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(54) **Title:** BIFUNCTIONAL CHAIR FOR SITTING AND KNEELING

(57) **Abstract:** The subject matter of the invention is a convertible bi-functional chair for sitting and kneeling, which allows to change positions and relieve the spine during long-lasting work involving sitting or long travels by plane, bus or train. The bi-functional chair for sitting and kneeling comprises a movable rotating seat (1), back rest (3) and knee support (6). It is equipped with devices allowing to change the distance between the front edge of the seat and the back rest, the angle of inclination of the back rest with regard to the seat and the height of the back rest with regard to the seat, which enables converting the seat and back rest for classic sitting into a seat and back rest for kneeling and vice versa.

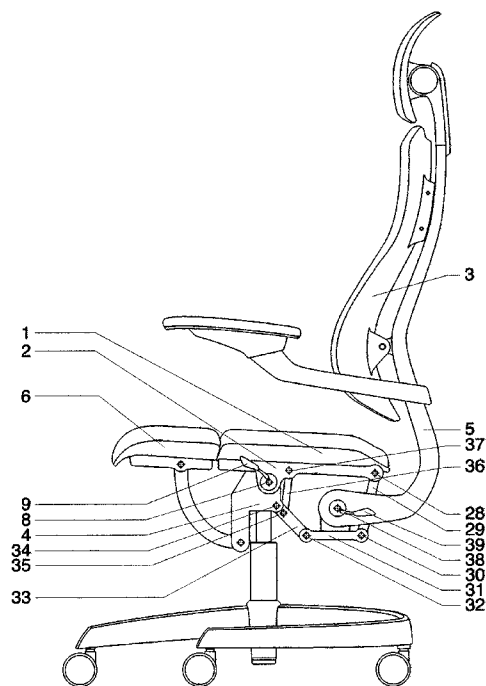


Fig. 11

Bifunctional chair for sitting and kneeling.

The subject matter of the invention is a convertible bi-functional chair for sitting and kneeling, which allows to change positions and relieve the spine during long-lasting work involving sitting or long travels by plane, bus or train.

A chair for kneeling is known from the Polish utility model no. 64081. It is a rehabilitation chair used mainly for kneeling, without a backrest, constructed in the shape of the letter X.

Another solution with a similar purpose is known from the Polish patent application P.390736. It is a convertible piece of furniture for sitting and kneeling in which a two-part kneeler assembly is supported on rotational and tilting arms mounted in brackets in a crosspiece.

Other solutions with similar uses are known, such as the solution from European patent description no. EP 0570550, in which the seat, knee support and backrest are suspended on a suitable mechanism from the supporting column based on a wheeled mount. This mechanism comprises levers allowing for moving the usable surfaces of the chair in space, depending on the needs. In this way the chair may be converted to a sitting position, sitting-kneeling position or similar. Locking the position of the seat, kneeler and backrest is effected by means of latch and bolt mechanisms.

Pieces of furniture of a similar type are also known from the Polish patent application no. P.387898. The chair described therein is equipped with a seat, two-part knee support, backrest and armrests. The kneeler assembly contains two parts. Each of these parts is able to tilt the kneeling chair and move it backwards.

A solution is also known from patent application PCT/IB2014/000114 the essential feature of which consists in the fact that the seat of the chair is dividable. Its front part converts into a kneeler. The chair possesses a two-arm seat support. Its movable arm supports the front part of the seat convertible into a kneeler and the second arm supports the back part of the seat and the backrest.

A solution in the form of a multi-purpose chair for yoga practice in which the kneeler is lowered along the seat column is known from the American patent document US 794672 B2.

Precise adjustment of the bi-functional chair for the function of sitting and kneeling, aside from changing the angle of inclination of the seat, requires changing the depth of the seat, the angle of the backrest in relation to the seat as well as adjustment of the height of the backrest in relation to the seat.

In kneeling form the depth of the seat is lower than during classic sitting. Depending on the manner of mounting and arrangement of the kneeler, in variants with dividable and non-dividable seat, the depth of the seat should be decreased or increased.

On account of changing the angle of inclination of the seat during conversion of the chair it is necessary to change the angle of the backrest in relation to the seat.

In order to appropriately support the lumbar section of the spine the backrest should be profiled and convex in the lumbar section. In order to ensure the appropriate placement of the backrest in both positions of the chair the backrest is preferably adjustable in height with regard to the seat.

Bi-functional chairs known from prior art do not offer the possibility to precisely adjust the device to the function of sitting and kneeling, at the same time preserving the aforementioned conditions.

The bi-functional chair for sitting and kneeling according to the invention contains a seat with adjustable angle of inclination, backrest and movable knee support. It is equipped with a device or several devices allowing to change the distance between the front edge of the seat and the backrest, the angle of inclination of the backrest in relation to the seat and the height of the backrest in relation to the seat, which enables precise conversion of the seat and backrest for classic sitting into a seat and backrest for kneeling and vice versa.

It is beneficial if the change of depth of the seat is ensured by a slide device in which the seat, being manually movable in relation to the backrest, is connected by means of the slide mechanism to the seat mount and the seat plate is rotationally connected to the chair pedestal assembly. Manual change of the angle between the backrest and the seat is enabled by the rotational connection of the frame of the backrest to the rear part of the seat plate. Manual change of the height of the backrest in relation to the seat is enabled by the connection of the backrest to the backrest support which is movable in the vertical direction.

It is beneficial if the chair for sitting and kneeling is equipped with a device maintaining the backrest angle selected by the user without the necessity to lock the movement of the backrest. Such a device does not require additional locking activities and allows the user to quickly and fluidly change the angle of inclination of the backrest by pushing with the back.

It is beneficial if the chair for sitting and kneeling is equipped with a device maintaining the backrest angle selected by the user without the necessity to lock the movement of the backrest, which possesses an assembly for equalizing the resistance of the backrest with the weight of the user. This device does not require regulating the chair for each user.

It is beneficial if the change of depth of the seat and the change of the angle between the backrest and the seat is ensured by a device in which the backrest support is connected by means of a shift and rotation mechanism with the seat plate connected rotationally to the chair pedestal assembly. It ensures manual adjustment of the angle between the backrest and the seat and the possibility to manually shorten or extend the backrest. Manual change of the height of the backrest in relation to the seat is enabled by the connection of the backrest to the backrest support which is manually movable in the vertical direction.

It is beneficial if the change of the depth of the seat and the height of the backrest in relation to the seat is enabled by a device in which the support of the seat is connected

rotationally to the mount of the seat, the rear part of the seat is extended by at least 35 mm and the backrest support is shaped in such a manner, that in the sitting position the lumbar support point of the backrest located closest to the front overlaps at least 35 mm on the seat. Owing to the above, after arranging the chair in the kneeling position the rear part of the seat is automatically extended. Adequate setting of the height of the backrest is ensured by placement of the axis of the backrest support at the end of the seat plate. The height of the backrest changes automatically. Manual change of the angle between the backrest and the seat is enabled by the rotational connection of the frame of the backrest to the rear part of the seat plate.

It is beneficial if the change of the depth of the seat, the angle and the height of the backrest in relation to the seat is enabled by a device in which the support of the seat is connected rotationally to the mount of the seat, the rear part of the seat is extended by at least 35 mm and the backrest support is shaped in such a manner, that in the sitting position the lumbar support point of the backrest located closest to the front overlaps at least 35 mm on the seat. The backrest support is connected by means of sliders through the sliding component to the seat support, which ensures automatic correction of the angle between the seat and the backrest during conversion of the chair. The seat extends automatically. Adequate setting of the height of the backrest is ensured by placement of the axis of the backrest support at the end of the seat plate. The height of the backrest changes automatically.

It is beneficial if the change of the depth of the seat, the angle and height of the backrest in relation to the seat is enabled by a device in which the support of the seat is connected rotationally to the support of the seat, the rear part of the seat is extended by at least 35 mm and the backrest support is shaped in such a manner, that in the sitting position the lumbar support point of the backrest located closest to the front overlaps at least 35 mm on the seat. The rear part of the seat plate is rotationally connected to a string which on its other end is connected rotationally to the mounting plate of the backrest support. The front of the mounting plate of the backrest support is rotationally connected to a string which on its other end is rotationally connected to the seat support. This string is additionally rotationally connected to a string which on its other

end is connected with the lower plate of the seat. The device enables automatic extension of the seat, automatic correction of the backrest angle, automatic correction of the height and distance of the backrest from the seat after arranging the chair in the kneeling position. The mounting plate of the backrest is affixed to the seat support by means of a rotational connection. It provides an additional function – a manually changeable angle between the backrest and the seat which aims at inclining the backrest in both positions of the chair.

It is beneficial if the change of the depth of the seat, the angle and height of the backrest in relation to the seat is enabled by a device in which the support of the seat is connected rotationally with the chair pedestal assembly, the rear part of the seat is extended by at least 35 mm and the backrest support is shaped in such a manner, that in the sitting position the lumbar support point of the backrest located closest to the front overlaps at least 35 mm on the seat. The rear part of the lower plate of the seat is rotationally connected to a string which on its other end is rotationally connected to the sliding component. This sliding component is connected to the chair pedestal assembly by means of any sliding mechanism allowing for vertical up-down movement. The device enables automatic extension of the seat, automatic correction of the backrest angle, automatic correction of the height and distance of the backrest from the seat after arranging the chair in the kneeling position. The sliding component is rotationally affixed with the chair seat support which is in turn rotationally affixed to the backrest support. This provides an additional function – a manually changeable angle between the backrest and the seat which aims at inclining the backrest in both positions of the chair.

