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(54) **Machine for muscular training**

(57) The invention relates to a machine intended for back muscular training including a seat (2) carried by a stand, a back rest (17) situated above the seat, as well as a main arm (12) which is turnable around a main joint (13) against the effect of a loading device (3). The back rest (17) is spaced from the seat and connected to a part of the main arm (12) extending upwards from the main joint (13), more precisely via a rocker arm (19) turnable around a secondary joint (20) on the main arm, which rocker arm has a cross boom (18), extending at an angle to the same on which the back rest is mounted. In this way, the back rest (17) is movable between a front starting position and a rear end position in an orbital path along which the back rest - thanks to the mounting thereof on the rocker arm (19) - can move freely between different radial positions in relation to the main joint (13) depending on the individual back flexing movements of individual users.

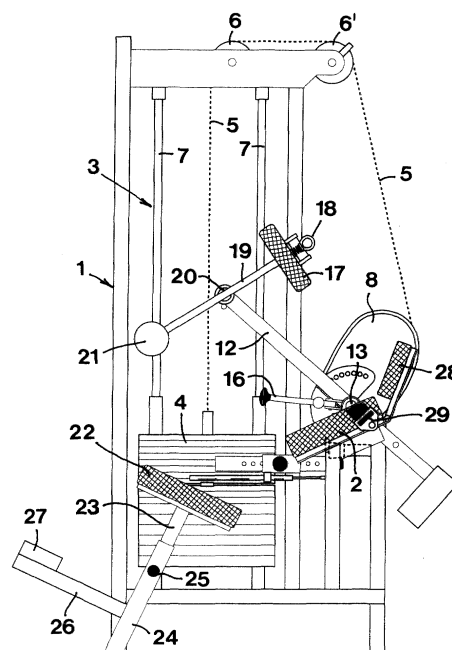


Fig 1

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Description

Technical Field of the Invention

[0001] This invention relates to a machine intended for muscular training, which comprises a seat carried by a stand, a back rest situated above the seat, as well as a main arm which is turnable around a main joint against the effect of a loading device.

Prior Art

[0002] A muscular training machine of the kind generally mentioned above is previously known by the Applicant's Swedish patent SE 9403228-1 (publication number no. 506 459). Said machine is especially intended for training the stomach muscles of the user and comprises for this purpose a transverse arm connected to the turnable main arm, which transverse arm is actuable by the fact that the user bends the trunk forwards and applies the chest against the same. Characteristic of the known machine is also that the seat and the back rest are stiffly united to each other and extend at an obtuse angle to each other, the back rest being longer than the seat and having a convexly arched contact surface for the back of the training person. The known machine is very suitable for training the musculature of the stomach, but is not for purposeful training of the back and the musculature thereof.

Objects and Features of the Invention

[0003] The present invention aims at developing the machine known by SE 9403228-1 further and at providing a muscular training machine particularly suitable for training the back. Therefore, a primary object of the invention is to provide a training machine by means of which users having different body sizes and different bodily constitutions as well as different back flexing patterns may practise the back musculature thereof while the loading device of the machine applies optimal resistance to the back during a back flexing cycle. An additional object is to create a training machine, which during a back flexing movement permits a spinal rotation. Yet an object of the invention is to create a training machine which during training of the back relieves the pressure on the vertebra column in respect of compressive stresses so as to achieve an optimum back extension.

[0004] According to the invention, at least the primary object is attained by the features defined in the characterizing clause of claim 1. Preferred embodiments of the invention are furthermore defined in the dependent claims.

Further Elucidation of Prior Art

[0005] Back training machines having back rests which are mounted on turnable arms and movable orb-

itally backwards and forwards, are previously known per se. However, in these known machines the back rest is mounted directly on the turnable arm and therefore compulsory movable in a genuine arc-shaped path around the main joint of the arm, i.e. without a possibility of moving radially in relation to this joint during the back flexing movements of the user.

Brief Description of the Appended Drawings

[0006] In the drawings:

- Fig 1 is a side view of the machine with the back rest thereof in a front starting position,
- Fig 2 is an analogous side view showing the same machine while being used by a training person, the back rest being shown in full lines in a rear end position at the same time as the front starting position according to fig 1 is shown with dashed lines,
- Fig 3 is an enlarged detailed side view showing a main arm carrying the back rest together with a number of components co-operating therewith,
- Fig 4 is a partial perspective view showing the main arm and the components co-operating therewith,
- Fig 5 is a view from above of the back rest in a neutral position on a carrying cross springer,
- Fig 6 is a view from above of the same back rest shown in a inclined position in relation to the cross springer, and
- Fig 7 is a view from above of an alternative embodiment of the back rest.

