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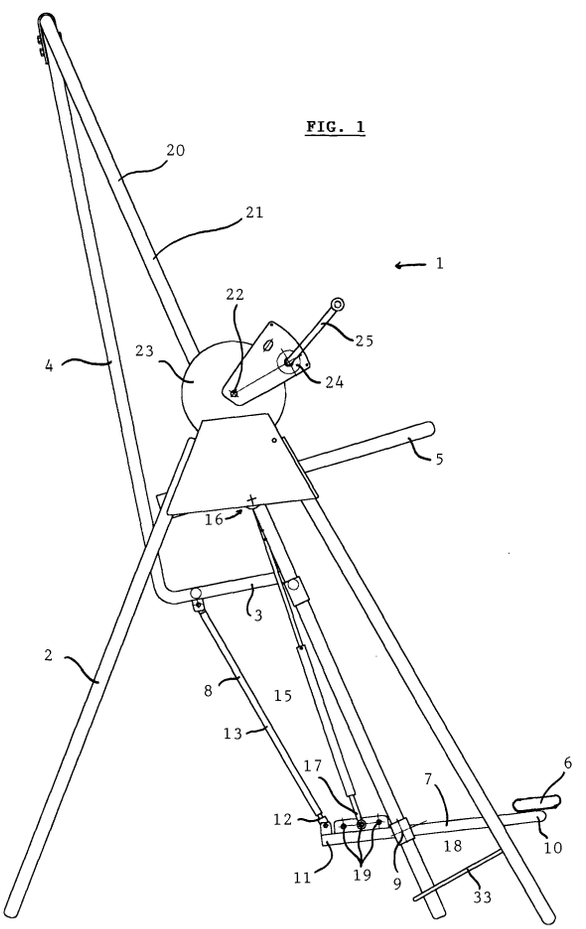
(54) Orthopaedic chair

(57) An orthopaedic chair for stretching the back of a user, the chair comprising a rotatable unit (1) having a seat (3) and a backrest (4), the rotatable unit (1) being rotatable about a substantially horizontal axis (22) between an upright position and an inverted position, the rotatable unit (1) being provided with a lap restraint (5) for securing the user to the seat (3), wherein the rotatable unit (1) is provided with means (6-8) for applying a force to the soles of the user's feet in the direction of the lap restraint (5).

FIG. 1



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Description

[0001] The present invention relates to an orthopaedic chair for stretching the back of a user according to the preamble of the first claim.

[0002] An orthopaedic chair for stretching the back of a user is for example known from WO-A-97/27904. This document discloses an orthopaedic chair comprising a stand on which a rotatable unit for seating a user is mounted. The rotatable unit is rotatable about a horizontal axis from an upright position to an inverted position, in which the user is turned upside down. The rotatable unit comprises a seat and a backrest for supporting the bottom and the back of the user. The seat and backrest are rigidly connected to each other. Below the seat, a pair of cushion rolls is provided on either side of a bar which extends from the middle of the bottom side of the seat. The cushion rolls are provided for engaging the ankles of the user, with the purpose of holding the legs of the user in position. The rotatable unit further comprises a removable lap restraint which is provided to rest over the upper thighs and lap area of the user and to be tightened over the thighs of the user to secure the user to the seat and prevent him from falling out of the chair when the rotatable unit is rotated to the inverted position.

[0003] The orthopaedic chair disclosed in WO-A-97/27904 however has the disadvantage that in the inverted position the weight of the user causes him to hang not only on his thighs, which are secured to the seat by the lap restraint, but also on his ankles, which are engaged by the cushion rolls. This can lead to pressure on the ankles and can cause pain and bruises on the ankles.

[0004] It is an aim of the present invention to provide an orthopaedic chair for stretching the back of a user with which pressure on the ankles of the user can be avoided.

[0005] This aim is achieved according to the invention with an orthopaedic chair having the technical characteristics of the characterising part of the first claim.

[0006] In the orthopaedic chair according to the invention, the rotatable unit comprises means for applying a force to the soles of the user's feet in the direction of the lap restraint. By applying this force in the direction of the lap restraint, the user's knees are pressed onto the lap restraint and the user's lower legs become clamped between the lap restraint and the force applying means. As a result, the user's lower legs are maintained in their position relative to the rotatable unit when rotated from the upright position to the inverted position. By providing the force applying means which engage the soles of the user's feet, it can be achieved that the user hangs only on his upper legs when in the inverted position, and the occurrence of pressure on the user's ankles can be minimised.

[0007] By providing the means for applying a force to the soles of the user's feet, the provision of cushion rolls or other means to engage the user's ankles can be avoided. This is advantageous as the taking place of the user in the chair can be facilitated. The force applying means in the orthopaedic chair of the invention are provided to engage the soles of the user's feet and as such can be located lower on the chair than the cushion rolls or other means, thus forming less of a hindrance.

[0008] The force applying means preferably comprise a footrest provided to engage the soles of the user's feet and moving means for moving the footrest from an open position to a clamping position. It is also possible to provide moving means which are provided to move the footrest between the open position and the clamping position, i.e. from the open position to the clamping position and back. With the footrest in the open position, the user's lower legs are loosely accommodated between the footrest and the lap restraint. With the footrest in the clamping position, the user's knees are pressed onto the lap restraint, so that the user's lower legs are clamped between the footrest and the lap restraint. The footrest provides an enlarged contact area between the force applying means and the soles of the user's feet. This has the advantage that the pressure exerted on the soles of the user's feet is spread over the whole of the contact area between the footrest and the soles of the user's feet, avoiding a large pressure on a small area of the soles of the user's feet. The movability of the footrest between the open position and the clamping position has the advantage, that the user can more easily sit himself in the chair before he is secured to the rotatable unit and rotated to the inverted position.

[0009] The moving means for moving the footrest from the open position to the clamping position preferably comprise a pivotable lever on the rotatable unit which is provided to pivot about a substantially horizontal pivot axis extending transversally of the rotatable unit, and drive means for pivoting the lever. The pivotable lever preferably has a front end in front of the pivot axis onto which the footrest is mounted. The drive means are preferably connected to a rear end of the lever, which is located behind the pivot axis. In this way, the movement of the footrest from the open position to the clamping position, which is mainly directed in upward direction, can be obtained by a pivoting action of the lever. This pivoting action of the lever can easily be achieved by the drive means moving the rear end of the lever in a mainly downward direction. So providing the lever with associated drive means can provide a simple construction for the means for applying a force to the soles of the user's feet.