It is beneficial if the change of the depth of the seat, the angle and height of the backrest in relation to the seat is enabled by a device in which the support of the seat is connected rotationally to the chair pedestal assembly, the rear part of the seat is extended by at least 35 mm and the backrest support is shaped in such a manner, that in the sitting position the lumbar support point of the backrest located closest to the front overlaps at least 35 mm on the seat. The rear part of the lower seat plate is rotationally connected to a string which on its other end is connected rotationally to the

mounting plate of the backrest support. The plate is rotationally connected to strings which on their other sides are rotationally connected to the seat support assembly. The axes of rotation of the strings are situated in relation to each other in the form of a rhomboid. The plate is rotationally connected to the backrest support which in turn is affixed to the backrest by means of a rotational connection. The device enables automatic extension of the seat, automatic correction of the backrest angle, automatic correction of the height and distance of the backrest from the seat after arranging the chair in the kneeling position. The rotational connection provides an additional function, namely manually changeable angle between the backrest and the seat which aims to incline the backrest in both positions of the chair.

It is beneficial if the change of the depth of the seat, the angle and height of the backrest in relation to the seat is enabled by a device in which the support of the seat is connected rotationally to the chair pedestal assembly, the rear part of the seat is extended by at least 35 mm and the backrest support is shaped in such a manner, that in the sitting position the lumbar support point of the backrest located closest to the front overlaps at least 35 mm on the seat. The rear part of the seat plate is rotationally connected to a string (which on its other end is rotationally connected to the mounting plate of the backrest support). The front of the mounting plate of the backrest support is rotationally connected to a string which on its other end is rotationally connected to the chair pedestal assembly. This string is additionally rotationally connected to the string which on its other end is connected with the lower plate of the seat. The device enables automatic extension of the seat, automatic correction of the backrest angle, automatic correction of the height and distance of the backrest from the seat after arranging the chair in the kneeling position. The mounting plate of the backrest is rotationally connected to the backrest support. It provides an additional function – a manually changeable angle between the backrest and the seat. Another additional function is provided by the inclination mechanism. In the sitting position the mechanism enables the inclination of the seat by means of moving the backrest backwards which, by affecting the seat mount / chair pedestal element, increases the angle between the seat and the backrest, which is beneficial for the spine.

A beneficial result of the invention is a better support for the back of the user which is possible owing to the fact that part of the backrest supporting the lumbar section of the spine is set on an appropriate height. What is more, the depth of the seat is decreased when the chair is arranged in the kneeling position and the angle of the backrest is adjusted for both positions of the chair. What is also beneficial is the introduction of the possibility to incline the backrest backwards in both positions of the chair, so as to place it in a more or less vertical position. Another beneficial fact is the introduction of a mechanism which, in the sitting position, when the backrest is moved backwards, also causes the inclination of the seat by around 50% of the angle of inclination of the backrest, which increases the angle between the seat and the backrest.

A beneficial result of the invention resides in the fact that it is possible to market new variants of the bi-functional chair with better functionalities and introduce this form of seating in buses, trains and planes, which would facilitate travelling for people suffering from back aches.

Embodiments of the subject matter of the invention are presented on the following drawing, where:

Fig. 1 presents the bi-functional chair with a person sitting in the classic position, with a device allowing for changing the distance between the front edge of the seat and the backrest, the angle of inclination of the backrest in relation to the seat and the height of the backrest in relation to the seat.

Fig. 2 presents the bi-functional chair with a person sitting in the classic position, with a device allowing for changing the distance between the front edge of the seat and the backrest, the angle of inclination of the backrest in relation to the seat and the height of the backrest in relation to the seat.

Fig. 3 presents the bi-functional chair arranged in the classic position, with sliding seat allowing for manual change of the distance between the front edge of the seat and the

backrest, with manual change of the angle of inclination of the backrest in relation to the seat and manual change of the height of the backrest in relation to the seat.

Fig. 4 presents the bi-functional chair arranged in the kneeling position, with sliding seat allowing for manual change of the distance between the front edge of the seat and the backrest, with manual change of the angle of inclination of the backrest in relation to the seat and manual change of the height of the backrest in relation to the seat.

Fig. 5 presents the bi-functional chair arranged in the classic position, with sliding backrest allowing for manual change of the distance between the front edge of the seat and the backrest, with manual change of the angle of inclination of the backrest in relation to the seat and manual change of the height of the backrest in relation to the seat.

Fig. 6 presents the bi-functional chair arranged in the kneeling position, with sliding backrest allowing for manual change of the distance between the front edge of the seat and the backrest, with manual change of the angle of inclination of the backrest in relation to the seat and manual change of the height of the backrest in relation to the seat.

Fig. 7 presents the bi-functional chair arranged in the classic position in which the rear part of the seat is extended by at least 35 mm and the backrest support is shaped in such a manner, that in the sitting position the lumbar support point of the backrest located closest to the front overlaps at least 35 mm on the seat. This chair is equipped with a manual mechanism for setting the angle of the backrest support and a support axis located at the end of the seat plate.

Fig. 8 presents the bi-functional chair arranged in the kneeling position in which the rear part of the seat is extended by at least 35 mm and the backrest support is shaped in such a manner, that in the sitting position the lumbar support point of the backrest located closest to the front overlaps at least 35 mm on the seat. This chair is equipped with a manual mechanism for setting the angle of the backrest support and a support axis located at the end of the seat plate.

Fig. 9 presents the bi-functional chair arranged in the classic position, with a mechanism automatically adjusting the angle between the backrest and the seat during conversion of the chair from the sitting position to the kneeling position. This chair is equipped with a support axis located at the end of the seat plate.

Fig. 10 presents the bi-functional chair arranged in the kneeling position, with a mechanism automatically adjusting the angle between the backrest and the seat during conversion of the chair from the sitting position to the kneeling position. This chair is equipped with a support axis located at the end of the seat plate.

Fig. 11 presents the bi-functional chair arranged in the classic position, with a backrest setting device in which the backrest mounting plate is movable by means of sliders. The chair possesses an additional function of inclining the backrest backwards.

Fig. 12 presents the bi-functional chair arranged in the kneeling position, with a backrest setting device in which the backrest mounting plate is movable by means of sliders. The chair possesses an additional function of inclining the backrest backwards.

Fig. 13 presents the bi-functional chair arranged in the classic position, with a backrest setting device in which the backrest mounting plate is movable by means of a sliding mechanism. The chair possesses an additional function of inclining the backrest backwards.

Fig. 14 presents the bi-functional chair arranged in the kneeling position, with a backrest setting device in which the backrest mounting plate is movable by means of a sliding mechanism. The chair possesses an additional function of inclining the backrest backwards.

Fig. 15 presents the bi-functional chair arranged in the classic position, with a backrest setting device in which the backrest mounting plate is movable by means of strings arranged in relation to each other in the form of a rhomboid. The chair possesses an additional function of inclining the backrest backwards.

Fig. 16 presents the bi-functional chair arranged in the kneeling position, with a backrest setting device in which the backrest mounting plate is movable by means of

strings arranged in relation to each other in the form of a rhomboid. The chair possesses an additional function of inclining the backrest backwards.

Fig. 17 presents the bi-functional chair arranged in the classic position, with a backrest setting device in which the backrest mounting plate is movable by means of sliders. The chair possesses an additional function of inclining the backrest backwards synchronized with the function of inclining the seat. The backrest of the chair on this figure is set in the vertical position.

Fig. 18 presents the bi-functional chair arranged in the classic position, with a backrest setting device in which the backrest mounting plate is movable by means of sliders. The chair possesses an additional function of inclining the backrest backwards synchronized with the function of inclining the seat. The backrest of the chair on this figure is set in the maximally reclined position.

Fig. 19-20 present an embodiment of the bi-functional chair with a device for moving the seat and setting the backrest in the classic sitting position and the kneeling position mounted on a stationary pedestal in means of transportation.

Fig. 21 presents the bi-functional chair with a device maintaining the backrest angle selected by the user without the necessity to lock the movement of the backrest manually.

Fig. 22 presents the device maintaining the backrest angle selected by the user without the necessity to lock the movement of the backrest manually.

Fig. 23 presents the device maintaining the backrest angle selected by the user without the necessity to lock the movement of the backrest manually, which contains an assembly for equalizing the resistance of the backrest with the weight of the user.

The embodiment presented on fig. 1 and 2 shows a person sitting in the classic position and in the kneeling position, respectively, on a bi-functional chair for sitting and kneeling equipped with a device automatically changing the distance between the front edge of the seat and the backrest, the angle of inclination of the backrest in

relation to the seat and the height of the backrest in relation to the seat. The device converts the seat and the backrest for classic sitting into a seat and backrest for kneeling and vice versa.

The embodiment presented on fig. 3 and 4 shows the bi-functional chair for sitting and kneeling equipped with a seat with a changeable angle of inclination, backrest and movable knee support in two positions. All regulations are manual. The seat of chair 1 is connected by means of any type of sliding mechanism 7 to seat mount 2. Movement of mechanism 7 may be locked or unlocked by any means – an example slide lock 11. Seat mount 2 is rotationally connected (rotation axis 8) to seat support 4. Rotation may be locked or unlocked by any means – an example rotation lock 9. Seat mount 2 is rotationally connected (rotation axis 10) to backrest support 5. Rotation may be locked or unlocked by any means. Backrest support 5 is affixed with any type of vertical sliding mechanism 14 to backrest 3. Movement of the backrest may be locked or unlocked by any means – an example slide lock 13. If the seat is dividable the knee support 6 constitutes an extension of the seat when the chair is arranged in the sitting position; if the seat is not dividable the knee support 6 is placed under the seat and is moved to the kneeling position during conversion of the chair by means of any mechanism.

The embodiment presented on fig. 5 and 6 shows the bi-functional chair for sitting and kneeling equipped with a seat with a changeable angle of inclination, backrest and movable knee support in two positions. All regulations are manual. Seat mount 2 is rotationally connected (rotation axis 8) to seat support 4. Rotation may be locked or unlocked by any means – an example rotation lock 9. Seat mount 2 is connected by means of a rotational-sliding mechanism or rotational (rotation axis 16) and sliding mechanism 15 to backrest support 5. Movement may be locked by any means – example slide and rotation lock 17. Backrest support 5 is connected with a vertical sliding mechanism 14 to backrest 3. Movement may be locked by any means – example slide lock 13. If the seat is dividable the knee support 6 constitutes an extension of the seat when the chair is arranged in the sitting position; if the seat is not

dividable the knee support 6 is placed under the seat and is moved to the kneeling position during conversion of the chair by means of any mechanism.