Detailed Description of Preferred Embodiments of the Invention

[0007] The back training machine shown in the drawings comprises a stand in its entirety designated 1 and a seat 2 carried in a fixed point by the stand. In the stand, a loading device generally designated 3 is mounted, which advantageously (but not necessarily) may be of the type which includes a set of weights 4, which in a suitable, selectable number may be lifted via a hauling rope 5 which is laid over two upper pulley wheels 6, 6'. The set of weights is guided by two guide bars 7.

[0008] The hauling rope 5 is at the end thereof distanced from the set of weights 4 connected to an elongate cam disk 8 and partially laid along the periphery thereof. Said cam disk has a substantially oval basic shape and is rigidly connected to a shaft 9 located eccentric in relation to the disk (see fig 4). Via two mutually movable and lockable adjusting disks 10, 11, said shaft 9 is connected to a main arm 12, which on the side thereof turned from the adjusting disk 11 has a perpendicularly projecting, rotatably mounted shaft 13, which forms a main joint around which the main arm 12 is turnable.

In a cage 14 projecting from the adjusting disk 11, an axially movable, spring-activated ratchpin (not visible) is mounted which may engage one of a plurality of tangentially spaced holes 15 in the adjusting disk 10. By bringing the ratchpin in engagement with different holes, the torsional angle position of the cam disk in relation to the main arm 12 may be varied. For manipulation of the ratchpin, a turnable lever 16 is arranged.

[0009] As far as the shown machine has been described hitherto, the same is in all essentials previously known by SE 9403228-1.

[0010] In the machine, a back rest 17 is also included in addition to the seat 2. Against this back rest a portion of the back positioned between the shoulders and the waist of a user may be pressed. Characteristic of this back rest 17 is that the same is separated from the seat 2 and connected to the main arm 12, more precisely by being mounted on a cross boom 18 (see also fig 5 and 6) which extends perpendicularly to a rocker arm designated 19, which is connected to the main arm 12 via a secondary joint 20. In the preferred embodiment, the joint 20 is placed at the upper end of the main arm 12, and located approximately halfway between the back rest 17 and a front end of the rocker arm 19. In order to hold the rocker arm 19 in a predetermined, balanced starting position in relation to the main arm 12, when the back rest is unloaded, a damper weight 21 is arranged on the front end of the rocker arm, the weight of which balances the weight of the back rest and the cross boom in such a way that the rocker arm assumes approximately the inclined state according to fig 1. When the main arm 12 turns from the forwardly folded starting position thereof shown in fig 1, to the rearwardly folded state thereof shown with full lines in fig 2, the joint 20 compulsorily moves along a genuinely arc-shaped path. As a consequence of its mounting on the rocker arm 19, which is turnable in relation to the joint 20, the accompanying back rest 17 can, however, freely move radially outwards as well as inwards in relation to the arc-shaped path of motion of the joint.

[0011] In fig 3 is seen how the main arm 12 has a lower part underneath the main joint 13, a damper weight 12' being fixed on the lower end of the main arm.

[0012] As seen in figs 1 and 2, the seat 2 formed by a supporting plate and a soft cushion extends in the direction obliquely forwards/downwards at a moderate angle of inclination to the horizontal plane. In the area in front of and below the seat 2, a leg rest 22 is arranged against which the lower parts of the legs of the user are applicable. Like the seat 2, this leg rest is composed of a supporting plate and a soft, upper cushion, but unlike the seat, the leg rest 22 extends in the direction obliquely backwards/downwards. Also the angle of inclination of the leg rest in relation to the horizontal plane is moderate. The leg rest is fixedly attached to a post 23, which is telescopically displaceable in a box profile 24 and lockable in different positions by means of a locking screw 25 or the like. In other words, the leg rest is ad-

justable at different levels. Forwardly from the box profile 24, a jib 26 extends, which at the front end thereof carries a foot rest 27, which is situated in front of as well as below the leg rest 22. Against said foot rest 27, the user may, if required, apply a foot of one of the legs.

[0013] Advantageously, the seat 2 is in the area of the rear end thereof connected to an additional support 28, which has a limited height and extends at an obtuse angle to the seat. Against said support 28, the lumbar or bottom of the user may be pressed with the purpose of facilitating a correct position of the seat part of the body against the seat 2. With the seat, an adjustable belt 29 is advantageously also associated by means of which the user may fix the seat part thereof in relation to the seat.