[0010] The drive means for pivoting the pivotable lever preferably comprise a blockable gas spring which is mounted between the rear end of the lever and a bottom side of the seat. The drive means for pivoting the pivotable lever may however also comprise any other drive means known to the person skilled in the art. With the use of the gas spring as drive means for pivoting the lever and moving the footrest, it is possible to adjust the position of the footrest in which it exerts the most suita-

ble clamping force onto the soles of the user's feet to the length of the user's lower legs.

[0011] Due to the blockability of the gas spring by means of the valve, the movement of the piston rod out of the cylinder can be interrupted at any time by closing the valve. In this way, the user can decide himself how much clamping force is applied to his lower legs, as he can adjust the position of the footrest before the gas spring is blocked by the closing of the valve. This has the advantage that the user can adjust the amount of clamping force needed to maintain his lower legs in position to the amount he thinks is suitable. The blockability of the gas spring further has the advantage that the footrest can be held in the open position, i.e. the lowest position with respect to the seat with the rotatable unit in the upright position, to facilitate the taking place of the user in the chair.

[0012] In the orthopaedic chair of the invention, the lap restraint is preferably movable between a lifted position, in which the user's upper legs are loosely accommodated between the lap restraint and the seat, and a securing position, in which the user's upper legs are clamped between the lap restraint and the seat, thereby securing the user to the seat. The movement of the lap restraint from the lifted position to the securing position can be achieved by moving means which are operable independently from the moving means for moving the footrest, but in a preferred embodiment of the invention, the lap restraint is connected to the moving means for moving the footrest in such a way that the lap restraint is moved from the lifted position to the securing position upon movement of the footrest from the open position to the clamping position. In this way, it is achieved that the lap restraint is moved from the lifted position to the securing position by the moving means together with the footrest being moved from the open position to the clamping position. This embodiment has the advantage that, upon operating the moving means, the user is secured to the seat together with the clamping of the user's lower legs. In a normal procedure, the user will be secured to the seat before he is rotated to the inverted position. So with this embodiment, it can be prevented that the user is secured to the seat and rotated to the inverted position without the user's lower legs being clamped between the lap restraint and the footrest, which may lead to difficulties for the user in maintaining his lower legs in their position with respect to the rotatable unit. So by coupling the lap restraint to the footrest in the manner described above, it can be ensured that the user's lower legs are clamped between the footrest and the lap restraint before the user is rotated to the inverted position.

[0013] In a preferred embodiment of the orthopaedic chair of the invention, the distance between the footrest and the seat is adjustable. In this way the distance between the footrest and the seat, and thus also between the footrest and the lap restraint, can be adapted to the length of the user's lower legs, or in other words to the user's height. This has the advantage that the clamping force for maintaining the user's lower legs can be further optimised. The adjustability of the distance between the footrest and the seat can for example be obtained by mounting the pivotable lever, onto which the footrest is mounted, in a slidable bearing on the rotatable unit. The adjustability can however also be obtained by making the seat adjustable in height, or in any other way known to the person skilled in the art.

[0014] The orthopaedic chair according to the invention is preferably provided with drive means for rotating the rotatable unit between the upright position and the inverted position. These drive means may comprise mechanical drive means, such as for example gear wheels which are operable by means of a handle, electric drive means, such as for example an electric motor, or any other drive means known to the person skilled in the art.

[0015] The orthopaedic chair of the invention is preferably further provided with stopping means for stopping the rotation of the rotatable unit in any intermediate position between the upright position and the inverted position. By means of the stopping means, the user can stop the rotation of the rotatable unit in any intermediate position, i.e. with the direction of the backrest in any angle with respect to the horizontal plane, if he feels the inverted position to be uncomfortable, or if he does not wish to be rotated to the inverted position in one go. By releasing the stopping means the rotatable unit can be further rotated towards the inverted position.

[0016] The orthopaedic chair of the invention is preferably further provided with limiting means for limiting the maximum angle over which the rotatable unit can be rotated. These limiting means allow the user to select a maximum rotation before rotating the rotatable unit. This has the advantage that the user can prevent himself to be rotated beyond a maximum position, which he can select in advance.

[0017] The invention will be further elucidated by means of the following description and the appended figures.

[0018] Figure 1 shows a preferred embodiment of the orthopaedic chair of the invention.

[0019] Figure 2 shows a user being seated in the orthopaedic chair of figure 1, with the footrest in the open position and the lap restraint in the lifted position.

[0020] Figure 3 shows the embodiment of figure 2, with the footrest in the clamping position and the lap restraint in the securing position.

[0021] Figure 4 shows the embodiment of figure 2, with the rotatable unit rotated to the inverted position.

[0022] Figure 5 shows a cross-sectional view of the preferred embodiment of figure 1, showing the drive means for rotating the rotatable unit and the mounting of the lap restraint on the rotatable unit in greater detail.

[0023] Figures 6a and b show a second embodiment of the orthopaedic chair of the invention, respectively in the upright position and in the inverted position.

[0024] The orthopaedic chair shown in figure 1 comprises a rotatable unit 1 which is mounted on a stand 2.

The rotatable unit 1 is rotatable about a substantially horizontal axis 22 between an upright position (shown in figures 1 and 2) and an inverted position (shown in figure 4). The rotatable unit 1 comprises a seat 3 for supporting the bottom of a user and a backrest 4 for supporting the back of the user. The rotatable unit 1 is provided with a lap restraint 5 for securing the user to the seat 3 and means 6, 7, 8 for applying a force to the soles of the user's feet in the direction of the lap restraint 5.

[0025] The seat 3 and the backrest 4 are preferably rigidly connected to each other and enclose an angle α. This angle α is preferably about 90°, but may also be more or less than 90°. The seat 3 and the backrest 4 may also be movably connected to each other, the angle α being adjustable to the preferences of the user. The backrest 4 is preferably substantially straight over its entire length, but may also be curved or angled or have any other shape known to the person skilled in the art.