The embodiment presented on fig. 7 and 8 shows the bi-functional chair for sitting and kneeling equipped with a seat with a changeable angle of inclination, backrest and movable knee support in two positions. Regulation of the backrest angle is manual, setting the seat depth and height of the backrest over the seat is an automatic process effected during conversion of the chair from the classic sitting position into the kneeling position. Seat mount 2 is rotationally connected (rotation axis 8) to seat support 4. The movement of this connection may be locked by any means – an example rotation lock 9. Backrest support 5 is rotationally connected (rotation axis 18) to the end of seat mount 2. The movement of this connection may be locked by any means – an example rotation lock 19. Backrest support 5 is shaped in such a manner that in the sitting position the lumbar support point of the backrest located closest to the front overlaps at least 35 mm on the seat. Backrest support 5 is affixed to backrest 3. If the seat is dividable the knee support 6 constitutes an extension of the seat when the chair is arranged in the sitting position; if the seat is not dividable the knee support 6 is placed under the seat and is moved to the kneeling position during conversion of the chair by means of any mechanism.

The embodiment presented on fig. 9 and 10 shows the bi-functional chair for sitting and kneeling equipped with a seat with a changeable angle of inclination, backrest and movable knee support in two positions. Setting of the backrest angle, seat depth and height of the backrest over the seat is an automatic process effected during conversion of the chair from the classic sitting position into the kneeling position and vice versa. Seat mount 2 is rotationally connected (rotation axis 8) to seat support 4. Rotation of this connection may be locked by any means – an example rotation lock 9. Backrest support 5 is rotationally connected (rotation axis 18) to the end of seat mount 2. Backrest support 5 is shaped in such a manner that in the sitting position the lumbar support point of the backrest located closest to the front overlaps at least 35 mm on the seat. Backrest support 5 is affixed to backrest 3. The bi-functional is equipped with a mechanism automatically adjusting the angle between the backrest and the seat during

conversion of the chair from the sitting position to the kneeling position constructed in such a manner that seat support 4 is rotationally connected (connection rotation axis 22) to string 21 which on its other end is connected rotationally (connection rotation axis 23) with sliding component 24. Element 24 is connected to seat mount 2 by means of a horizontal sliding mechanism allowing for movement from the end to the front (and vice versa) of the seat. Sliding element 24 is rotationally connected (connection rotation axis 23) to string 25 which on its other end is connected rotationally (connection rotation axis 26) to the short arm of backrest support 27 – connection rotation axis 18. If the seat is dividable the knee support 6 constitutes an extension of the seat when the chair is arranged in the sitting position; if the seat is not dividable the knee support 6 is placed under the seat and is moved to the kneeling position during conversion of the chair by means of any mechanism.

The embodiment presented on fig. 11 and 12 shows the bi-functional chair for sitting and kneeling equipped with a seat with a changeable angle of inclination, backrest and movable knee support in two positions. Setting of the backrest angle, seat depth and height of the backrest over the seat is an automatic process effected during conversion of the chair from the classic sitting position into the kneeling position and vice versa. Seat mount 2 is rotationally connected (rotation axis 8) to seat support 4. Rotation of this connection may be locked by any means – an example rotation lock 9. String 29 is rotationally connected (connection rotation axis 28) to the rear part of seat mount 2. The other side of the string is rotationally connected (connection rotation axis 30) to backrest support mounting plate 31. The front of the backrest support mounting plate 31 is rotationally connected (connection rotation axis 32) to string (33) which on its other end is rotationally connected (connection rotation axis 34) to the chair pedestal assembly 4. In addition, string 33 is rotationally connected (rotation axis 35) to string 36 which on its other end is rotationally connected (connection rotation axis 37) to seat mount 2. Backrest support 20 is rotationally connected (rotation axis 38) to the backrest support mounting plate 31. Rotation of this connection may be locked by any means – an example rotation lock 39. Backrest 3 is affixed to backrest support 31. If the seat is dividable the knee support 6 constitutes an extension of the seat when the chair is arranged in the sitting position; if the seat is not dividable the knee support 6 is

placed under the seat and is moved to the kneeling position during conversion of the chair by means of any mechanism.

The embodiment presented on fig. 13 and 14 shows the bi-functional chair for sitting and kneeling equipped with a seat with a changeable angle of inclination, backrest and movable knee support in two positions. Setting of the backrest angle, seat depth and height of the backrest over the seat is an automatic process effected during conversion of the chair from the classic sitting position into the kneeling position and vice versa. Seat mount 2 is rotationally connected (rotation axis 8) to seat support 4. Rotation of this connection may be locked by any means – an example rotation lock 9. The rear part of the seat mount 2 is rotationally connected (rotation axis 40) to string 41 which on its other end is rotationally connected (rotation axis 42) to sliding component 43. Sliding element 43 is connected to seat support 4 by means of any sliding mechanism 44. Sliding element 43 is rotationally connected (rotation axis 45) to the chair backrest support 5. Rotational movement of this connection may be locked by any means – an example rotation lock 46. Backrest support 20 is affixed to backrest 3. If the seat is dividable the knee support 6 constitutes an extension of the seat when the chair is arranged in the sitting position; if the seat is not dividable the knee support 6 is placed under the seat and is moved to the kneeling position during conversion of the chair by means of any mechanism.

The embodiment presented on fig. 15 and 16 shows the bi-functional chair for sitting and kneeling equipped with a seat with a changeable angle of inclination, backrest and movable knee support in two positions. Setting of the backrest angle, seat depth and height of the backrest over the seat is an automatic process effected during conversion of the chair from the classic sitting position into the kneeling position and vice versa. Seat mount 2 is rotationally connected (rotation axis 8) to seat support 4. Rotation of this connection may be locked by any means – an example rotation lock 9. The rear part of the seat mount 2 is rotationally connected (rotation axis 46) to string 47 which on its other end is rotationally connected (rotation axis 48) to backrest support mounting plate 49. Backrest support mounting plate 49 is rotationally connected to strings 51 and 52, axes 50 and 53, which on their other ends are rotationally connected

with seat support 4, axes 54 and 55. The ends of rotation axes 50, 53, 54 and 55 are arranged in relation to each other in the form of a rhomboid. Backrest support 5, affixed to backrest 3, is rotationally connected (rotation axis 56) to backrest support mounting plate 49. The rotation is locked by any means – example rotation lock 57. If the seat is dividable the knee support 6 constitutes an extension of the seat when the chair is arranged in the sitting position; if the seat is not dividable the knee support 6 is placed under the seat and is moved to the kneeling position during conversion of the chair by means of any mechanism.

The embodiment presented on fig. 17 and 18 shows the bi-functional chair for sitting and kneeling equipped with a seat with a changeable angle of inclination, backrest and movable knee support in two positions. Setting of the backrest angle, seat depth and height of the backrest over the seat is an automatic process effected during conversion of the chair from the classic sitting position into the kneeling position and vice versa. Seat mount 2 is rotationally connected to seat support 4 – connection rotation axis 8. Rotation may be locked by any means. String 29 is rotationally connected to seat mount 2 – connection rotation axis 28. On its other end string 29 is rotationally connected to backrest support mounting plate 31 – connection rotation axis 30. String 33 is rotationally connected to the front of backrest support mounting plate 31 – connection rotation axis 32. On its other end string 33 is rotationally connected to seat support 4 – connection rotation axis 34. In addition, string 33 is rotationally connected (rotation axis 35) to string 36. On its other end string 36 is rotationally connected to seat mount 2 – connection rotation axis 37. The chair is equipped with a mechanism which during backwards inclination of backrest support 5 in the classic sitting position causes automatic inclination of seat 1 along with the mechanism and kneeler around axis 8. This mechanism is constructed in such a manner that the backrest support mounting plate 31 is rotationally connected to inclination lever 58 – connection rotation axis 32. One end of the inclination lever 58 is supported on spring 61a and the other end, which may be equipped with rotating wheel 59, is supported on pusher 60. Inclination lever 58 is affixed to backrest support 5. Backrest 3 is affixed to backrest support 5. If the seat is dividable the knee support 6 constitutes an extension of the seat

when the chair is arranged in the sitting position; if the seat is not dividable the knee support 6 is placed under the seat and is moved to the kneeling position during conversion of the chair by means of any mechanism.

The embodiment presented on fig. 19 and 20 shows an example utilization of the bi-functional chair for sitting and kneeling on a stationary pedestal in a configuration which may be used in lecture halls or in means of transportation such as buses, trains, ferries or planes.

The embodiment presented on fig. 21 and 22 shows the device maintaining the backrest angle selected by the user without the necessity to lock the movement of the backrest. It is constructed in such a manner that the chair pedestal 62 is connected through a taper joint to chair column 63 on which seat support 4 is set. Seat mount 4 is rotationally connected (rotation axis 64) to seat mount 2, which in turn is connected to seat 1. Arm 67 is rotationally connected (rotation axis 66) to seat support 4. Arm 67 is also connected to backrest inclination mechanism mount 69 by means of backrest frame rotation axis 68. Backrest inclination mechanism mount 69 is rotationally connected (rotation axis 70) to string 71 rotationally connected (rotation axis 72) to the seat mount. Retaining walls 73 and 74 of spring 75 tightened by means of screw 76 through washer 77 are affixed to the backrest inclination mechanism mount 69. Backrest frame rotation axis 68 is joined with spring pusher 78 which pushes bolt 79 connected to washer 80 and passing through wall 73. Seat mount 4 is affixed to seat support bracket 81 which possesses an aperture through which bolt 82 slides when moved by means of lever 83. The bolt enters the aperture in seat support 84 connected to the seat mount 2 and blocks the movement of the seat in the classic or kneeling position.