[0014] In the machine, an adjusting mechanism in its entirety designated 30 is furthermore included for variable adjustment of the rear end position of the back rest 17. This mechanism includes a sleeve 31 fixed on the stand 1 and oriented horizontally in which a bar 32 movable axially backwards and forwards is inserted. The bar as well as the sleeve may in practice consist of box profiles having a quadrangular cross-section shape. In the bar 32, a number of mutually spaced-apart holes 33 are formed arranged to co-operate with a ratchpin (not visible) which is connected to a spring-loaded withdrawable knob 34. At the rear end thereof, the bar 32 has an end body 35 made of an elastic material, e.g. rubber, against which a stopping element 36 projecting from the arm 12 is pressable. With the sleeve 31, a spring in the form of a gas spring 37 is connected, which always aims to bring the bar 32 in the backward direction in relation to the sleeve and against the effect of which the bar may, in a manual way, be drawn in the forward direction to a selected position in which the ratchpin of the knob 34 can be brought to engagement with a selected hole 33 in said series of holes (simply by the fact that the knob 34 is released when the ratchpin is right in front of the desired hole). In fig 3 is seen that the rear end position of the backrest 17 may be moved in the backward direction relatively the stand when the bar 32 is moved forwards in relation to the sleeve 31 and vice versa.

[0015] Reference is now made to figs 5 and 6 which illustrate a preferred embodiment of the mounting of the back rest 17 on the cross boom 18 of the rocker arm 19. Like the seat 2 and the aforementioned leg rest 22 and the support 28, respectively, the back rest 17 may advantageously be composed of a stiff supporting plate and a soft cushion. The supporting plate is connected to the cross boom 18 via a centrally placed joint 38. Mechanical springs 39, e.g. in the form of helical compression springs, on both sides of the joint 38 guarantee that the back rest in the unloaded state assumes a position parallel to the cross boom 18. However, against the effect of said springs 39, the back rest is turnable at a moderate angle to the cross boom, either towards the left, as is shown in fig 6, or towards the right. In the embodiment shown, the angle of deflection β between opposite

turning positions for the back rest is about 20° (i.e. 10° towards the left, 10° towards the right). However, this angle β may vary upwards as well as downwards from said value.

[0016] Between the front starting position thereof and the rear end position thereof according to fig 2, the back rest 17 is movable along an arc angle α which per se varies depending on the position of the rear end position, but which in the example according to fig 2 amounts to approx. 55°. Between the front end position and a conceived vertical plane through the joint 13, the arc angle may amount to approx. 35°.

The Function and Advantages of the Training Machine According to the Invention

[0017] In the unloaded state of the machine according to fig 1, the main arm 12 is folded forwards, the back rest 17 assuming a front end position. In this state, the set of weights 4 assumes a lower position in which the tension force in the rope 5 is moderate (or equals zero), the rope, however, holding the elongate cam disk 8 in a starting position pointing steeply upwards. In this starting position, the torque arm between, on one hand, the point of connection of the hauling rope against the cam disk and, on the other hand, a conceived vertical plane through the pulley wheel 6' is comparatively short. This means that the force that is required in order to lift the set of weights by turning the cam disk in the direction downwards/backwards is moderate.

[0018] Individual adjustment of the rear end position of the back rest 17 by means of the adjusting mechanism 30, as well as the desired reaction force from the loading device 3 by adjustment of the adjusting disks 10, 11 to a desired position in relation to each other, may be carried out either before or after the user has seated himself in the machine. When the machine is to be used, the user seats himself on the seat and fixes his seat part in relation thereto by means of the belt 29. During normal circumstances, the user presses his two lower parts of the legs against the leg rest 22. In this way, it is guaranteed that the muscles of the legs during the training to come do not apply considerable compressive forces to the vertebra column. Furthermore, the back rest 17 is applied against the back of the user, more precisely at a suitable point somewhere between the lumbar and the shoulders as is shown in fig 2. In the starting position of the machine according to fig 1, the user is sitting with his trunk and back bent forwardly. As has previously been pointed out, the torque arm between the point of connection of the rope 5 to the cam disk 8 and a conceived vertical plane through the pulley wheel 6' is then rather small. In other words, the back rest 17 offers only a moderate resistance to motion in the backward direction. The back flexing movement of the user consists of straightening out the back from the forwardly bent state (back extension) while the back rest moves in the backward direction towards the rear end position according

