each track to guide the rollers in the track when the frame 8 is tilted. The lifting rod 17 extends through the central hole 14a in the weights 14.

[0022] At an embodiment which is not shown in the drawings the guide rollers of fig. 11 can be provided at other sites, e.g., all rollers can be provided on anyone of the long side of the weight instead of on the opposite short sides. In this case the tracks are not mounted on the tiltable frame, but across the long sides of the weights and fastened to the frame.

[0023] If the tracks in the embodiments shown in figs. 9 - 11 are so oriented that the weights will be hanging on the guide rollers, each roller can be replaced by two parallel wheels and the tracks will have flanges at the outer ridges thereof to receive such parallel wheels.

[0024] At both embodiments shown in figs. 9 - 11, at least one weight between weights having rollers mounted thereon can be provided without having a roller, since a predetermined number of weights having guide rollers will be sufficient to guide all weights hence and forth. The weights without rollers can be provided with recesses which are intended to receive protrusions on the following weight having guide rollers to prevent that the weight without rollers is turned around the lifting rod.

[0025] At the shown and above described preferred embodiment of the training machine according to the invention it is achieved that the trained person is given the possibility to either lift more weights than what is possible by means of conventional known machine or lift more times with the same weight as was earlier used.

[0026] Although different embodiments are disclosed in the description and drawings, the training machine according to the invention can be modified within the scope of the appended claims.

Claims

1. A training machine for strength training and rehabilitation comprising pull or press means (42, 43), which are arranged to be moved backwards and forwards while a pre-determined number of selected weights (16a, 18) in a weight package (16, 16a, 18, 18a) is arranged to be lifted and lowered, alternatively, by connection means (22, 19), said pre-determined number of weights being lifted in a continuous movement by means of a first user intended powered force against said pull or press means (42, 43) and being lowered by means of a second user intended powered force against said pull or press means (42, 43), said first power being less than said second power, **characterised in that** the machine comprises an inner frame (8) which carries said weights (16, 16a, 18, 18a) and along which said pre-determined

number of weights (16a, 18) are slidable, **in that** said inner frame comprising the whole weight package including the selected and the not selected weights is turnably journaled about a substantially horizontal turning axis (9, 10), which is constituted of two pivot pins (9, 10), which are provided on both sides of said frame and which are situated on a substantial distance from the lower side of the frame, and **in that** it further comprises a control unit to automatically turn the inner frame by means of driving means (48), said control unit comprising sensors sensing via the movement of the connection means (22, 19) and turning the inner frame from an inclined position to a substantially vertical position and vice versa, said driving means (48) being an electrical motor or a hydraulic cylinder device or the like, said driving means being arranged to move the frame backwards and forwards about said pivot pins (9, 10) from the pre-determined inclined position, where the selected weights are to be raised, and the substantially vertical position, where the selected weights are to be lowered.

2. Training machine according to claim 1, **characterised in that** said turning axis (9, 10) is parallel to the lower substantial horizontal side of the frame.
3. Training machine according to claim 1 or 2, **characterised in that** said turning axis is situated approximately at the middle of the frame in a vertical direction.
4. Training machine according to any of claims 1-3, **characterised in that** said first power is substantially less than said second power, i.e., in the order of more than 30%, more precisely about 40%.
5. Training machine according to any of claims 1-4, **characterised in that** said connection means are constituted of at least one non-elastic belt (22, 19), preferably of the material Kevlar®, said belt being connected between said pull or press means (42, 43) and said pre-determined number of weights (16a, 18) via a lever system (29, 34, 38, 36) and freely journaled pulleys (23, 24, 25, 26, 32, 91, 92, 94) arranged on the machine.
6. Training machine according to claim 5, **characterised in that** said non-elastic belt (22, 19) is past from said pre-determined number of weights (16a, 18) along the frame (8) about a pulley (25) which is arranged substantially on the level of said turning axis (9) and further on the machine for connection to said pull or press means (42, 43).

Patentansprüche

1. Trainingsmaschine für verstärktes Training und verstärkte Rehabilitation, die Zug- oder Druckmittel (42, 43) aufweist, die angeordnet sind, um vorwärts und rückwärts bewegt zu werden, während eine vorbestimmte Anzahl von ausgewählten Gewichten (16a, 18) in einer Gewichtspackung (16, 16a, 18, 18a) angeordnet ist, um durch Verbindungsmittel (22, 19) abwechselnd angehoben und abgesenkt zu werden, wobei die vorbestimmte Anzahl von Gewichten mittels einer ersten vom Benutzer gewünschten Kraft gegen die Zug- oder Druckmittel (42, 43) in kontinuierlicher Bewegung angehoben wird und mittels einer zweiten vom Benutzer gewünschten Kraft gegen die Zug- oder Druckmittel (42, 43) abgesenkt wird, wobei die erste Kraft geringer als die zweite Kraft ist, **dadurch gekennzeichnet, dass** die Maschine einen inneren Rahmen (8) aufweist, der die Gewichte (16, 16a, 18, 18a) trägt und entlang dem die vorbestimmte Anzahl von Gewichten (16a, 18) verschiebbar sind, dass der innere Rahmen, der die gesamte Gewichtspackung einschließlich der gewählten und der nicht gewählten Gewichte aufweist, um eine im Wesentlichen horizontale Schwenkachse (9, 10) schwenkbar gelagert ist, welche aus zwei Schwenkzapfen (9, 10) dargestellt ist, die an beiden Seiten des Rahmens vorgesehen sind und die mit wesentlichem Abstand von der Unterseite des Rahmens angeordnet sind, und dass sie ferner eine Steuereinheit aufweist, um den inneren Rahmen durch Antriebsmittel (48) automatisch zu drehen, wobei die Steuereinheit Sensoren aufweist, die über die Bewegung der Verbindungsmittel (22, 19) und die Drehung des inneren Rahmens in einer geneigten Position zu einer im Wesentlichen vertikalen Position und umgekehrt sensieren, wobei die Antriebsmittel (48) ein Elektromotor oder eine Hydraulikzylindervorrichtung oder dergleichen sind, wobei die Antriebsmittel angeordnet sind, um den Rahmen um die Schwenkzapfen (9, 10) aus der vorbestimmten geneigten Position, wo die gewählten Gewichte anzuheben sind, und der im Wesentlichen vertikalen Position, wo die gewählten Gewichte abzusenken sind, vorwärts und rückwärts zu bewegen.
2. Trainingsmaschine nach Anspruch 1, **dadurch gekennzeichnet, dass** die Schwenkachse (9, 10) parallel zur unteren im Wesentlichen horizontalen Seite des Rahmens ist.
3. Trainingsmaschine nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die Schwenkachse angenähert in der Mitte des Rahmens in vertikaler Richtung angeordnet ist.