The embodiment presented on fig. 23 shows the device maintaining the backrest angle selected by the user without the necessity to lock the movement of the backrest, which contains an assembly for equalizing the resistance of the backrest with the weight of the user. It is constructed in such a manner that the chair pedestal 62 is connected through a taper joint to chair column 63 on which seat support 4 is set. Seat support 4 is rotationally connected (rotation axis 64) to seat mount 2, which in turn is

rotationally connected (rotation axis 65) to seat 1. Arm 67 is rotationally connected (rotation axis 66) to seat support 4. Arm 67 is also connected to backrest inclination mechanism mount 69 by means of backrest frame rotation axis 68. Backrest inclination mechanism mount 69 is rotationally connected (rotation axis 70) to string 71 rotationally connected (rotation axis 72) to the seat mount. Retaining walls 73 and 74 of spring 75 tightened by means of screw 76 through washer 77 are affixed to the backrest inclination mechanism mount 69. Backrest frame rotation axis 68 is joined with spring pusher 78 which pushes bolt 79 connected to washer 80 and passing through wall 73. Seat mount 4 is affixed to seat support bracket 81 which possesses an aperture through which bolt 82 slides when moved by means of lever 83. The bolt enters the aperture in seat support 84 connected to the seat mount 2 and blocks the movement of the seat in the classic or kneeling position. The assembly for equalizing the resistance of the backrest with the weight of the user is constructed in such a manner that the backrest rotation axis 68 is joined with lever 86 rotationally connected to slider 87, which in turn is rotationally connected to lever 88 rotationally set on axis 89. This axis is set in the backrest inclination mechanism mount 69. Lever 88 is rotationally connected to string 90 which is also rotationally connected to lever 91. Lever 91 is rotationally connected to seat mount 2 by means of axis 92. Lever 91 is rotationally connected to arm 93 which in turn is rotationally connected to seat 1.

Patent Claims

1. Bi-functional chair for sitting and kneeling comprising a seat with adjustable angle of inclination, backrest and movable knee support **characterized in that** it is equipped with devices allowing to change the distance between the front edge of the seat and the backrest, the angle of inclination of the backrest in relation to the seat and the height of the backrest in relation to the seat, which enables conversion of the seat and backrest for classic sitting into a seat and backrest for kneeling and vice versa.

2. Bi-functional chair for sitting and kneeling comprising a seat with adjustable angle of inclination, backrest and movable knee support **characterized in that** it is equipped with devices allowing to change the distance between the front edge of the seat and the backrest and the angle of inclination of the backrest in relation to the seat, which enables conversion of the seat and backrest for classic sitting into a seat and backrest for kneeling and vice versa.

3. Bi-functional chair for sitting and kneeling equipped with a seat with adjustable angle of inclination, backrest and movable knee support pursuant to claim 1, **characterized in that** it is equipped with a device maintaining the backrest angle selected by the user without the necessity to lock the movement of the backrest manually.

4. Bi-functional chair pursuant to claim 3 **characterized in that** the device maintaining the backrest angle selected by the user without the necessity to lock the movement of the backrest is constructed in such a manner that the chair pedestal (62)

is connected with the chair column (63) affixed with seat support (4); the seat support (4) is rotationally connected through rotation axis (64) to the seat mount (2), which is connected to seat (1); the seat support (4) is rotationally connected through rotation axis (66) to arm (67), which is in turn, through backrest frame rotation axis (68), is connected to the backrest inclination mechanism mount (69); the backrest inclination mechanism mount (69) is rotationally connected through rotation axis (70) to string (71) connected rotationally through rotation axis (72) to the seat mount; the backrest inclination mechanism mount (69) is affixed with retaining walls (73) and (74) of spring (75) tightened by means of screw (76) through washer (77); the backrest frame rotation axis (68) is joined with spring pusher (78) pushing bolt (79) moving through an aperture in wall (73) and connected to washer (80); the seat support (4) is affixed with seat support bracket (81) with an aperture through which slides bolt (82) moved by lever (83); the bolt enters the aperture of the seat support (84) connected to seat mount (2).

5. Bi-functional chair pursuant to claim 3 **characterized in that** the device maintaining the backrest angle selected by the user without the necessity to lock the movement of the backrest comprises an assembly for equalizing the resistance of the backrest with the weight of the user and is constructed in such a manner that the chair pedestal (62) is connected with the chair column (63) affixed with seat support (4); the seat support (4) is rotationally connected through rotation axis (64) to the seat mount (2), which is connected to seat (1) through rotation axis (65); the seat support (4) is rotationally connected through rotation axis (66) to arm (67), which is in turn, through backrest frame rotation axis (68), is connected to the backrest inclination mechanism mount (69); the backrest inclination mechanism mount (69) is rotationally connected through rotation axis (70) to string (71) connected rotationally through rotation axis (72) to the seat mount; the backrest inclination mechanism mount (69) is affixed with retaining walls (73) and (74) of spring (75) tightened by means of screw (76) through washer (77); the backrest frame rotation axis (68) is joined with spring pusher (78) pushing bolt (79) moving through an aperture in wall (73) and connected to washer (80); the seat support (4) is affixed with seat support bracket (81) with an aperture through which slides bolt (82) moved by lever (83); the bolt enters the aperture of the

seat support (84) connected to seat mount (2); the backrest rotation axis (68) is joined with lever (86) rotationally connected to slider (87), which in turn is rotationally connected to lever (88) rotationally set on axis (89) mounted on the backrest inclination mechanism mount (69); lever (88) is rotationally connected to string (90) which is rotationally connected to lever (91), which in turn is rotationally connected through axis (92) to the seat mount (2); lever (91) is rotationally connected with arm (93) which is rotationally connected to seat (1).

6. Bi-functional chair for sitting and kneeling comprising a seat with changeable angle of inclination, backrest and movable knee support pursuant to claim 1 **characterized in that** the seat (1) is slide connected by means of any type of sliding mechanism (7) equipped with slide lock, to the seat mount (2); seat mount (2) is rotationally connected, with any type of rotation lock, to chair pedestal assembly (4) – connection rotation axis (8); seat mount (2) is rotationally connected, with any type of rotation lock, to backrest support (5) – connection rotation axis (10); backrest support (5) is connected to backrest (3) by means of any type of sliding mechanism (14) locked in any manner, which allows for vertical sliding; if the seat is dividable knee support (6) constitutes an extension of the seat when the chair is arranged in the sitting position; if the seat is not dividable the knee support (6) is placed under the seat and is moved to the kneeling position during conversion of the chair by means of any type of mechanism.

7. Bi-functional chair for sitting and kneeling comprising a seat with changeable angle of inclination, backrest and movable knee support pursuant to claim 1 **characterized in that** seat mount (2) is rotationally connected, through any type of rotation lock, to the chair pedestal assembly (4) – connection rotation axis (8); seat mount (2) is connected by means of any type of rotating and sliding mechanism (15) with any type of movement lock, to backrest support (5) – connection rotation axis (16); backrest support (5) is connected by means of any type of sliding mechanism allowing for vertical movement (14), with any type of slide lock, to backrest (3); if the seat is dividable knee support (6) constitutes an extension of the seat when the chair is

arranged in the sitting position; if the seat is not dividable knee support (6) is placed below the seat and is moved to the kneeling position during conversion of the chair by means of any type of mechanism.

8. Bi-functional chair for sitting and kneeling comprising a seat with changeable angle of inclination, backrest and movable knee support pursuant to claim 1 **characterized in that** seat mount (2) is rotationally connected, through any type of rotation lock, to the chair pedestal assembly (4) – connection rotation axis (8); the end of seat mount (2) is rotationally connected to backrest support (5) – connection rotation axis (18); backrest support (5) is shaped in such a manner that in the sitting position the lumbar support point of the backrest located closest to the front overlaps at least 35 mm on the seat; backrest support (5) is connected to backrest (3); if the seat is dividable knee support (6) constitutes an extension of the seat when the chair is arranged in the sitting position; if the seat is not dividable knee support (6) is placed below the seat and is moved to the kneeling position during conversion of the chair by means of any type of mechanism.

9. Bi-functional chair for sitting and kneeling comprising a seat with changeable angle of inclination, backrest and movable knee support pursuant to claim 1 **characterized in that** seat mount (2) is rotationally connected, through any type of rotation lock, to the chair pedestal assembly (4) – connection rotation axis (8); the end of seat mount (2) is rotationally connected to backrest support (5) – connection rotation axis (18); backrest support (5) is shaped in such a manner that in the sitting position the lumbar support point of the backrest located closest to the front overlaps at least 35 mm on the seat; backrest support (5) is connected to backrest (3); the chair comprises a mechanism automatically adjusting the angle between the backrest and the seat during conversion of the chair from the classic sitting position to the kneeling position, constructed in such a manner that the chair pedestal assembly (4) is rotationally connected to string (21) – connection rotation axis (22); the other end of the string (21) is rotationally connected to sliding component (24) – connection rotation axis (23); sliding component (24) is slide connected to seat mount (2) in a manner allowing for horizontal movement from the front to the end of the seat and vice versa; sliding

component (24) is rotationally connected to string (25) – connection rotation axis (23); the other end of string (25) is rotationally connected to the short arm of backrest support (27) – connection rotation axis (26). If the seat is dividable the knee support (6) constitutes an extension of the seat when the chair is arranged in the sitting position; if the seat is not dividable the knee support (6) is placed under the seat and is moved to the kneeling position during conversion of the chair by means of any mechanism.