to fig 2. During this displacement of the back rest 17 in the backward direction, the resistance from the loading device is successively increased because the aforementioned torque arm becomes longer and longer as a consequence of the elongate cam disk 8 moving in the clockwise direction about the joint 13. During the back flexing movement in the backward direction, the back rest 17 abuts in the main against one and the same point along the backbone. Because the back rest is mounted in the rocker arm 19 which is turnable in relation to the main arm, the back rest does not necessarily have to follow a genuinely arc-shaped path of motion of the type that the secondary joint 20 compulsorily has to follow. Thus, the back rest may move radially outwards as well as inwards in relation to the arc path and in this way smoothly follow the back, irrespective of individual variations in the movement patterns of the individual user, as well as in the movement patterns of different users. During the straightening out of the back and the displacement of the back rest in the backward direction, the backbone may at the same time be subjected to a so-called spinal rotation, more precisely by the fact that the back rest, via the joint 38, may be turned alternately towards the left and towards the right. During this simultaneous extension and rotation of the back, the following muscles of the back musculature, among others, participate in an advantageous way: iliocostalis lumborum, iliocostalis thoracis, iliocostalis cervicis, longissimus thoracis, longissimus cervicis, longissimus capitis, spinalis thoracis, spinalis cervicis and spinalis capitis. As a consequence of the spinal rotation, the following muscles participate in particular: multifidus, semispinalis thoracis, semispinalis cervicis, semispinalis capitis and rotatores. Furthermore, the following muscles are trained: interspinales, intertransversarii, levatores costarum and quadratus lumborum. In addition to this, also oblique and transverse abdominal muscles of the body participate, viz. obliquus externus abdominis, obliquus internus abdominis and transversus abdominis.

[0019] When the back rest has reached the rear end position thereof, the body movement is reversed, i.e. from a straightened back the user bends the back forwards in the direction of the starting position for the back rest. Also during this movement phase, the back rest is subjected to a force of the loading device, which means that the user has to put his weight firmly against the back rest end up to the frontal starting position thereof. Also during this movement phase, the above-mentioned muscles participate.

[0020] During training in the machine according to the invention, the pressure on the lower lumbar region of the user is relieved, since the special training position means that the flexion in this region may be decreased. Also the activities of muscles in thighs, calves, seat and hip may be reduced. This is something that ensures clear advantages as regards the relief of the vertebra column.

[0021] As mentioned above, the two lower parts of the

legs are normally pressed against the leg rest 22. However, would the user have an impaired functional ability in one of the legs, the foot of said leg can be applied to and rest against the foot rest 27, while the lower part of the leg in working order is applied against the leg rest 22, as is shown in fig 2.

[0022] Reference is now made to fig 7, which illustrates an alternative way of mounting the back rest 17. In this case a pivot pin 38' included in the joint in question is arranged in an elongate hole 40. This elongate hole enables lateral displacement of the back rest during the turning movement in relation to the pivot pin, as is outlined by dash-dotted lines in fig 7.

Claims

1. Machine for muscular training, including a seat (2) carried by a stand (1), a back rest (17) situated above the seat, as well as a main arm (12) which is turnable around a main joint (13) against the effect of a loading device (3),
characterized in that the back rest (17) is spaced from the seat (2) and connected to a part of the main arm (12) extending upwards from the main joint (13), more precisely via a rocker arm (19) turnable around a secondary joint (20) on the main arm, which rocker arm has a cross boom (18) extending at an angle to the same on which the back rest is mounted, the back rest (17) being movable between a front starting position and a rear end position in an orbital path along which the back rest (17) - thanks to the mounting thereof on the rocker arm (19) - can move freely between different radial positions in relation to the main joint (13) depending on the individual back flexing movements of individual users.
2. Machine according to claim 1, **characterized in that** the back rest (17) is connected to the cross boom (18) via a joint (38) and loaded by at least one spring, which always aims to hold the back rest in a neutral position parallel to the cross boom, and against the effect of which the back rest is turnable to positions at an acute angle to the cross boom, either towards the right or towards the left.
3. Machine according to claim 1 or 2, **characterized in that** in the area in front of and below the seat (2), a leg rest (22) is arranged, against which the lower parts of the legs of the user are applicable.
4. Machine according to claim 3, **characterized in that** in the area in front of and below the leg rest (22), a foot rest (27) is arranged against which the foot of one leg is applicable at the same time as the lower part of the other leg is applicable against the leg rest.
5. Machine according to any one of the preceding claims, **characterized in that** a damper weight (21) is arranged on an end of the rocker arm (19) distanced from the cross boom (18), with the purpose of automatically holding the rocker arm in a neutral position at an angle to the main arm (12).
6. Machine according to any one of the preceding claims, **characterized in that** a lumbar support (28) having a limited height is connected to the seat (2) and extends at an obtuse angle to the same.
7. Machine according to any one of the preceding claims, **characterized in that** the same comprises an adjusting mechanism (30) for variable adjustment of the rear end position of the back rest (17).