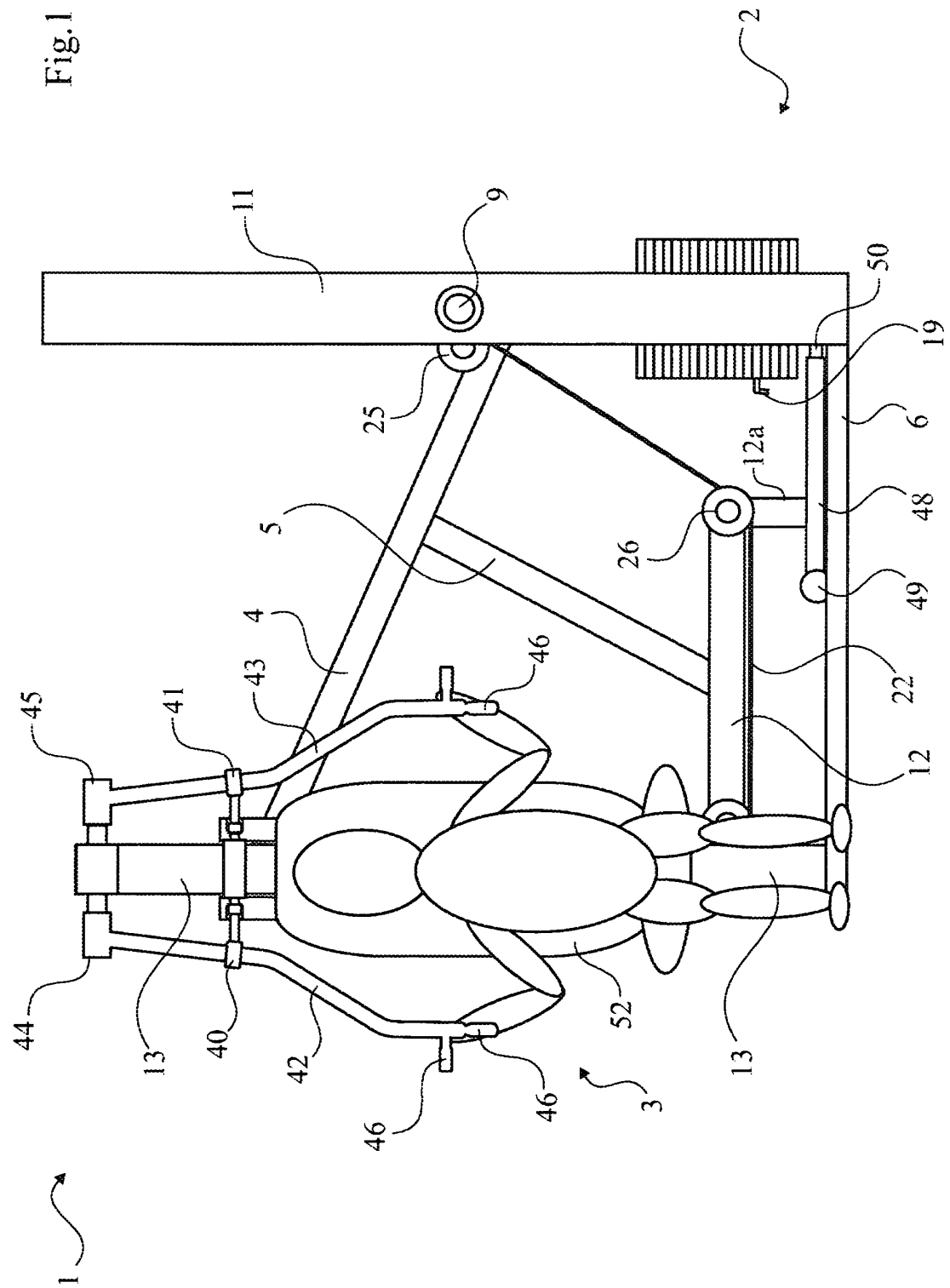
4. Trainingsmaschine nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** die erste Kraft wesentlich kleiner als die zweite Kraft ist, d.h. in der Größenordnung von mehr als 30%, genauer etwa 40%.
5. Trainingsmaschine nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** die Verbindungsmittel dargestellt sind aus zumindest einem nicht elastischen Riemen (22, 19), bevorzugt aus dem Material Kevlar®, wobei der Riemen zwischen den Zug- oder Druckmitteln (42, 43) und der vorbestimmten Anzahl von Gewichten (16a, 18) über ein Hebelsystem (29, 34, 38, 36) und frei drehbare Riemenscheiben (23, 24, 25, 26, 32, 91, 92, 94), die an der Maschine angeordnet sind, angeschlossen sind.
6. Trainingsmaschine nach Anspruch 5, **dadurch gekennzeichnet, dass** der nicht elastische Riemen (22, 19) von der vorbestimmten Anzahl von Gewichten (16a, 18) entlang dem Rahmen (8) um eine Riemenscheibe (25), die im Wesentlichen in Höhe der Schwenkachse (9) angeordnet ist, und weiter an der Maschine zur Verbindung mit den Zug- oder Druckmitteln (42, 43) verläuft.