10. Bi-functional chair for sitting and kneeling comprising a seat with changeable angle of inclination, backrest and movable knee support pursuant to claim 1 **characterized in that** seat mount (2) is rotationally connected, through any type of rotation lock, to the chair pedestal assembly (4) – connection rotation axis (8); seat mount (2) is rotationally connected to string (29) – connection rotation axis (28); the other end of string (29) is rotationally connected to backrest support mounting plate (31) – connection rotation axis (30); the front of backrest support mounting plate (31) is rotationally connected to string (33) – connection rotation axis (32); the other end of string (33) is rotationally connected to chair pedestal assembly (4) – connection rotation axis (34); string (33) is additionally rotationally connected to string (36) – connection rotation axis (35); the other end of string (36) is rotationally connected to seat mount (2) – connection rotation axis (37); backrest support mounting plate (31) is rotationally connected, with any type of rotation lock, to backrest support (5) – connection rotation axis (38); backrest support (5) is affixed to backrest (3); if the seat is dividable knee support (6) constitutes an extension of the seat when the chair is arranged in the sitting position; if the seat is not dividable knee support (6) is placed below the seat and is moved to the kneeling position during conversion of the chair by means of any type of mechanism.

11. Bi-functional chair for sitting and kneeling comprising a seat with changeable angle of inclination, backrest and movable knee support pursuant to claim 1 **characterized in that** seat mount (2) is rotationally connected, through any type of rotation lock, to the chair pedestal assembly (4) – connection rotation axis (8); the rear

of the seat mount (2) is rotationally connected to string (41) – connection rotation axis (40); the other end of string (41) is rotationally connected to sliding component (43) – connection rotation axis (42); sliding component (43) is slide connected by means of any type of sliding mechanism (44) to chair pedestal assembly (4); sliding component (43) is rotationally connected, with any type of rotation lock, to backrest support (5) – connection rotation axis (45); backrest support (5) is affixed to backrest (3); if the seat is dividable knee support (6) constitutes an extension of the seat when the chair is arranged in the sitting position; if the seat is not dividable knee support (6) is placed below the seat and is moved to the kneeling position during conversion of the chair by means of any type of mechanism.

12. Bi-functional chair for sitting and kneeling comprising a seat with changeable angle of inclination, backrest and movable knee support pursuant to claim 1 **characterized in that** seat mount (2) is rotationally connected, through any type of rotation lock, to the chair pedestal assembly (4) – connection rotation axis (8); seat mount (2) is rotationally connected to string (47) – connection rotation axis (46), the other end of string (47) is rotationally connected to backrest support mounting plate (49) – connection rotation axis (48); backrest support plate (49) is rotationally connected to strings (51) and (52) – connection rotation axes (50) and (53); the other ends of strings (51) and (52) are rotationally connected to chair pedestal assembly (4) – rotation axes (54) and (55); the ends of rotation axes (50), (53), (54) and (55) are arranged in relation to each other in the form of a rhomboid; backrest support mounting plate (49) is rotationally connected, with any type of rotation lock, to backrest support (5) – connection rotation axis (56); backrest support (5) is connected to backrest (3); if the seat is dividable knee support (6) constitutes an extension of the seat when the chair is arranged in the sitting position; if the seat is not dividable knee support (6) is placed below the seat and is moved to the kneeling position during conversion of the chair by means of any type of mechanism.

13. Bi-functional chair for sitting and kneeling comprising a seat with changeable angle of inclination, backrest and movable knee support pursuant to claim 1

characterized in that seat mount (2) is rotationally connected, through any type of rotation lock, to the chair pedestal assembly (4) – connection rotation axis (8); seat mount (2) is rotationally connected to string (29) – connection rotation axis (28); the other end of string (29) is rotationally connected to backrest support mounting plate (31) – connection rotation axis (30); the front of backrest support mounting plate (31) is rotationally connected to string (33) – connection rotation axis (32); the other end of string (33) is rotationally connected to chair pedestal assembly (4) – connection rotation axis (34); string (33) is additionally rotationally connected to string (36) – connection rotation axis (35); the other end of string (36) is rotationally connected to seat mount (2) – connection rotation axis (37); the chair comprises a mechanism which in the classic sitting position, during backwards inclination of the backrest support (5) causes backwards inclination of the seat (1) along with the mechanism and the knee support around axis (8); the mechanism is constructed in such a manner that the backrest support mounting plate (31) is rotationally connected to inclination lever (58) – connection rotation axis (32); one end of the inclination lever (58) leans on string (61) and the other end, which may be equipped with a rotating wheel (59), leans on pusher (60); inclination lever (58) is affixed to backrest support (5). Backrest (3) is affixed to backrest support (5); if the seat is dividable the knee support (6) constitutes an extension of the seat when the chair is arranged in the sitting position; if the seat is not dividable the knee support (6) is placed under the seat and is moved to the kneeling position during conversion of the chair by means of any mechanism.

List of designators:

- 1 – seat
- 2 – seat mount
- 3 – backrest
- 4 – seat support
- 5 – backrest support
- 6 – knee support
- 7 – sliding mechanism
- 8 – rotation axis
- 9 – rotation lock
- 10 – rotation axis
- 11 – example slide lock
- 12 – example rotation lock
- 13 – example slide lock
- 14 – sliding mechanism
- 15 – sliding-rotating mechanism
- 16 – rotation axis
- 17 – example slide and rotation lock
- 18 – rotation axis
- 19 – example rotation lock

- 20 – armrest
- 21 – string
- 22 – rotation axis
- 23 – rotation axis
- 24 – sliding component
- 25 – string
- 26 – rotation axis
- 27 – short arm of backrest support
- 28 – rotation axis
- 29 – string
- 30 – rotation axis
- 31 – backrest support mounting plate
- 32 – rotation axis
- 33 – string
- 34 – rotation axis
- 35 – rotation axis
- 36 – string
- 37 – rotation axis
- 38 – rotation axis
- 39 – example rotation lock
- 40 – rotation axis
- 41 – string

- 42 – rotation axis
- 43 – sliding component
- 44 – sliding mechanism
- 45 – rotation axis
- 46 – rotation axis
- 47 – string
- 48 – rotation axis
- 49 – backrest support mounting plate
- 50 – rotation axis
- 51 – string
- 52 – string
- 53 – rotation axis
- 54 – rotation axis
- 55 – rotation axis
- 56 – rotation axis
- 57 – example rotation lock
- 58 – inclination lever
- 59 – rotating wheel
- 60 – pusher
- 61 – spring
- 62 – chair pedestal
- 63 – chair column

64 – rotation axis

65 – rotation axis

66 – rotation axis

67 – arm

68 – backrest frame rotation axis

69 – backrest inclination mechanism mount

70 – rotation axis

71 – string

72 – rotation axis

73 – retaining wall

74 – retaining wall

75 – spring

76 – screw through

77 – washer

78 – spring pusher

79 – bolt

80 – washer

81 – seat support bracket

82 – bolt

83 – lever

84 – seat support

85 – knee support arm

86 – lever

87 – slider

88 – lever

89 – axis

90 – string

91 – lever

92 – axis

93 – string

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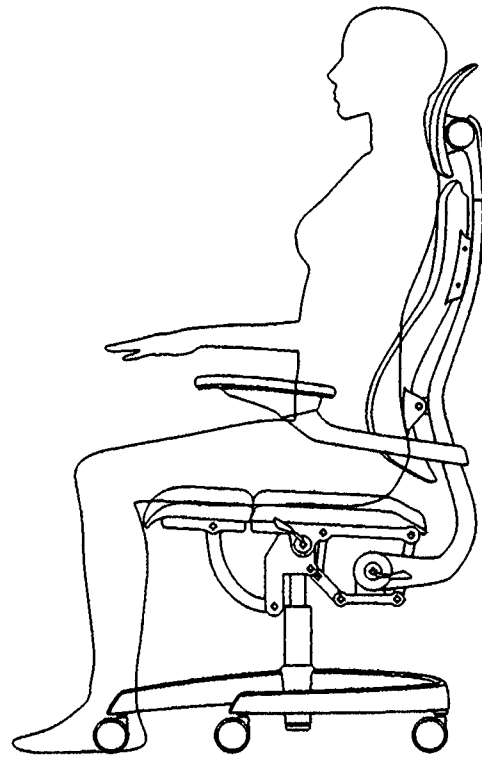