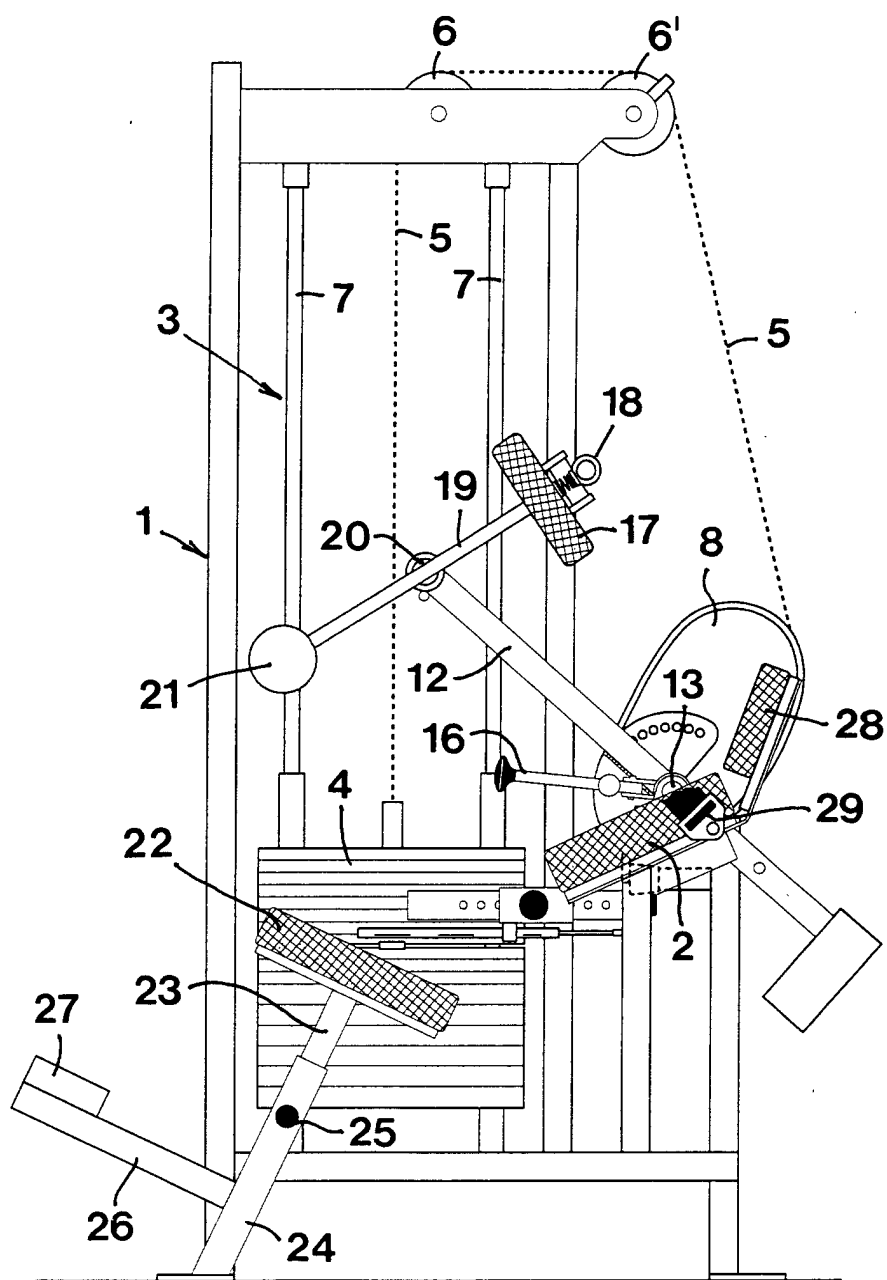


Fig 1

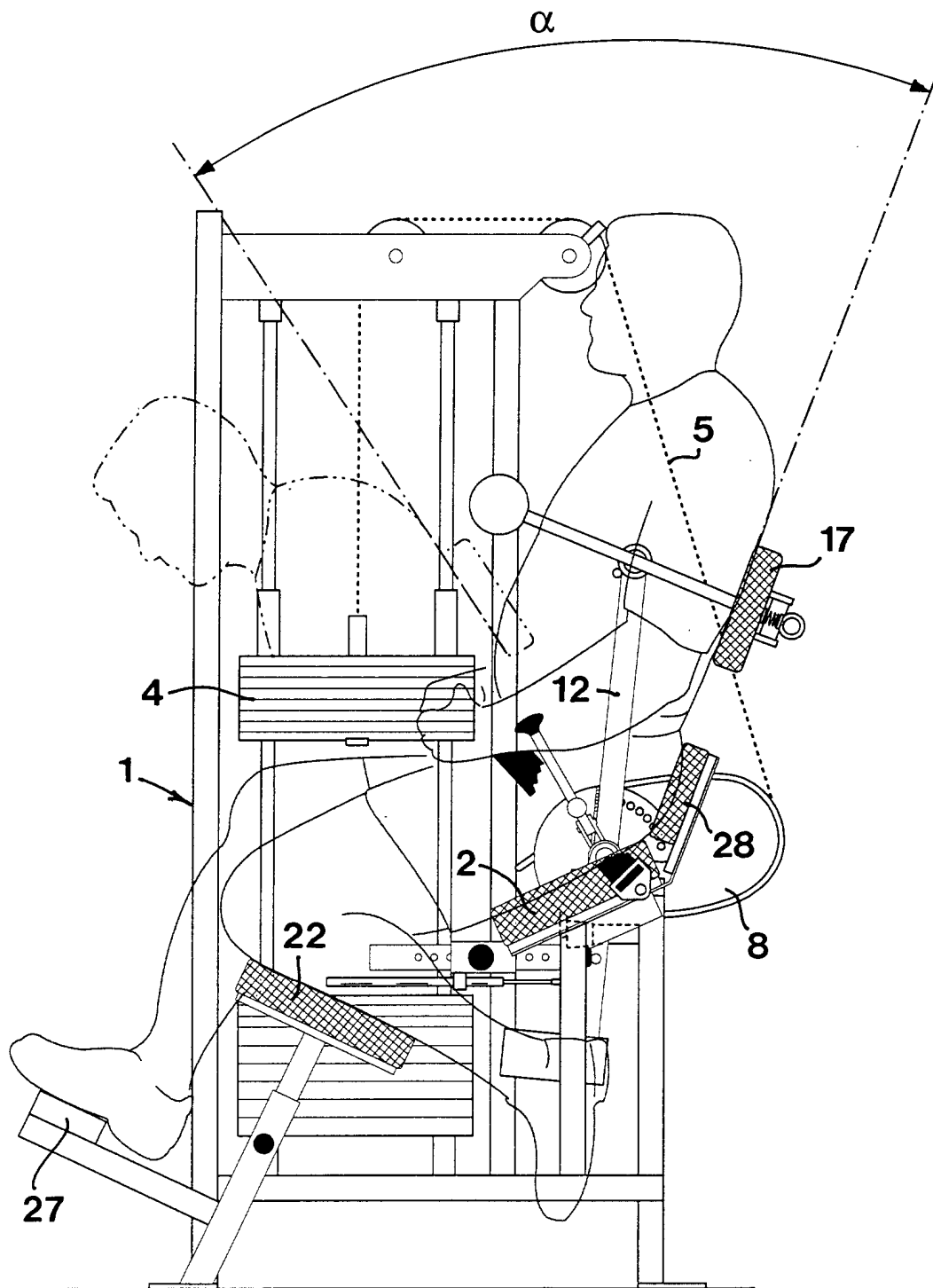