Revendications

1. Un appareil d'entraînement pour la musculation et la rééducation comprenant des moyens de traction ou de pression (42, 43), qui sont agencés pour être déplacés vers l'arrière et vers l'avant tandis qu'un nombre prédéterminé de poids sélectionnés (16a, 18) parmi un ensemble de poids (16, 16a, 18, 18a) est agencé pour être alternativement levé et abaissé, par des moyens de liaison (22, 19), ledit nombre prédéterminé de poids sélectionnés étant levé selon un mouvement continu par l'intermédiaire d'une première force exercée par un utilisateur sur lesdits moyens de traction ou de pression (42, 43) et étant abaissé au moyen d'une deuxième force exercée par un utilisateur sur les moyens de traction ou de pression (42, 43), ladite première force étant inférieure à ladite deuxième force, **caractérisé en ce que** la machine comprend un châssis intérieur (8) qui porte lesdits poids (16, 16a, 18, 18a) et le long duquel ledit nombre prédéterminé de poids (16a, 18) peut coulisser, **en ce que** ledit châssis intérieur, qui comprend le groupe entier de poids, y compris ceux sélectionnés et ceux non sélectionnés, est monté pivotant autour d'un axe de pivotement (9, 10) sensiblement horizontal, qui est constitué par deux tourillons (9, 10) qui sont disposés sur les deux côtés dudit châssis et qui sont situés sur une distance substantielle du côté inférieur du châssis, et **en ce qu'il** comprend en outre une unité de commande pour faire tourner automatiquement le châssis inté-

rieur par l'intermédiaire de moyens d'entraînement (48), ladite unité de commande comprenant des capteurs opérant une détection via le mouvement des moyens de liaison (22, 19) et faisant pivoter le châssis intérieur d'une position inclinée à une position sensiblement verticale et vice versa, lesdits moyens d'entraînement (48) étant un moteur électrique ou un dispositif à vérin hydraulique ou analogue, lesdits moyens d'entraînement étant agencés de manière à déplacer le châssis vers l'arrière et vers l'avant autour desdits axes de pivotement (9, 10), depuis la position prédéterminée inclinée, dans laquelle les poids sélectionnés doivent être soulevés, jusqu'à la position sensiblement verticale, dans laquelle les poids sélectionnés doivent être abaissés.

2. Appareil d'entraînement selon la revendication 1, **caractérisé en ce que** ledit axe de pivotement (9, 10) est parallèle à la partie inférieure sensiblement horizontale du châssis.
3. Appareil d'entraînement selon la revendication 1 ou la revendication 2, **caractérisé en ce que** ledit axe de pivotement est situé approximativement au niveau du milieu du châssis dans une direction verticale.
4. Appareil d'entraînement selon l'une quelconque des revendications 1 à 3, **caractérisé en ce que** ladite première force est sensiblement inférieure à ladite deuxième force, c'est-à-dire, de l'ordre de plus de 30%, et plus précisément d'environ 40%.
5. Appareil d'entraînement selon l'une quelconque des revendications 1 à 4, **caractérisé en ce que** lesdits moyens de liaison sont constitués par au moins une bande non élastique (22, 19), de préférence en matériau dit Kevlar®, ladite bande étant reliée auxdits moyens de traction ou de pression (42, 43) et audit nombre prédéterminé de poids (16a, 18) via un système à levier (29, 34, 38, 36) et à poulies (23, 24, 25, 26, 32, 91, 92, 94) à rotation libre, disposés sur l'appareil.
6. Appareil d'entraînement selon la revendication 5, **caractérisé en ce que** ladite bande non élastique (22, 19) s'étend depuis ledit nombre prédéterminé de poids (16a, 18) puis le long du châssis (8), autour d'une poulie (25) qui est située sensiblement au niveau dudit axe de pivotement (9), puis sur la machine pour être reliée auxdits moyens de traction ou de pression (42, 43).