[0026] The seat 3 may be fixed or adjustable in height. With a seat 3 which is adjustable in height it is achieved that the centre of gravity of the rotatable unit 1 and a user therein can be adjusted to an optimal position in which the force required for rotation to the inverted position is minimal. The adjustablity of the seat 3 in height can for example be achieved by mounting it in a slidable mounting (not shown) on the rotatable unit 1, the slidable mounting being such that the seat can be lowered or raised with respect to the rotation axis 22 and that the seat can be fixed in height by means of screws or any other means known to the person skilled in the art.

[0027] In the embodiment shown in figure 1, the means 6, 7, 8 for applying a force to the soles of the user's feet comprise a footrest 6 and moving means 7, 8 for moving the footrest 6. The footrest 6 is provided to engage the soles of the user's feet. The moving means 7, 8 are provided to move the footrest 6 from an open position (shown in figures 1 and 2), in which the user's lower legs are loosely accommodated between the footrest 6 and the lap restraint 5, to a clamping position (shown in figure 3), in which the user's lower legs are clamped between the footrest 6 and the lap restraint 5. The force applying means 6, 7, 8 may however also comprise any other force applying means known to the person skilled in the art.

[0028] In the embodiment shown in figure 1, the moving means 7, 8 comprise a pivotable lever 7 on the rotatable unit 1 and drive means 8 for pivoting the pivotable lever 7. The pivotable lever 7 is provided to pivot about a substantially horizontal pivot axis 9 extending transversally of the rotatable unit 1. The pivotable lever 7 is located below the seat 3 (when the rotatable unit 1 is in the upright position) and has a front end 10, onto which the footrest 6 is mounted, in front of the pivot axis 9 and a rear end 11 behind the pivot axis 9. The drive means 8 for pivoting the lever 7 are connected to the rear end 11 of the pivotable lever 7. In this way, the footrest 6 is moved in generally upward direction towards the lap restraint when the drive means 8 move the rear end 11 of the lever 7 in generally downward direction. The moving means 7, 8 for moving the footrest 6 may however also comprise any other moving means known to the person skilled in the art.

[0029] The drive means 8 for pivoting the lever 7 preferably comprise a gas spring 8, which is preferably mounted between the rear end 11 of the lever 7 and the bottom side of the seat 3. Such a gas spring 8 is known in the art and will not be described here in great detail. It comprises a piston rod 12 which is slidably mounted in a cylinder 13. The force for sliding the piston rod 12 out of the cylinder is obtained by a pressurised gas inside the cylinder. Due to the mounting of the gas spring 8 between the rear end 11 of the lever 7 and the bottom side of the seat 3, the footrest 6 is moved from the open position towards the clamping position when the piston rod 12 is forced out of the cylinder 13 by the pressurised gas. The drive means 8 for pivoting the lever 7 may however also comprise any other drive means 8 known to the person skilled in the art, such as for example a spring or a torsion spring.

[0030] The gas spring 8 used as drive means for pivoting the lever 7 is preferably a blockable gas spring 8. This means that the gas spring 8 is provided with a closable valve (not shown), by means of which the movement of the piston rod 12 in and out of the cylinder 13 can be interrupted. When the valve is opened, the piston rod 12 is moved out of the cylinder by means of expansion of a pressurised gas inside the cylinder 13, or the piston rod 12 can be pushed into the cylinder 13 by means of an external force, thereby compressing the gas inside the cylinder 13. When the valve is closed, the position of the piston rod 12 relative to the cylinder 13 is maintained.

[0031] With the use of the blockable gas spring 8 as drive means for pivoting the lever 7 and thus moving the footrest 6, it can be achieved that a suitable force for clamping the user's lower legs is applied to the soles of the user's feet. This means that the force applied is not too large, which could hurt the user's lower legs, and not too small, which could cause the user difficulty to maintain his lower legs in position when in the inverted position. This can be achieved as, when the valve of the gas spring 8 is opened, the piston rod will be moved out of the cylinder by the compressed gas until the force exerted by the gas spring 8 on the rear end 11 of the lever 7 is in balance with the force exerted by the user's feet on the front end 10 of the lever 7. The latter force is a reaction force caused by the clamping of the user's lower legs between the lap restraint 5 and the footrest 6. So when a suitable pressure is chosen for the compressed gas of the gas spring, it can be achieved that a suitable clamping force is exerted on the user's lower legs, i.e. a clamping force not too large and not too small.

[0032] It is obvious that the distance over which the footrest 6 and thus also the piston rod 12 is moved before the force balance mentioned in the former paragraph is reached depends on the length of the user's

lower legs. As the movement of the piston rod 12 continues until this force balance is reached, it can be achieved that the most suitable position for the footrest to apply the most suitable clamping force is adjusted to the length of the user's lower legs. So providing the gas spring 8 as drive means has the advantage that the orthopaedic chair of the invention is adapted to accommodate users having different heights.

[0033] The blockable gas spring 8 is preferably operable by the user by means of a first handle (not shown) which is mounted on the rotatable unit 1 and connected to the gas spring 8 by means of a cable. The first handle is preferably mounted on the rotatable unit 1 within reach of the user's left or right hand, so that the user can operate the gas spring, i.e. open the valve, by pressing the first handle. The gas spring 8 may however also be operated in any other way known to the person skilled in the art.

[0034] The lap restraint 5 is preferably in such a way mounted on the rotatable unit 1 that the user can easily move into and out of the rotatable unit 1, without being hindered by the lap restraint 5. This can be achieved by providing a removably mounted lap restraint, so that the user can remove the lap restraint 5 to get into or out of the chair. Alternatively, this can be achieved by providing a lap restraint with a first lateral side releasably mounted on the rotatable unit 1 and a second lateral side rotatably mounted on the rotatable unit about its longitudinal axis, so that the user can pivot the lap restraint 5 upwardly towards one lateral side to get into or out of the chair. Preventing the hindering of the lap restraint 5 can also be achieved in any other way known to the person skilled in the art.

[0035] In the embodiment shown in figure 1, the lap restraint 5 is movably mounted on the rotatable unit between a lifted position (shown in figures 1 and 2) in which the user's upper legs are loosely accommodated between the lap restraint 5 and the seat 3, and a securing position (shown in figure 3) in which the user's upper legs are clamped between the lap restraint 5 and the seat 3. The lap restraint 5 can be movable independently from the footrest 6, but in the embodiment shown in figure 1, the lap restraint 5 is in such a way connected to the moving means 7, 8 that the lap restraint 5 is moved from the lifted position to the securing position upon movement of the footrest 6 from the open position to the clamping position.