Fig 2

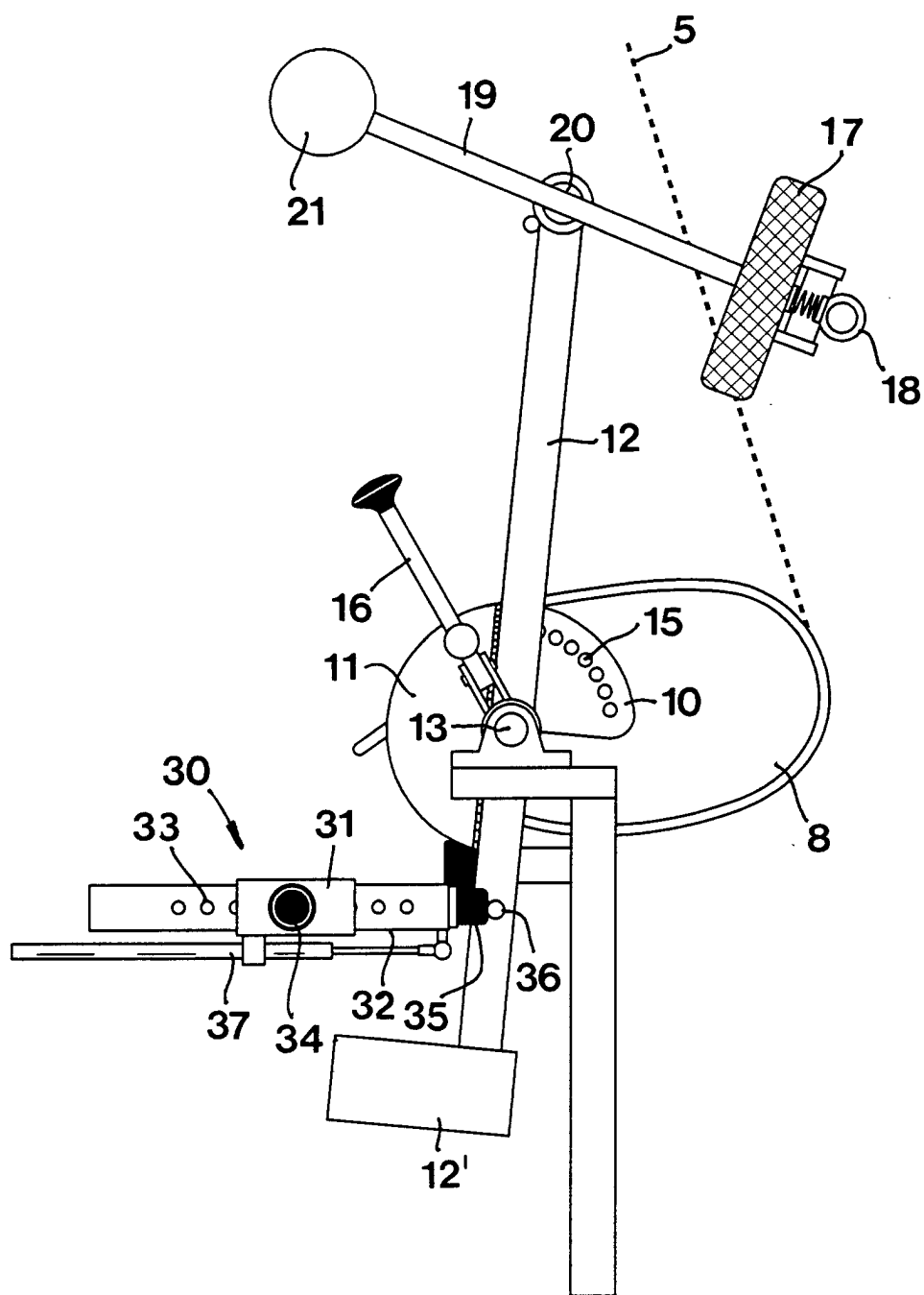


Fig 3

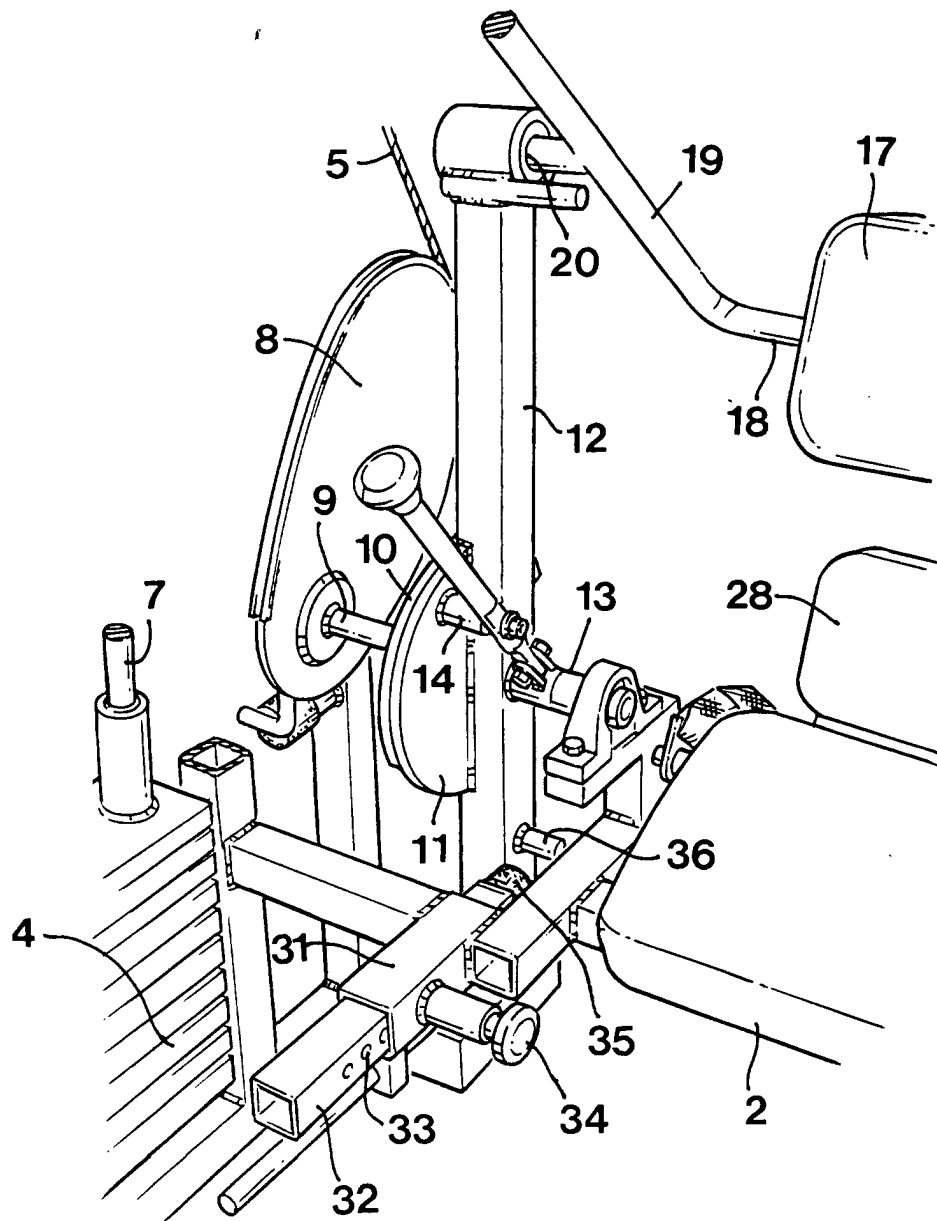