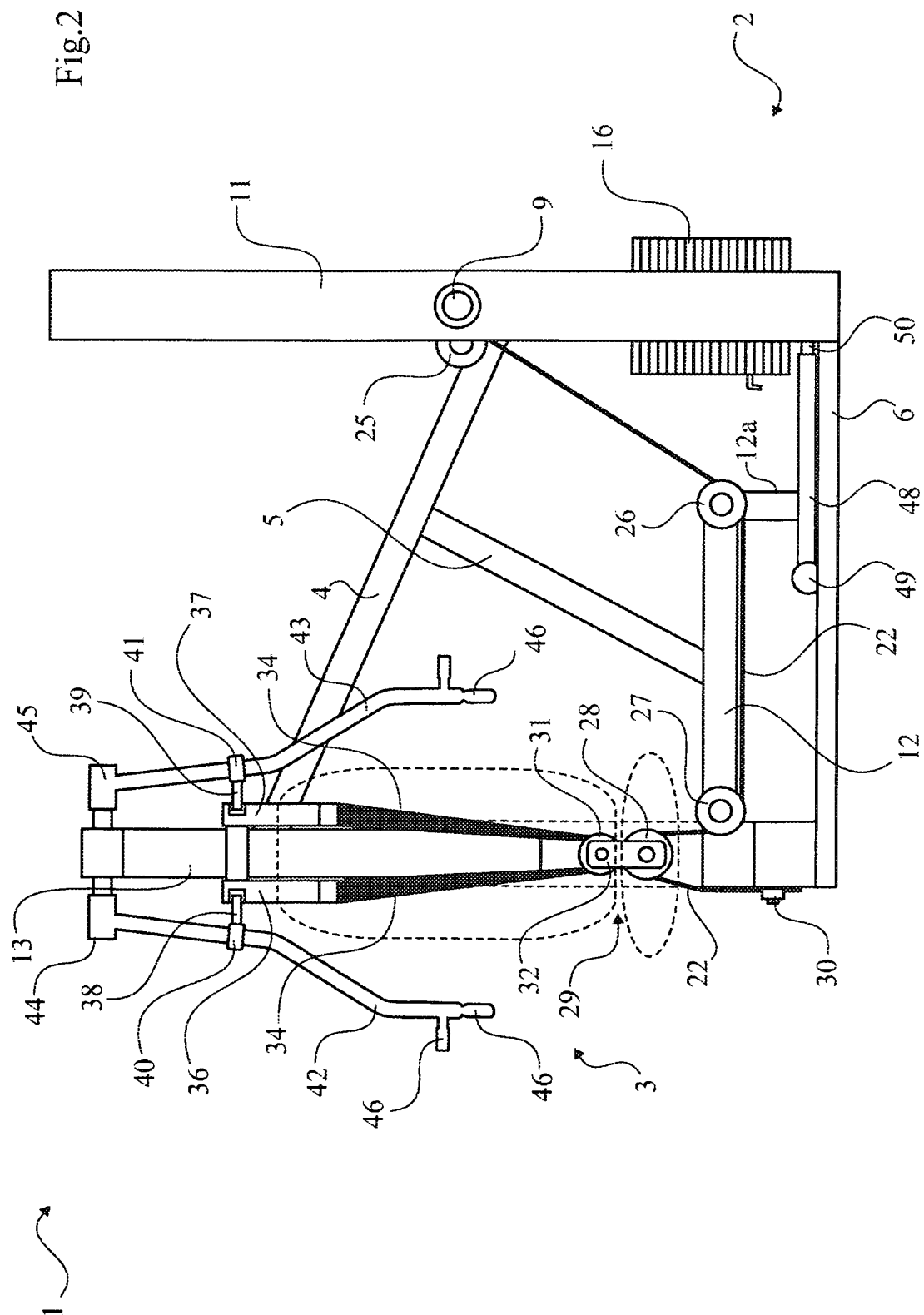


Fig. 2

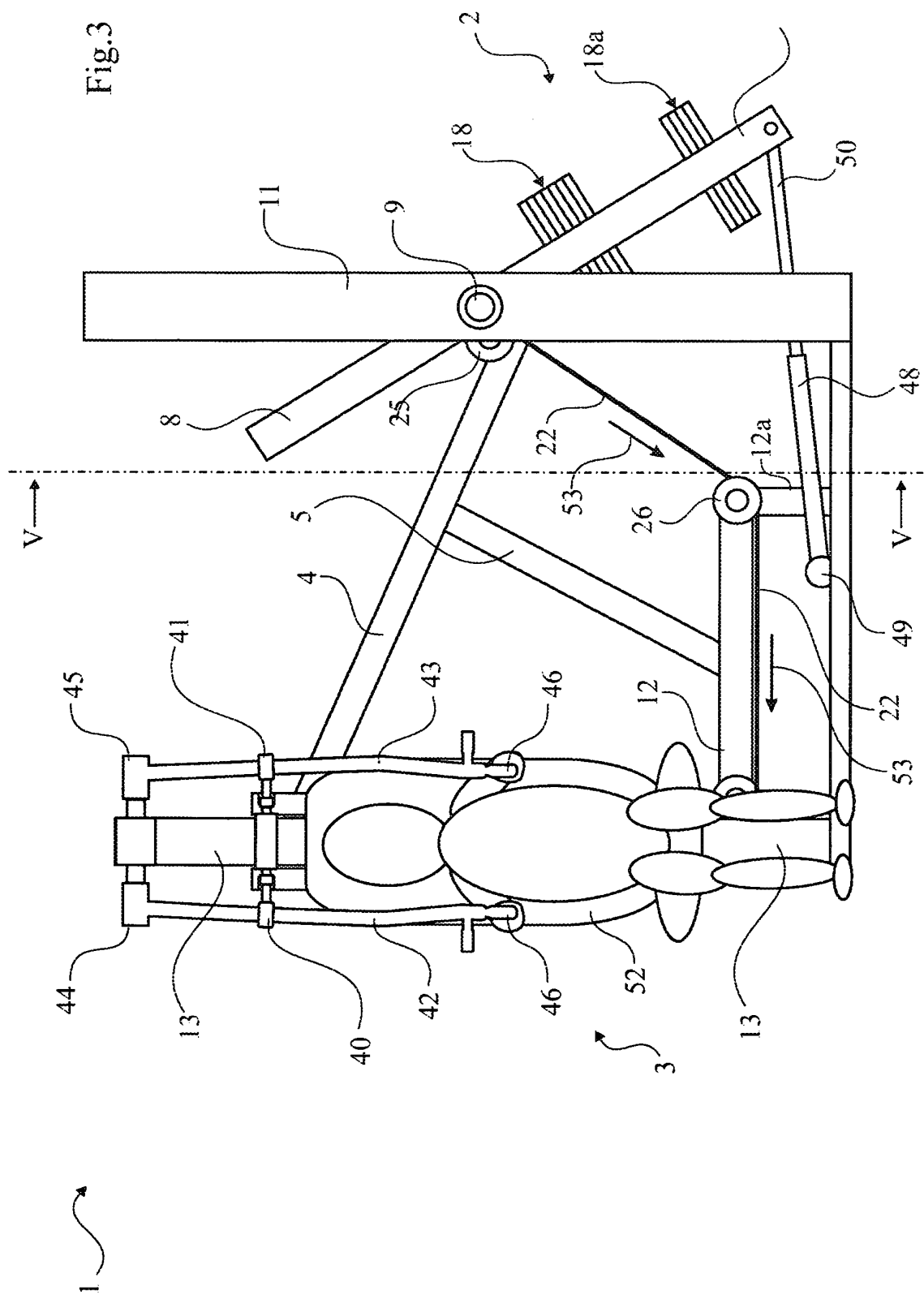