Fig. 1

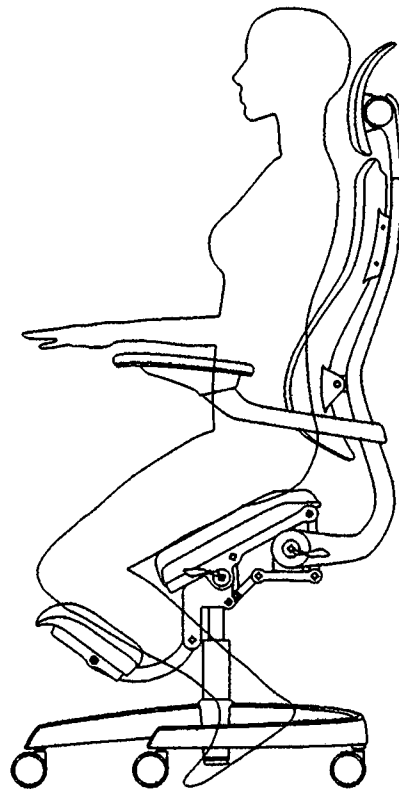


Fig. 2

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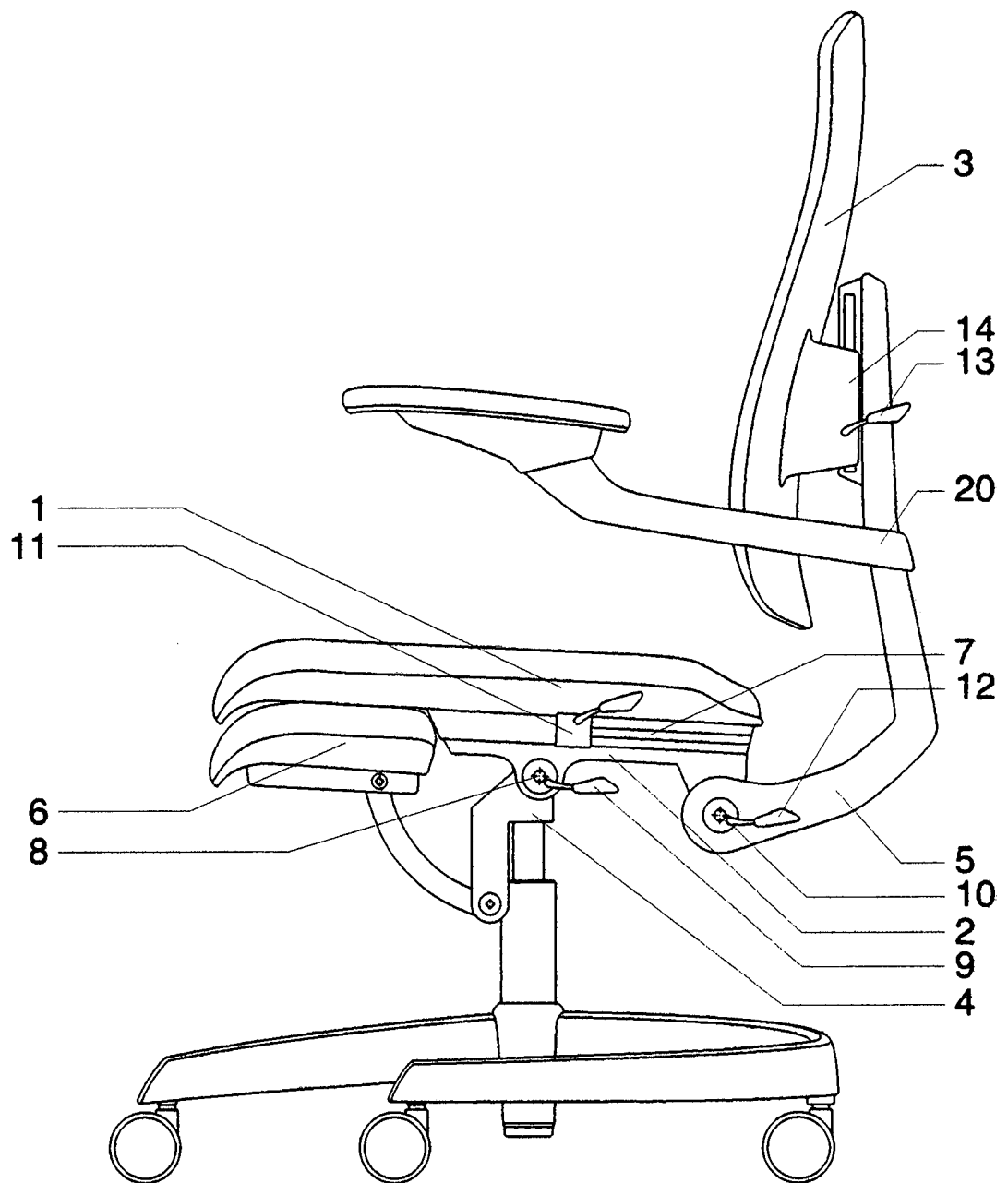


Fig. 3

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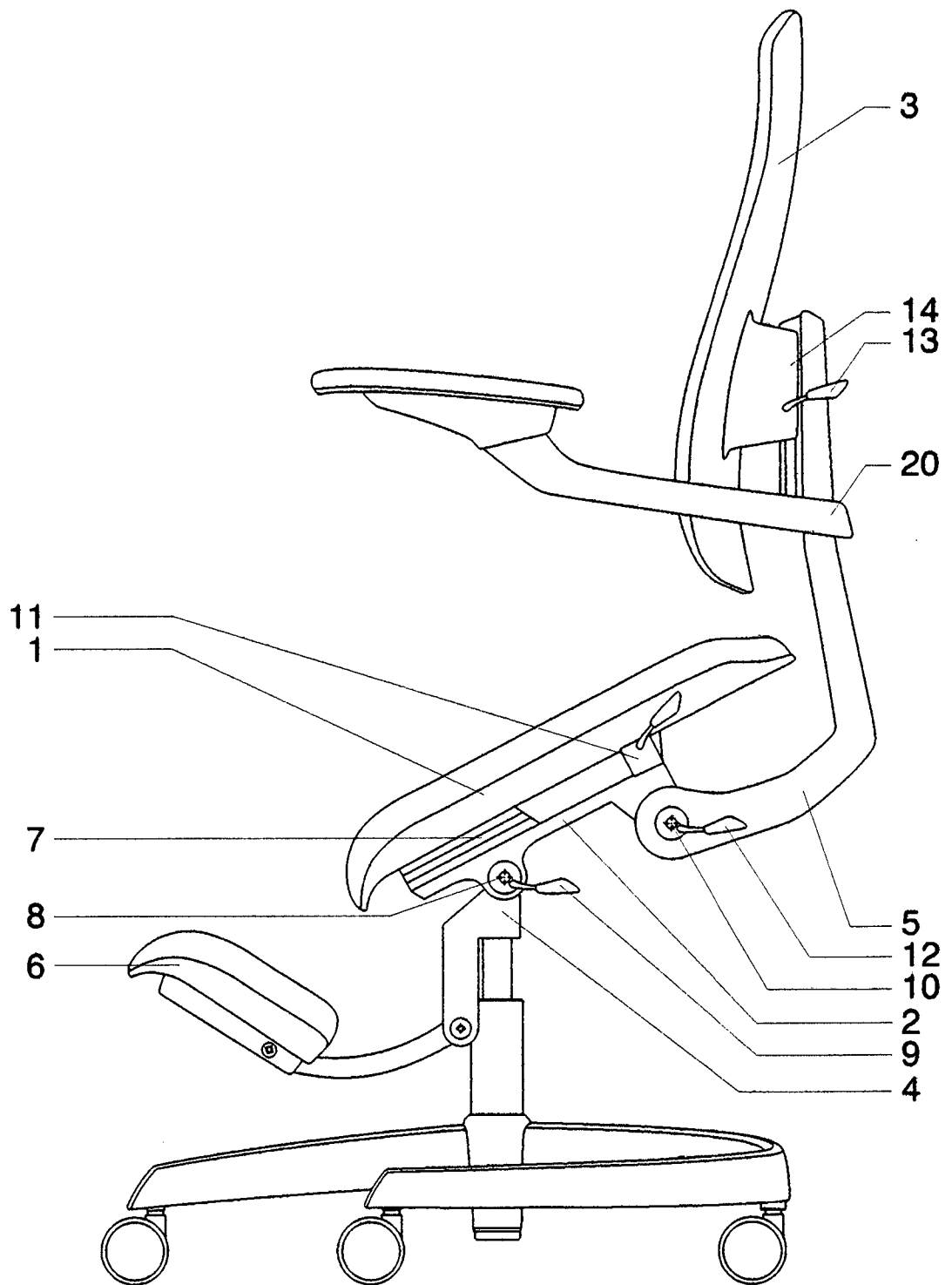


Fig. 4

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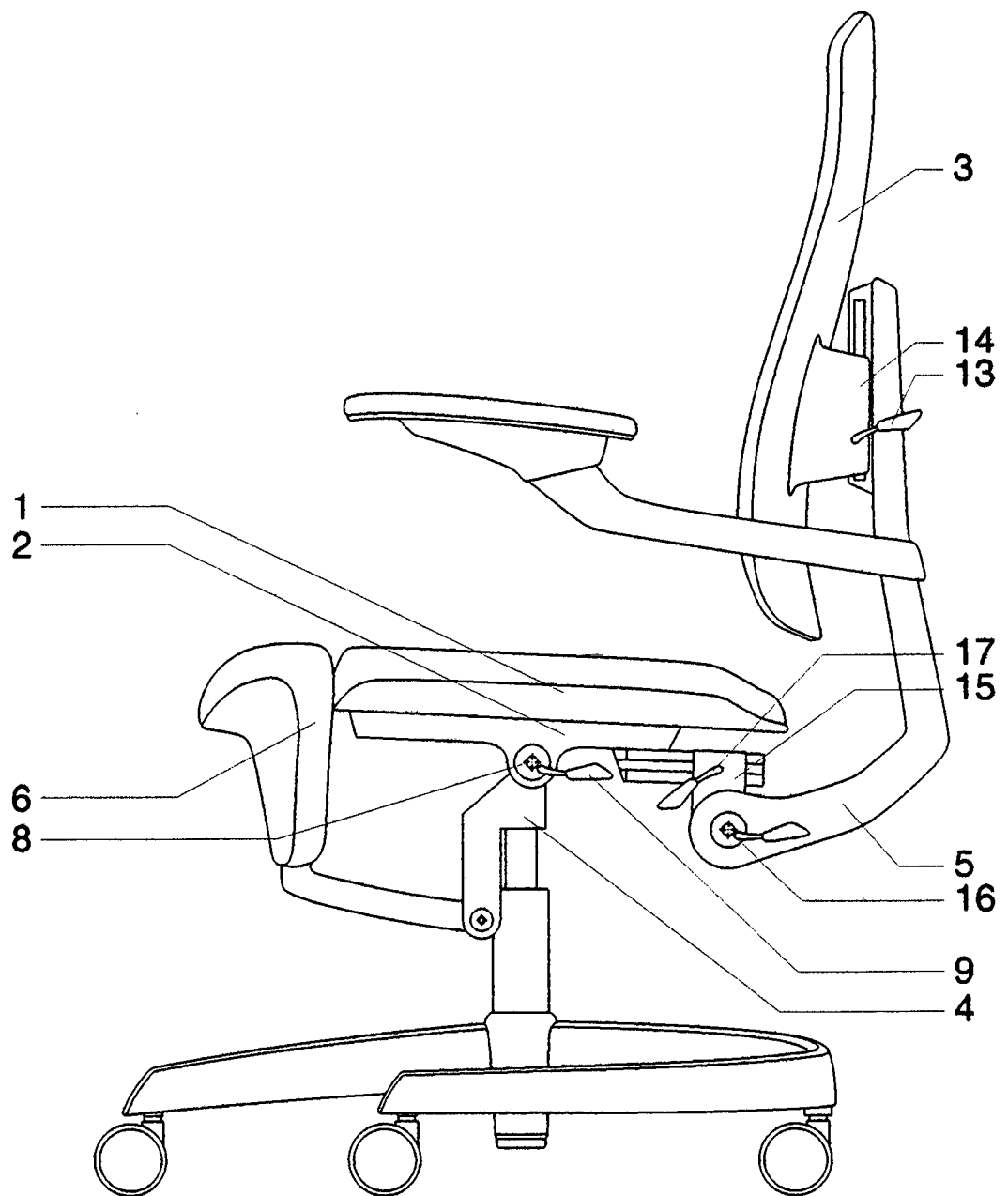