[0036] In the embodiment shown in figure 1 and in greater detail in figure 5, this is preferably achieved in the following way. The lap restraint 5 is mounted on the rotatable unit 1 in such a way that it is pivotable about a substantially horizontal pivot axis 14 extending in transverse direction of the chair. On lateral sides of the rotatable unit 1, the lap restraint 5 is connected to the lever 7 by means of connector bars 15. Each of these connector bars 15 has a first end 16 connected to the lap restraint 5 in front of its pivot axis 14, and a second end 17 connected to the lever 7 between its rear end 11 and its pivot axis 9. In this way, when the drive means 8 move the rear end 11 of the lever 9 in generally downward direction, the second ends 17 of the connector bars 15 are also moved in downward direction, so that the connector bars 15 pull the lap restraint 5 in downward direction towards the seat 3. So, as a result of a downward movement of the rear end 11 of the lever 7, the footrest 6 is moved in upward direction and the lap restraint 5 is moved in downward direction. In other words, a downward movement of the rear end 11 of the lever causes the lap restraint 5 and the footrest 6 to move towards each other. The movability of the lap restraint 5 together with the footrest 6 may however also be achieved in any other way known to the person skilled in the art.

[0037] The pivotable lever 7 can be fixed or adjustable in height. With a pivotable lever 7 which is adjustable in height, the distance between the footrest 6 and the lap restraint 5 can be adjusted to the length of the user's lower legs. In this way, the clamping force can be optimised for each user. In the embodiment shown in figure 1, the adjustability of the lever 7 in height is achieved by providing it with a slidable mounting 18 and by making the connector bars 15 adjustable in length. In this way, the lever 7 can be raised or lowered with respect to the lap restraint 5, while the position of the lap restraint 5 can be maintained by adjusting the length of the connector bars 15. The slidable mounting 18 of the lever 7 can be fixed by means of screws or any other fixing means known to the person skilled in the art. The adjustability of the lever 7 in height may however also be achieved in any other way known to the person skilled in the art.

[0038] In the embodiment of figure 1, the lever 7 is preferably provided with a number of fixing points 19 for the second ends 17 of the connector bars 15. In figure 1, the lever 7 is provided with three fixing points 19, but it may also be provided with more or less fixing points 19. By proving a number of fixing points 19, the second ends 17 of the connector bars can be fixed closer to or further from the rear end 11 of the lever 7, to which the gas spring 8 is connected. When the second ends 17 of the connector bars 15 are fixed closer to the rear end 11 of the lever 7, i.e. further from the pivot axis 9 of the lever 7, the second ends 17 of the connector bars 15 and hence the lap restraint 5 will be moved a greater distance upon movement of the piston rod 12 of the gas spring 8. When the second ends 17 of the connector bars 15 are fixed further from the rear end 11 of the lever 7, i.e. closer to the pivot axis 9 of the lever 7, the second ends 17 of the connector bars 15 and hence the lap restraint 5 will be moved a smaller distance upon movement of the piston rod 12 of the gas spring 8. In this way, the movement of the lap restraint 5 can be adjusted to the amount needed for achieving enough securing force for securing the user to the seat 3. In other words, providing the number of fixing points 19 has the advantage that the securing position of the lap restraint 5 can be

adjusted to each user.

[0039] In the embodiment shown in figure 1, the rotatable unit preferably comprises a main frame 20 to provide a simple mounting structure for all the parts of the rotatable unit 1. The main frame 20 preferably comprises two lateral bars 21 extending over substantially the entire height of the rotatable unit 1. On top the lateral bars 21 are preferably connected by means of a top bar (not shown). Optionally, the lateral bars 21 may also be connected below by means of a bottom bar (not shown). The lateral bars 21 are rotatably mounted on the stand 2. They are provided to rotate about a substantially horizontal rotation axis 22 extending in transversal direction of the chair. The backrest 4 and the seat 3 are mounted on the frame 20 in such a way that they are located behind the plane of the frame 20, with the top end of the backrest 4 connected to the top bar and the front end of the seat connected to the lateral bars 21 below the rotation axis 22. The pivotable lever 7 is mounted on the lower part of the frame 20. As the frame extends over substantially the entire height of the rotatable unit, the frame 20 forms a rigid mounting structure for all the parts of the rotatable unit 1. The rotatable unit may however comprise any other mounting structure known to the person skilled in the art.

[0040] As shown in figure 5, the lap restraint is preferably mounted in such a way on the rotatable unit 1 that its pivot axis 14 is located behind the frame 20. In order to be removable, the lap restraint 5 preferably comprises a removable member 26 which is slidable into and out of holding bars 27. The holding bars 27 extend from the pivot axis 14 towards the front of the chair.

[0041] The orthopaedic chair of the invention preferably comprises drive means 23, 24, 25 for rotating the rotatable unit 1 between the upright position and the inverted position. These drive means are preferably operable by the user. In the embodiment shown in figure 1 and in greater detail in figure 4, the drive means comprise a large gear wheel 23 which is rigidly mounted on the stand 2 and a small gear wheel 24 which is provided to run along the circumference of the large gear wheel 23 and which is connected to the rotatable unit 1. The centre of the large gear wheel 23 corresponds to the rotation axis 22 of the rotatable unit 1. Figure 5 clearly shows that the rotation axis 22 is preferably located slightly in front of the frame 20, so that the centre of gravity of the rotatable unit and the user is located behind the rotation axis 22, which can facilitate the rotation of the rotatable unit. The drive means further comprise a lever 25 which is rigidly connected to the small gear wheel 24. By means of the lever 25, the user can rotate the small gear wheel 24 along the circumference of the large gear wheel 23, thereby rotating the rotatable unit 1 between the upright position and the inverted position. As the gear wheel 23 is larger than the gear wheel 24 which can be operated by the user, the user has to apply less force to the lever to rotate the rotatable unit 1 than would be the case if the gear wheels 23 and 24 would be of equal size. This has the advantage that the user can more easily rotate himself to the inverted position. Apart from gear wheels 23, 24 and lever 25, also a motor or any other drive means known to the person skilled in the art may be used in the orthopaedic chair of the invention.