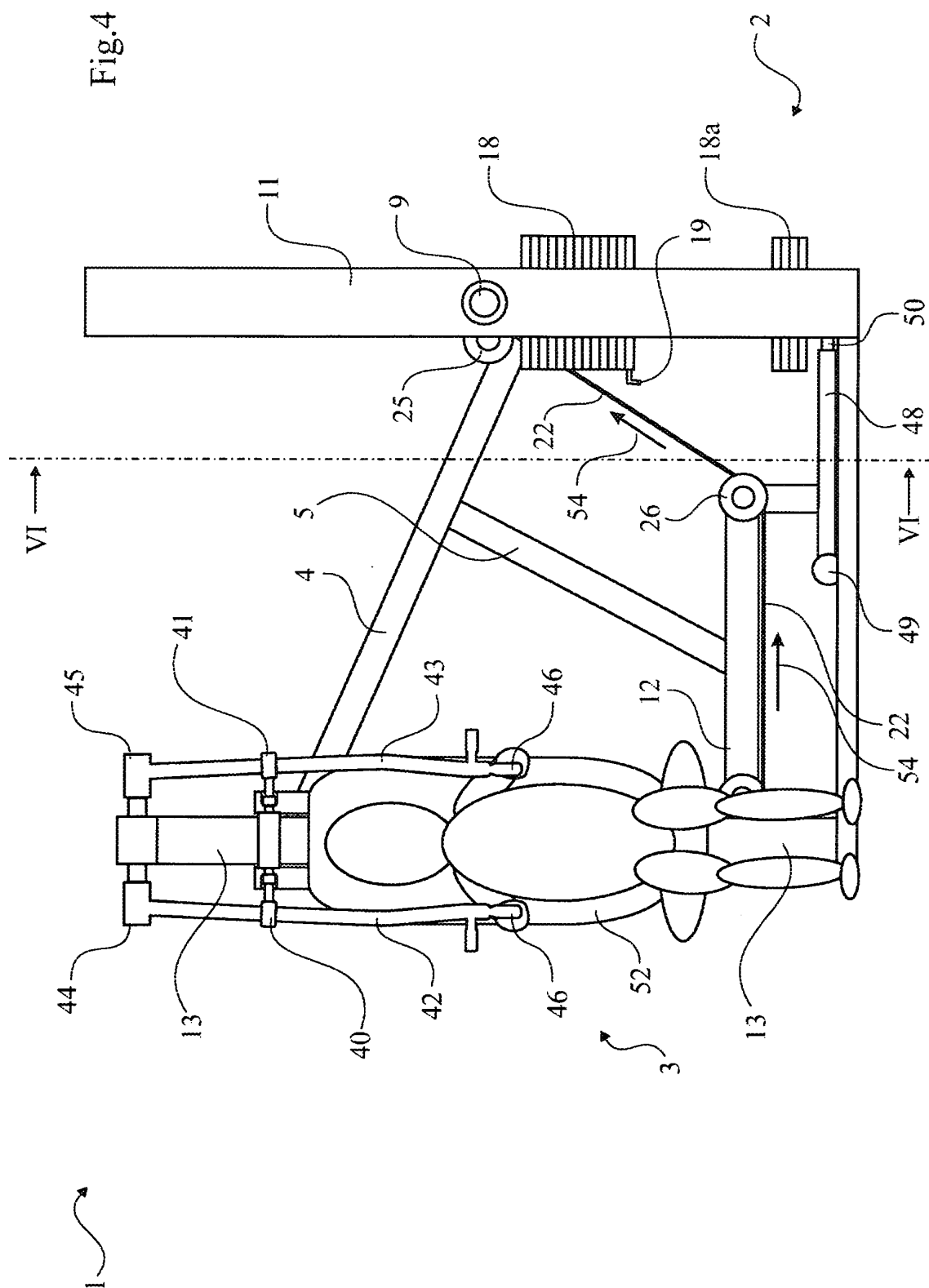