Fig. 5

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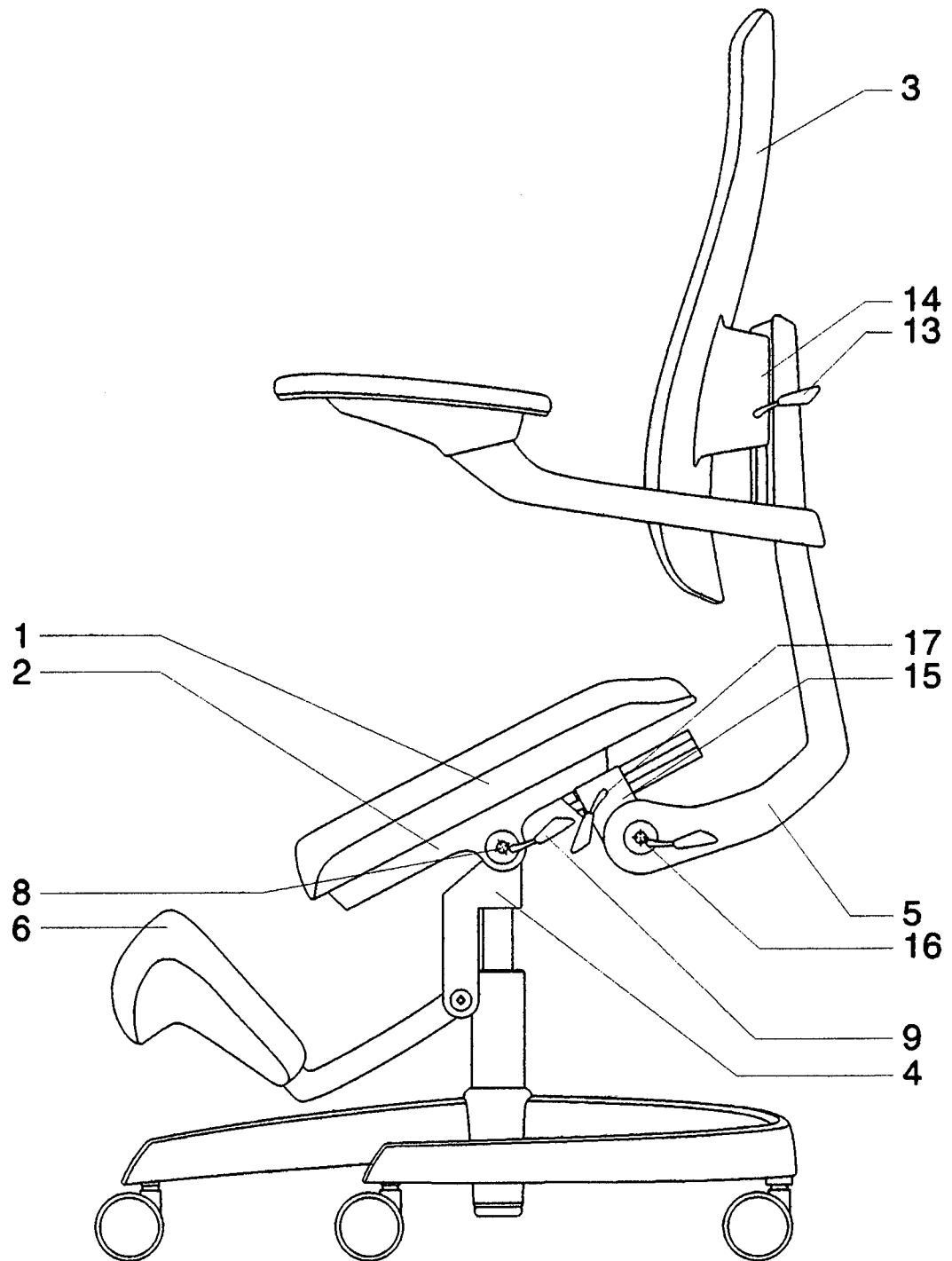


Fig. 6

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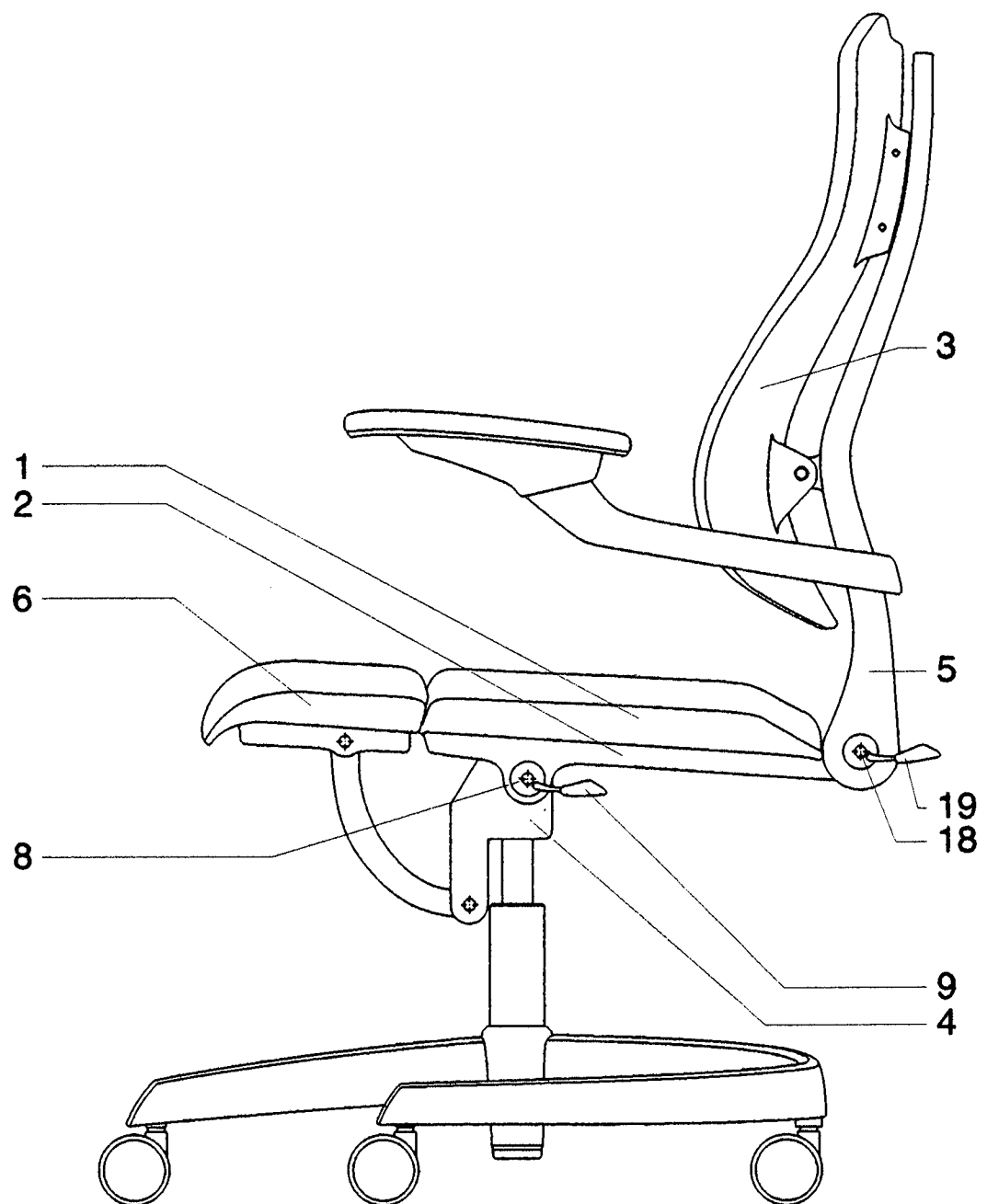