Fig 4

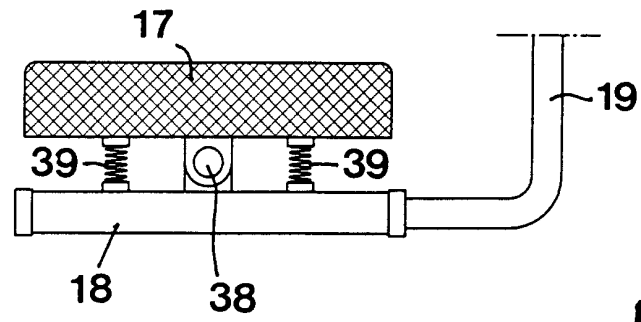


Fig 5

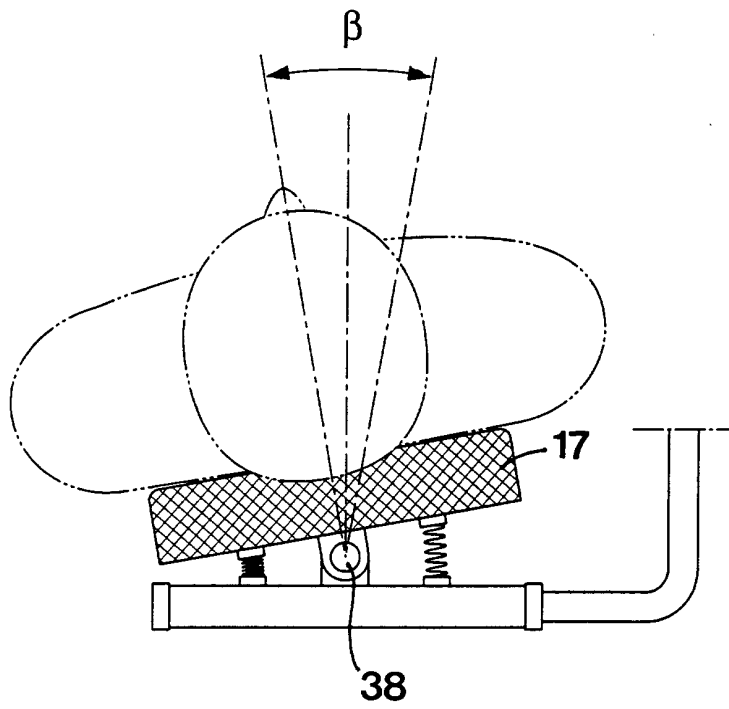


Fig 6

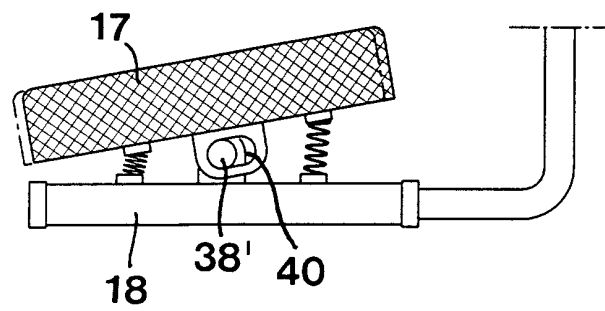


Fig 7