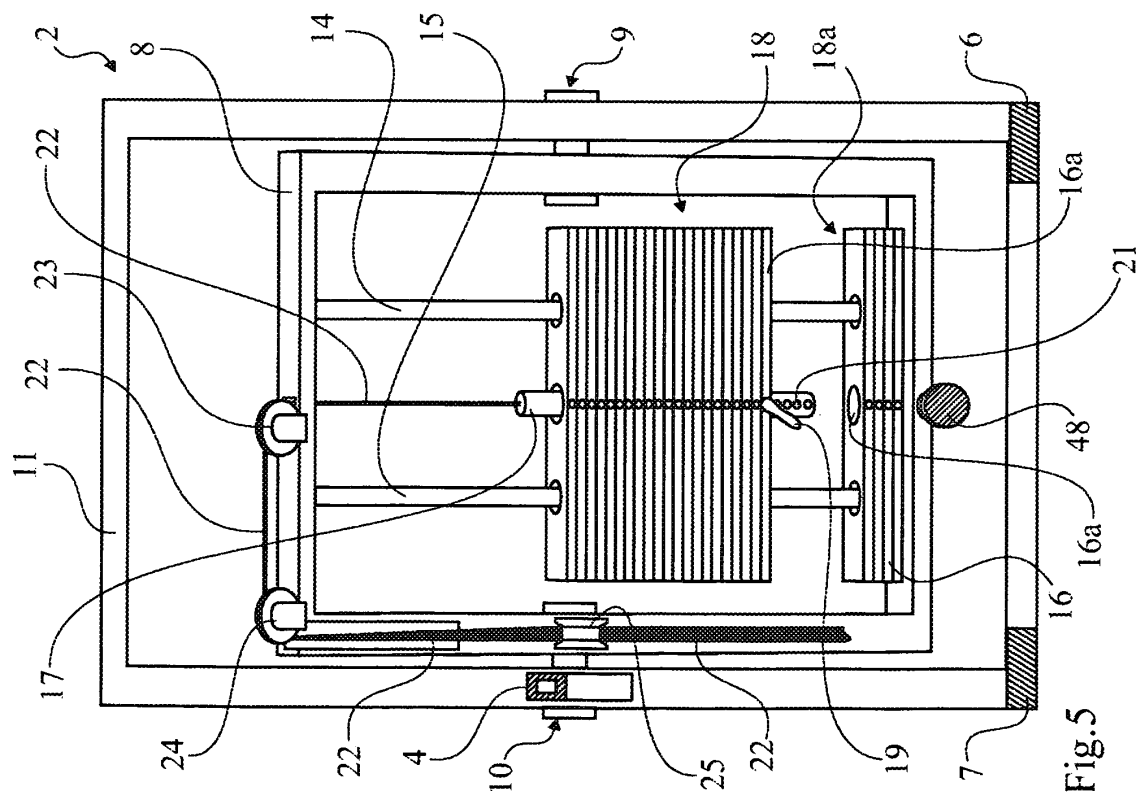
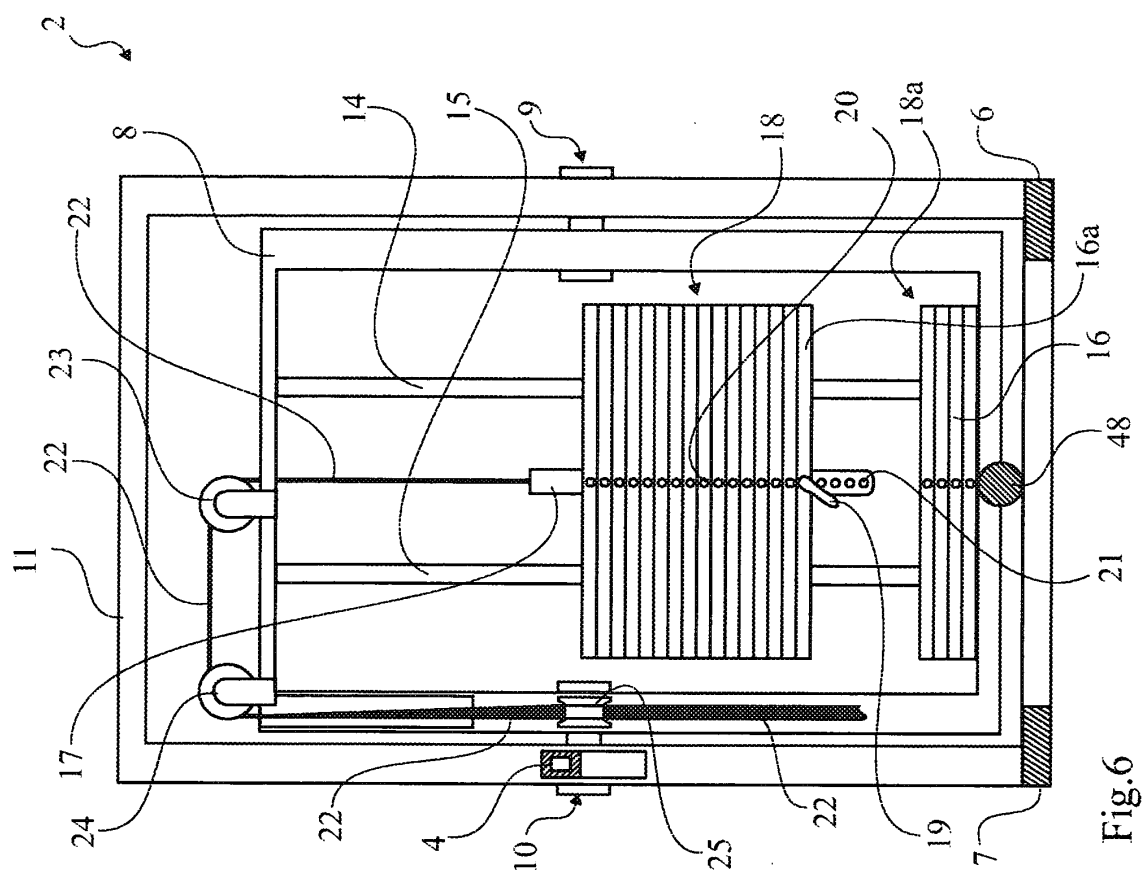