[0042] The gear wheels 23, 24 and the lever 25 are preferably located on a lateral side of the chair other than that on which the first handle for operating the gas spring 8 is located. This has the advantage that the user can operate the first handle with one hand and the lever 25 with the other hand. The gear wheels 23, 24 and the lever 25 are preferably located on the right hand side and the first handle on the left hand side. They may however also be located on the same lateral side of the chair, either left or right.

[0043] The orthopaedic chair of the invention is preferably provided with stopping means 28, 29, 30 for stopping the rotation of the rotatable unit in any intermediate position between the upright position and the inverted position. These stopping means are preferably operable by the user by means of a second handle (not shown), which is connected to the stopping means by means of a cable (not shown). The second handle is preferably located on the same lateral side of the chair as the first handle for operating the gas spring 8. This has the advantage that the user can operate the second handle with one hand and thereby release the stopping means, allowing the rotation of the rotatable unit 1, while using his other hand to operate the lever 25 and rotate the rotatable unit 1 to the inverted position. The second handle may however also be mounted on any other location of the orthopaedic chair which is deemed suitable by the person skilled in the art.

[0044] In the embodiment shown in figure 5, the stopping means comprise a liftable member 28 which is provided to mesh with the large gear wheel 23 and which is provided to be lifted from the circumference of the large gear wheel 23 upon operation of the second handle (not shown). The stopping means further comprise a spring 29 for exerting a force onto the liftable member 28 in the direction of the circumference of the large gear wheel 23. Stops 30 are preferably provided to prevent the liftable member 28 from being lifted too far from the circumference of the large gear wheel 23.

[0045] The orthopaedic chair of the invention preferably further comprises limiting means 31 for limiting the rotation of the rotatable unit 1 to a maximum rotation angle. By means of the limiting means 31 the user can select a maximum rotation angle in advance, i.e. before rotating the rotatable unit to the inverted position. In other words, the user can adjust the inverted position to his preferences by means of the limiting means. In the embodiment shown in figure 5, the limiting means comprise holes 31 which are provided in the large gear wheel 23, slightly inwardly from the circumference of the large gear wheel 23. The limiting means further comprise a pin (not shown) which is insertable into either one of the

holes 31 for selecting the maximum rotation angle of the rotatable unit 1. When the pin is located in one of the holes, it protrudes from the side of the large gear wheel 23, so that the rotation is limited to the position in which the mounting plate 32, onto which the small gear wheel 24 and the stopping means 28, 29, 30 are mounted, contacts the pin. Hence, the maximum rotation angle of the rotatable unit 1 can be selected in advance by inserting the pin into one of the holes 31. The limiting means for limiting the rotation of the rotatable unit may however also comprise any limiting means known to the person skilled in the art.

[0046] The orthopaedic chair of the invention preferably further comprises a stop 33 for stopping the rotatable unit 1 when it is rotated back to the upright position. By providing the stop 33, it can be prevented that the rotatable unit 1 is rotated beyond the upright position. In the embodiment shown in figure 1, this stop 33 is constructed as a bar 33 on the stand 2 extending mainly in transverse direction of the chair. When in the upright position, the frame 20 contacts this bar 33. By providing this bar 33 it can be prevented that the rotatable unit 1 is rotated further back, which could lead to the frame 20 coming into contact with the floor underneath the stand and could lead to damaging of the floor or the frame 20. The stop 33 can also be constructed in any other way known to the person skilled in the art.

[0047] The orthopaedic chair of figure 1 is operated as follows. First, with the rotatable unit 1 in the upright position (shown in figures 1 and 2), the user selects a preferred inverted position by inserting the pin into one of the holes 31 in the large gear wheel 23. The lap restraint 5 is removed, allowing the user to easily take place in the chair. Then, the lap restraint 5 is put in position over the upper legs of the user. Next, the user operates the first handle (not shown), by which the valve of the gas spring is opened and the piston rod 12 moves out of the cylinder 13. This movement of the piston rod causes the footrest to be moved from the open position (figures 1 and 2) to the clamping position (figure 3). Due to the provision of the connector bars 15, the lap restraint 5 is at the same time moved from the lifted position (figures 1 and 2) to the securing position (figure 3). The user then releases the first handle, so that the valve is closed and the footrest 6 and the lap restraint 5 are locked in their respective positions. The user is now secured to the seat 3 and the user's lower legs are now clamped between the lap restraint 5 and the footrest 6. Next, the user operates the second handle (not shown) with one hand to release the liftable member 28 of the stopping means from the circumference of the large gear wheel 23, thereby allowing the rotation of the rotatable unit. Without releasing the second handle, the user can now rotate himself to the inverted position (figure 4) by rotating the lever 25 with his other hand. The user can at any time stop the rotation by releasing the second handle, so that the liftable member 28 is pressed by the spring 29 against the circumference of the large gear wheel 23. In any case, the user can keep rotating the rotatable unit 1 until the mounting plate 32, onto which the small gear wheel 24 and the stopping means 28, 29, 30 are mounted, contacts the pin of the limiting means 31 and the rotatable unit is in the inverted position (figure 4) which was selected in advance. The user can now release the second handle to lock the rotatable unit 1 in the inverted position, so that he can maintain the rotatable unit 1 in the inverted position for as long as he wishes to, without there being a risk that the rotatable unit 1 rotates any further or back. In the inverted position, the user's back is stretched by the user's own body weight. The lap restraint 5 prevents the user from falling out of the chair and the force applied by the footrest 6 holds the user's lower legs in position.

[0048] In order to rotate the unit 1 back to the upright position, the user operates the second handle to allow the rotation of the unit 1 and rotates the lever 25 until the frame 20 contacts the stop 33 and the unit 1 is back in the upright position (figure 3). In order to get out of the chair, the user again operates the first handle to open the valve of the gas spring 8, after which he can push down the footrest 6 until it is back in the open position (figure 2). By pushing down the footrest 6, the piston rod 12 is moved back into the cylinder 13 of the gas spring, and the lap restraint 5 is moved back to the lifted position. By releasing the first handle, the valve is closed, so that the footrest 6 and the lap restraint 5 are locked in their respective positions. To get out of the chair, the user removes the lap restraint 5.