Fig. 4





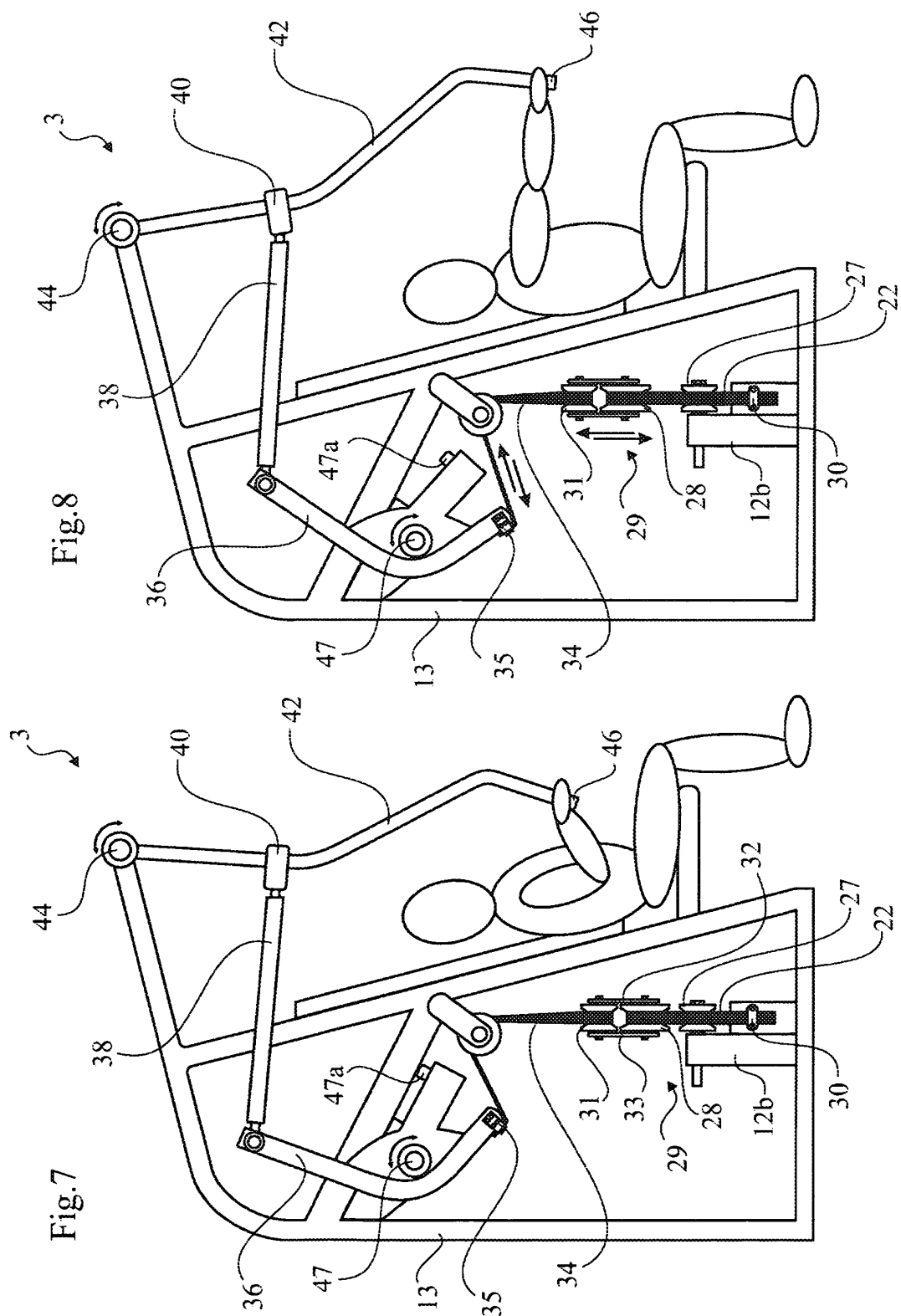


Fig.9

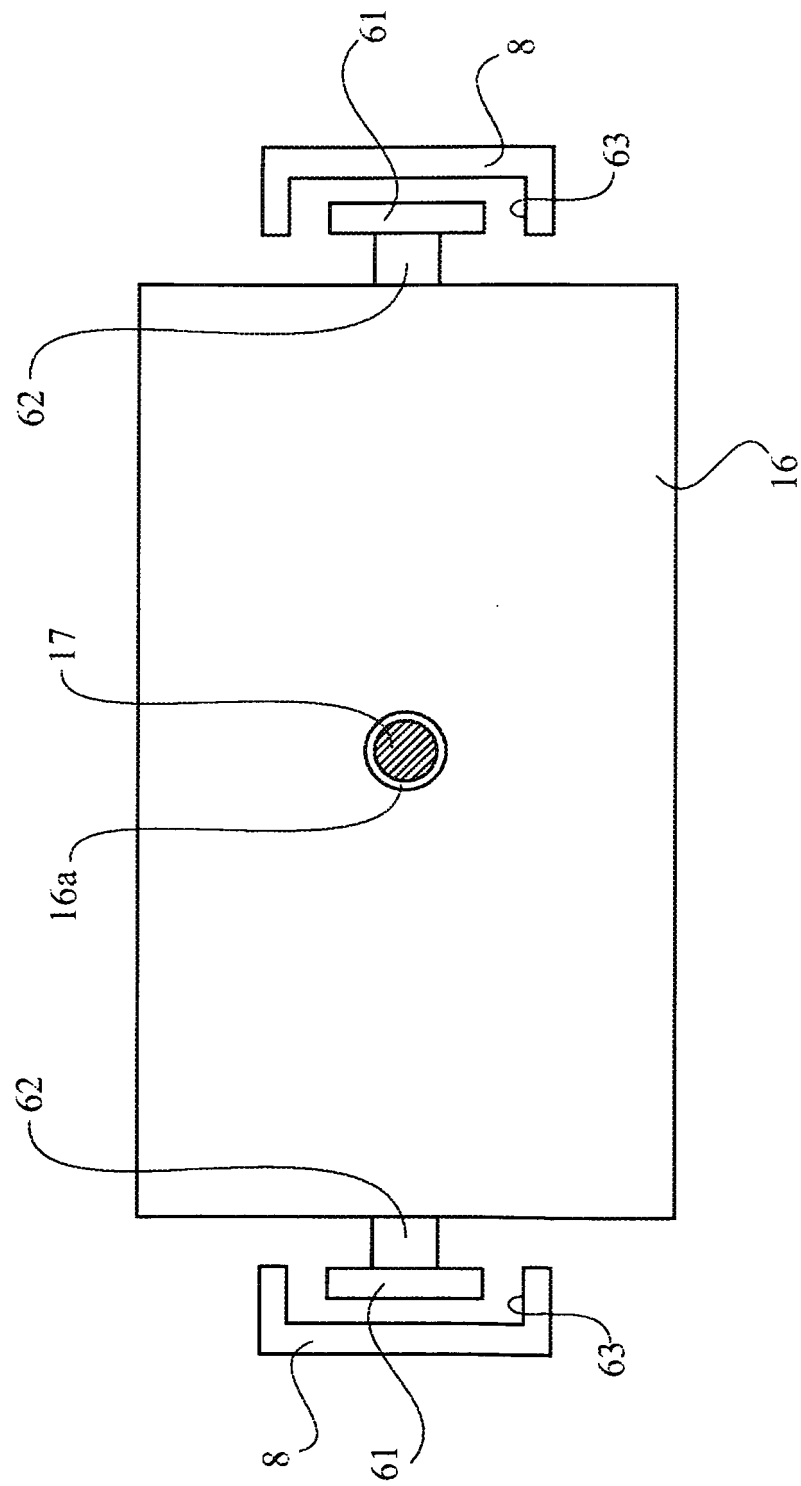


Fig.10

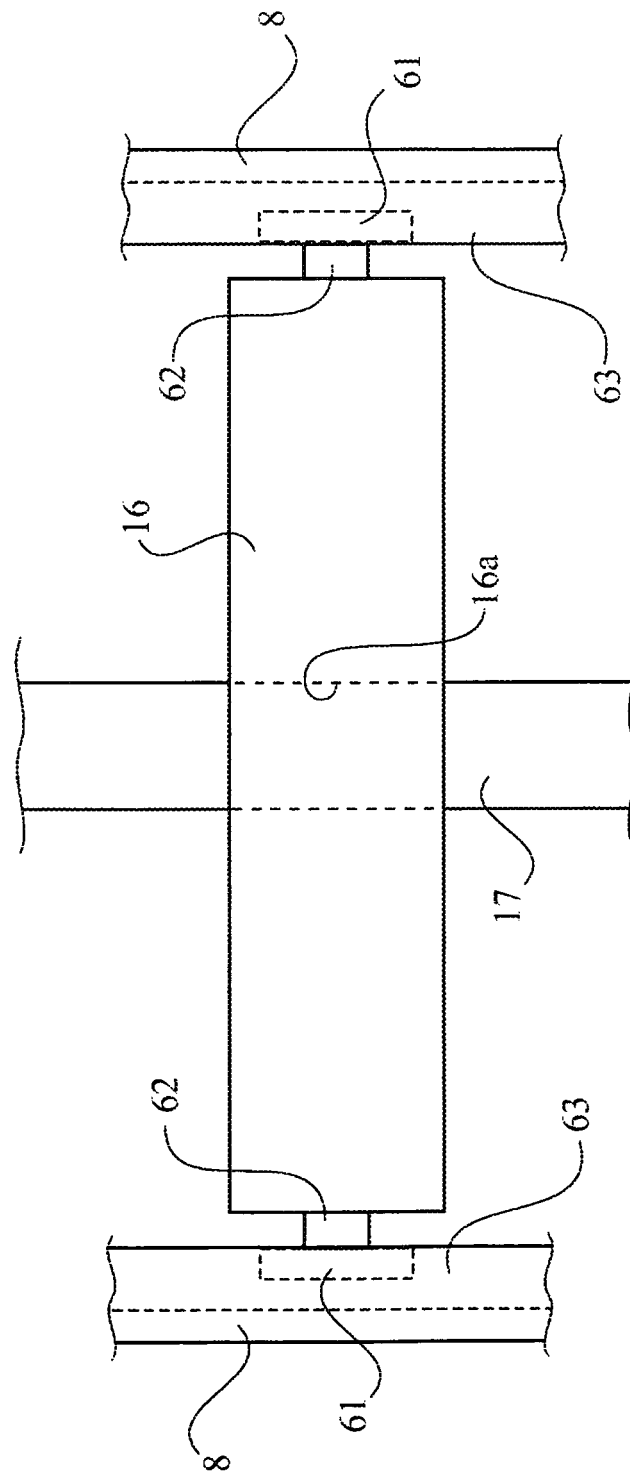