[0049] In the second embodiment of the orthopaedic chair of the invention shown in figures 6a and b, the rotatable unit 1 is provided with means 34-37 for enhancing the stretching force exerted on the user's back in the inverted position. These means preferably comprise a headrest 34 for supporting the user's head which is located on the upper part of the backrest 4 and protrudes from it. This headrest 34 is in such a way mounted on the backrest 4 that it is movable in longitudinal direction of the backrest. The headrest 34 is connected to a weight 35 by means of a cable 36 which runs along a double pulley 37 provided on the back side of the backrest 4. As the cable 36 runs along the double pulley 37, the weight 35 only pulls the headrest 34 towards the top of the backrest 4 in the inverted position. By means of this arrangement, the stretching force exerted on the user's back in the inverted position can be enhanced, as the headrest pulls the head of the user slightly in the direction of the top of the backrest in the inverted position. A suitable weight value for the weight 35 is for example one or two kilograms or more or less. The headrest 34 preferably has a concave shape, for example a shell, so that the back of the user's head is easily accommodated on the headrest.

List of reference numerals used

[0050]

1. Rotatable unit
2. Stand
3. Seat
4. Backrest
5. Lap restraint
6. Footrest
7. Pivotable lever
8. Gas spring
9. Pivot axis
10. Front end
11. Rear end
12. Piston rod
13. Cylinder
14. Pivot axis
15. Connector bars
16. First end
17. Second end
18. Slidable mounting
19. Fixing points
20. Frame
21. Lateral bars
22. Rotation axis
23. Large gear wheel
24. Small gearwheel
25. Lever
26. Removable member
27. Holding bars
28. Liftable member
29. Spring
30. Stops
31. Holes
32. Mounting plate
33. Stop
34. Headrest
35. Weight
36. Cable
37. Double pulley

Claims

1. An orthopaedic chair for stretching the back of a user, the chair comprising a rotatable unit (1) having a seat (3) and a backrest (4), the rotatable unit (1) being rotatable about a substantially horizontal axis (22) between an upright position and an inverted position, the rotatable unit (1) being provided with a lap restraint (5) for securing the user to the seat (3), **characterised in that** the rotatable unit (1) is provided with means (6-8) for applying a force to the soles of the user's feet in the direction of the lap restraint (5).

2. An orthopaedic chair according to claim 1, **characterised in that** the force applying means (6-8) comprise a footrest (6) provided to engage the soles of the user's feet and moving means (7-8) for moving the footrest (6) from an open position, in which the user's lower legs are loosely accommodated between the footrest (6) and the lap restraint (5), to a clamping position, in which the user's lower legs are clamped between the footrest (6) and the lap restraint (5).

3. An orthopaedic chair according to claim 2, **characterised in that** the moving means (7-8) comprise a pivotable lever (7) on the rotatable unit (1) which is provided to pivot about a substantially horizontal pivot axis (9) extending transversally of the rotatable unit (1), and drive means (8) for pivoting the lever (7), the pivotable lever (7) having a front end (10) in front of the pivot axis (9) onto which the footrest (6) is mounted and a rear end (11) behind the pivot axis (9) connected to the drive means (8).

4. An orthopaedic chair according to claim 3, **characterised in that** the drive means (8) comprise a blockable gas spring (8) which is mounted between the rear end (11) of the lever and a bottom side of the seat (3).

5. An orthopaedic chair according to any one of claims 2-4, **characterised in that** the lap restraint (5) is movably mounted on the rotatable unit (1) between a lifted position in which the user's upper legs are loosely accommodated between the lap restraint (5) and the seat (3), and a securing position in which the user's upper legs are clamped between the lap restraint (5) and the seat (3), and that the lap restraint (5) is in such a way connected to the moving means (7-8) that the lap restraint (5) is moved from the lifted position to the securing position upon movement of the footrest (6) from the open position to the clamping position.

6. An orthopaedic chair according to any one of claims 2-5, **characterised in that** the distance between the footrest (6) and the seat (3) is adjustable.

7. An orthopaedic chair according to any one of claims 1-6, **characterised in that** the chair comprises drive means (23-25) for rotating the rotatable unit (1) between the upright position and the inverted position.

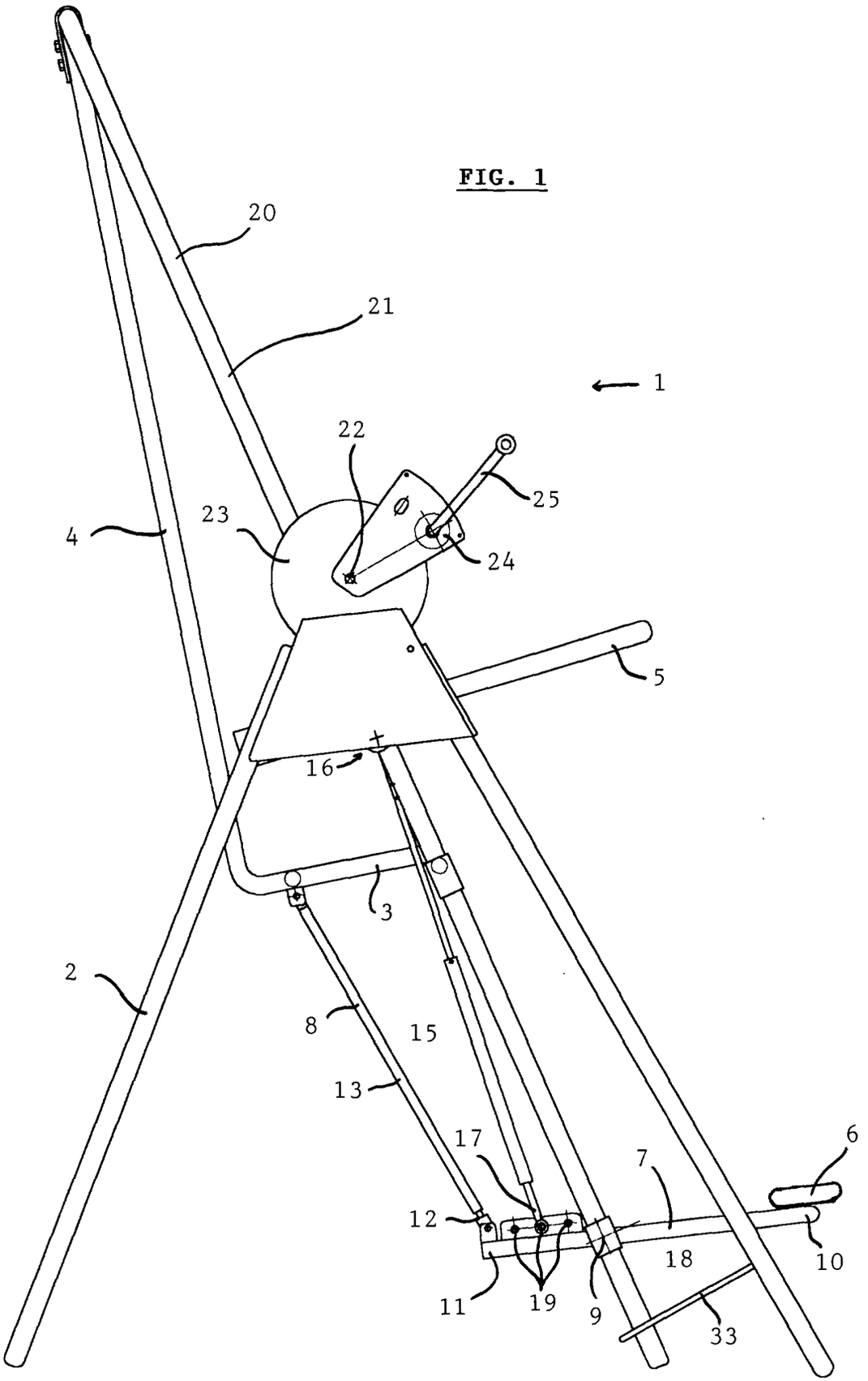
8. An orthopaedic chair according to any one of claims 1-7, **characterised in that** the chair is provided with stopping means (28-30) for stopping the rotation of the rotatable unit (1) in any intermediate position between the upright position and the inverted position.

9. An orthopaedic chair according to any one of claims

1-8, **characterised in that** the chair is provided with limiting means (31-32) for limiting the maximum angle over which the rotatable unit (1) can be rotated.

10. An orthopaedic chair according to any one of claims 1-9, **characterised in that** the chair is provided with means (34-37) for enhancing the stretching force exerted on the user's back in the inverted position.

FIG. 1



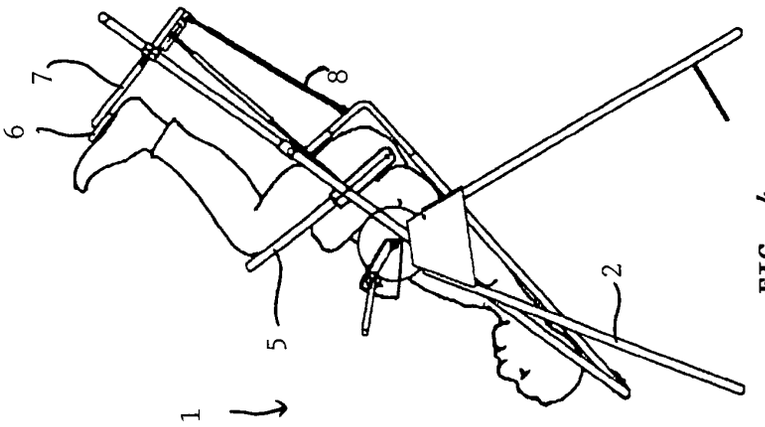