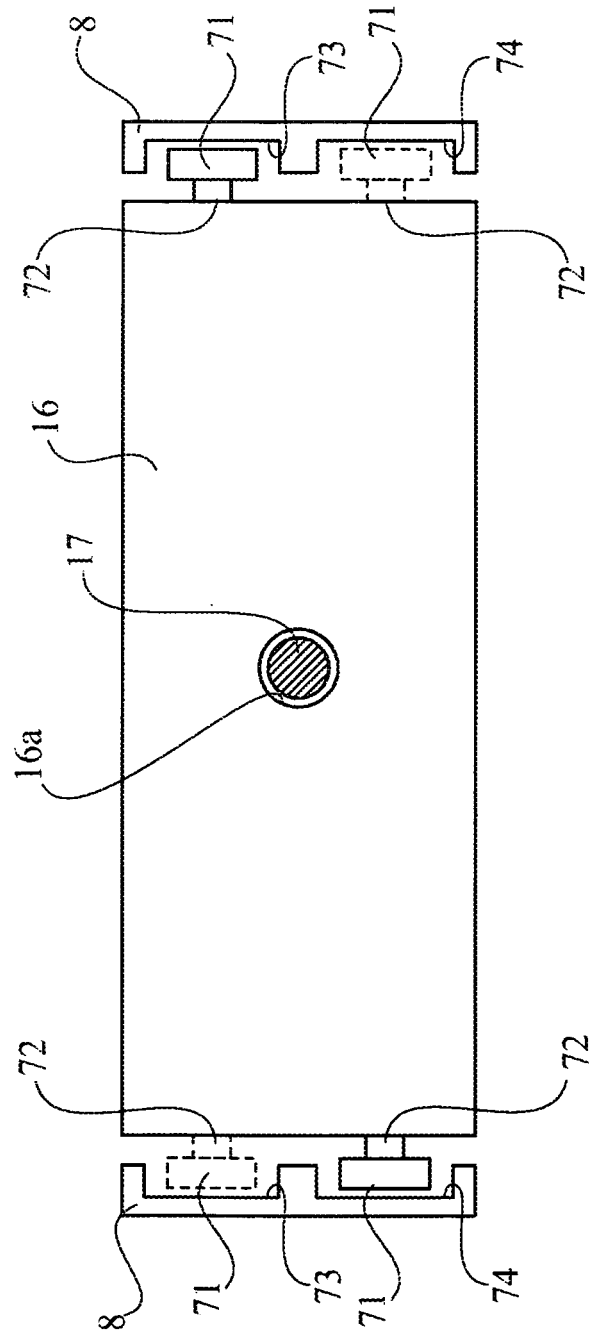


Fig.11



REFERENCES CITED IN THE DESCRIPTION

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