FIG. 4

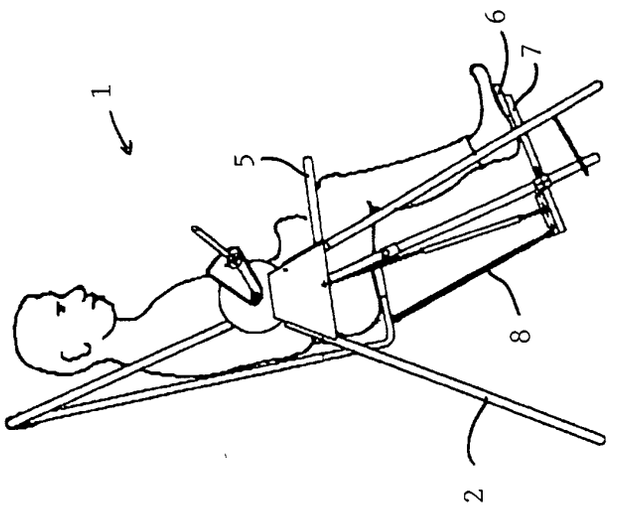


FIG. 3

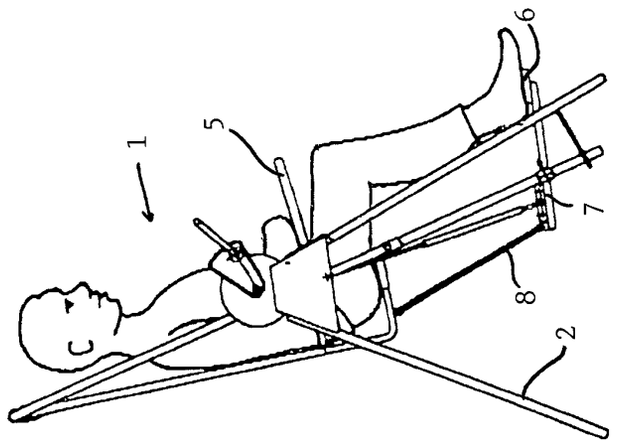


FIG. 2

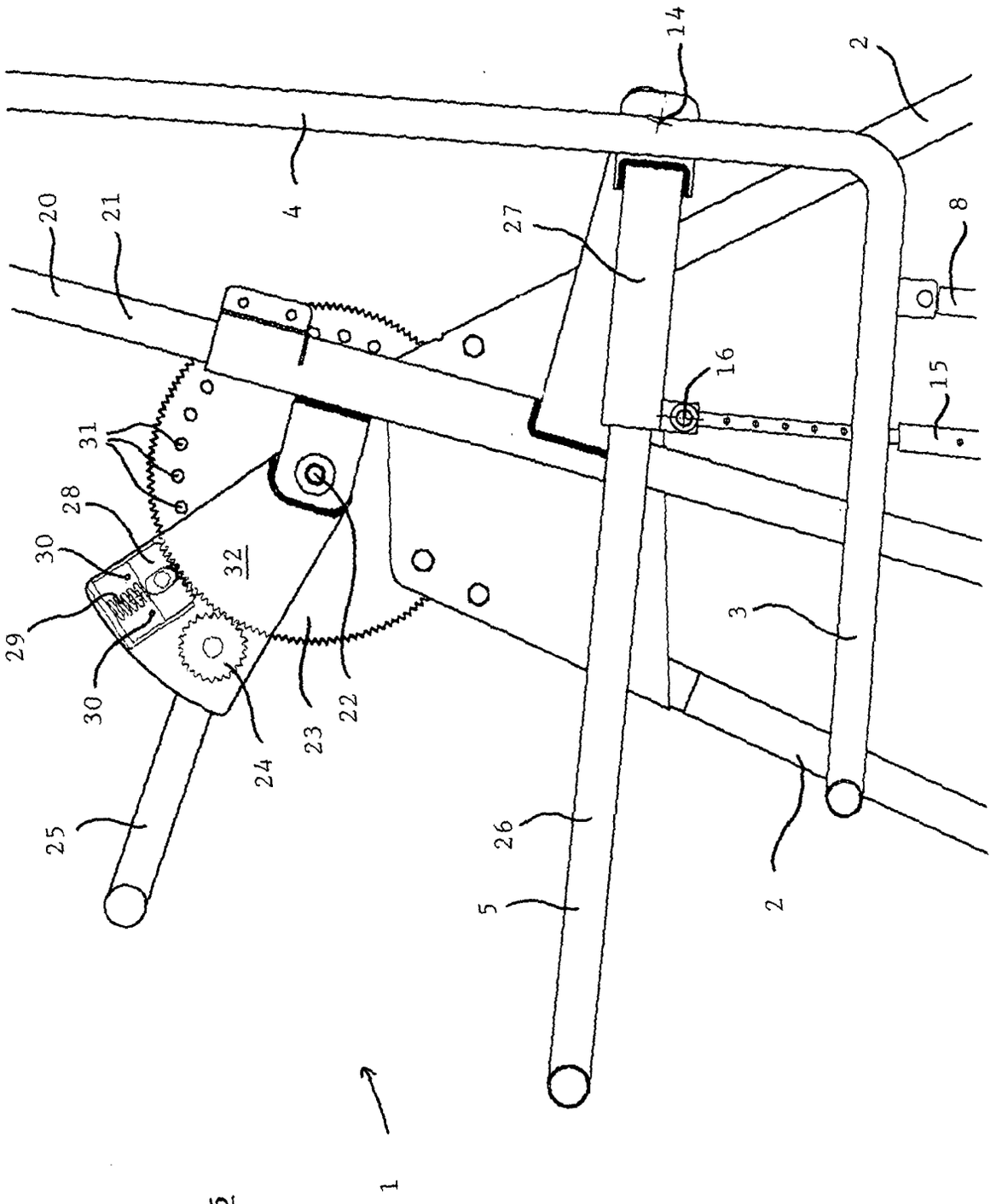


FIG. 5

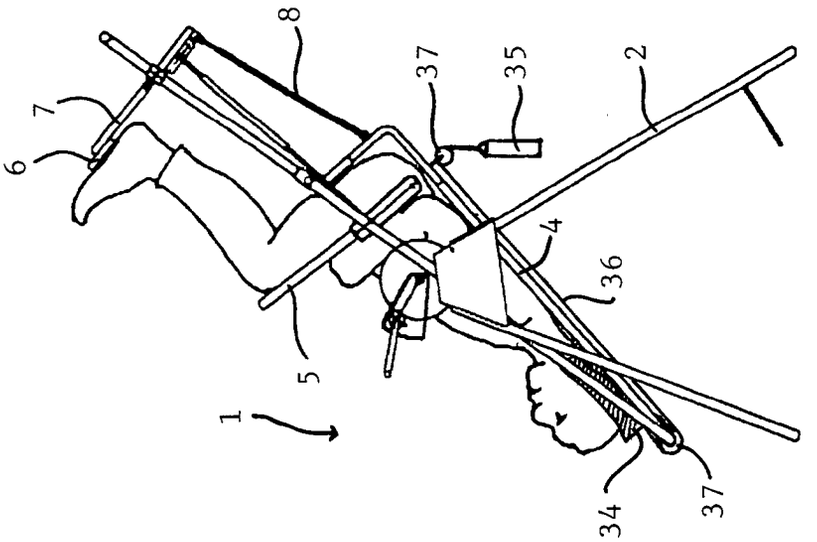


FIG. 6b

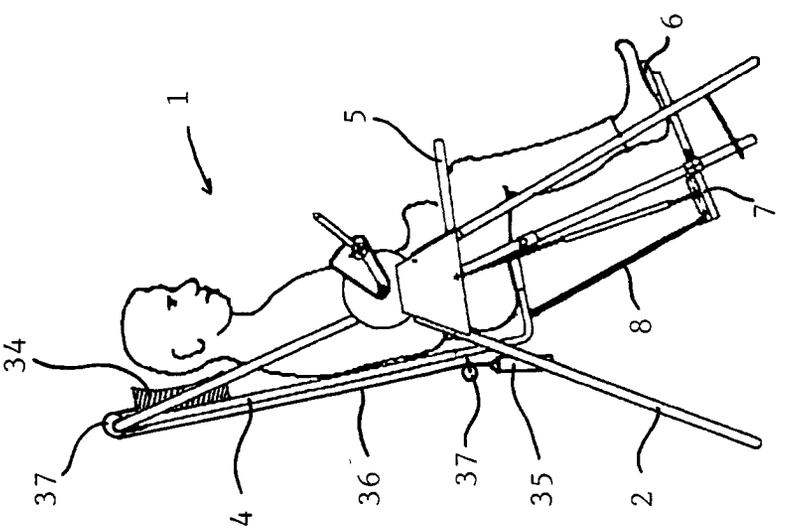


FIG. 6a

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 87 0001

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	30 August 2001	Georgiou, Z

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