Fig. 7

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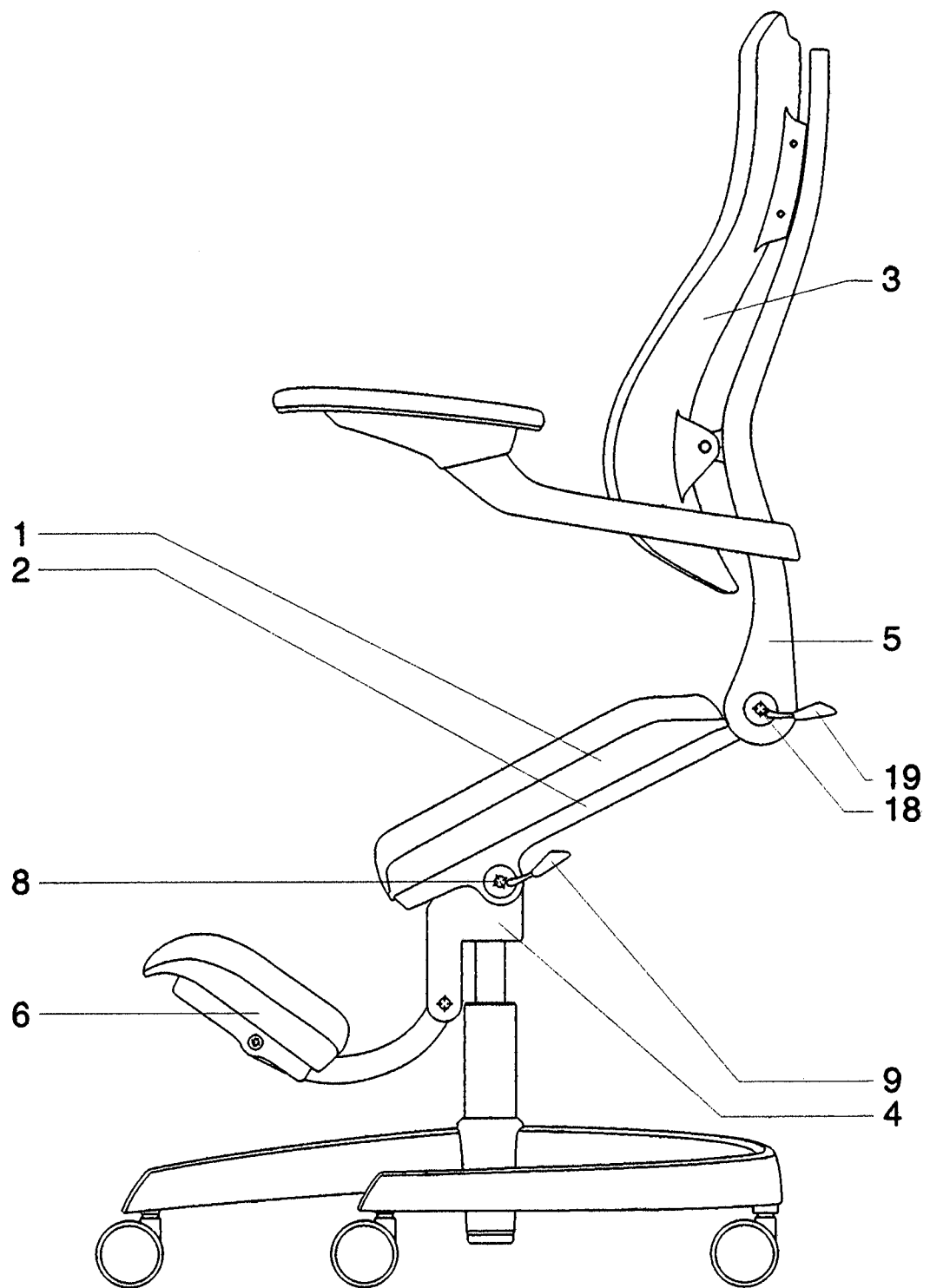


Fig. 8

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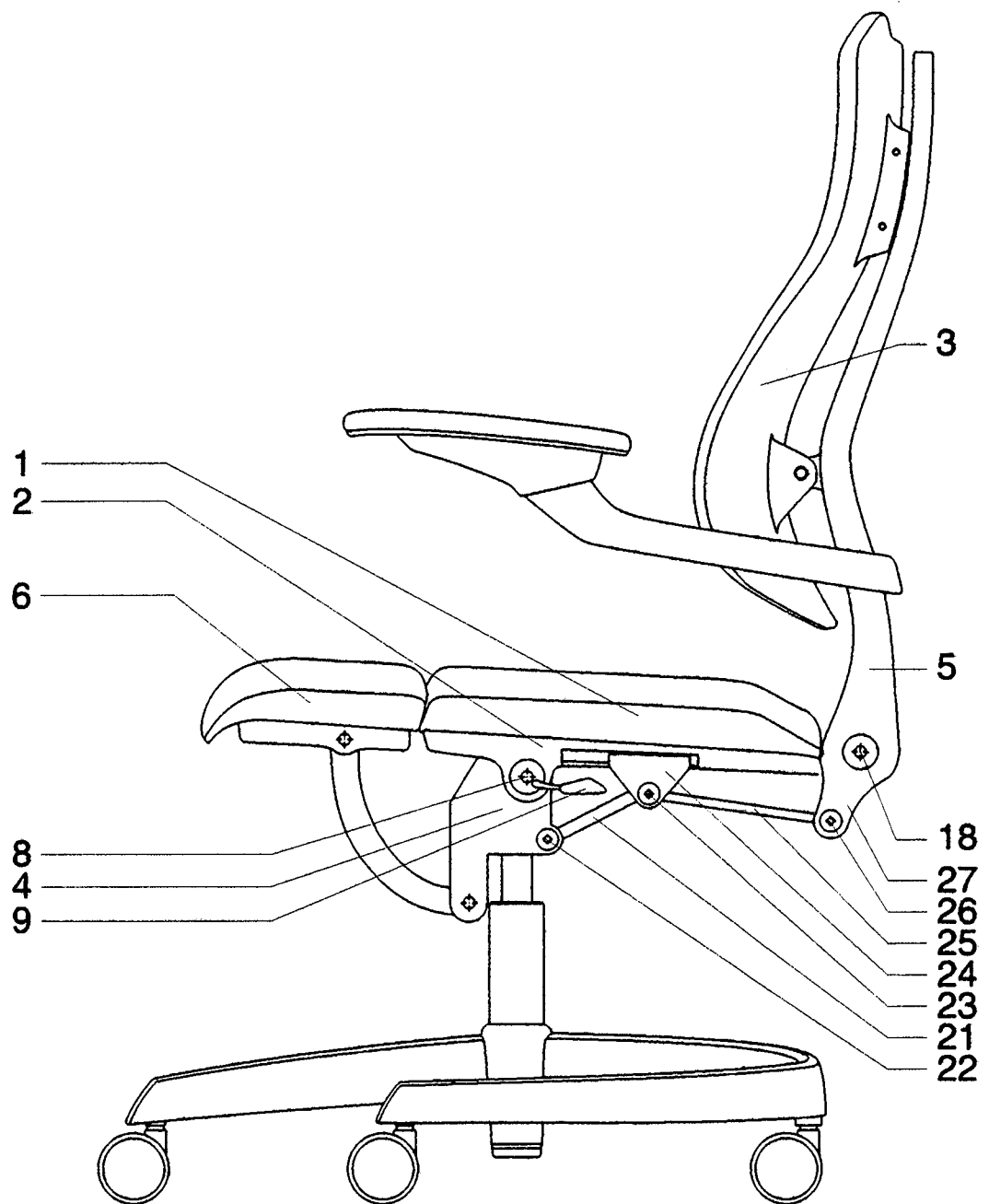


Fig. 9

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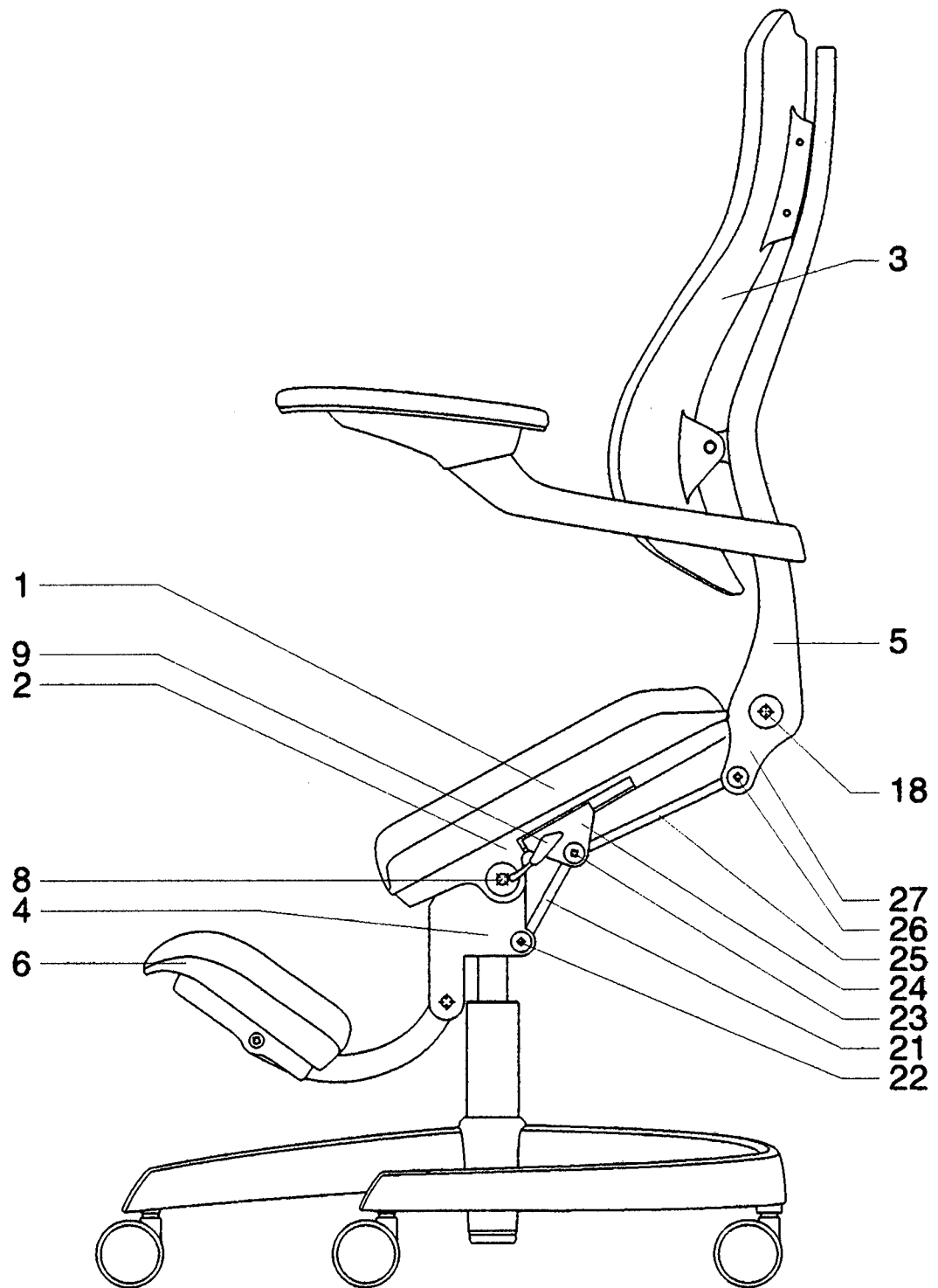


Fig. 10

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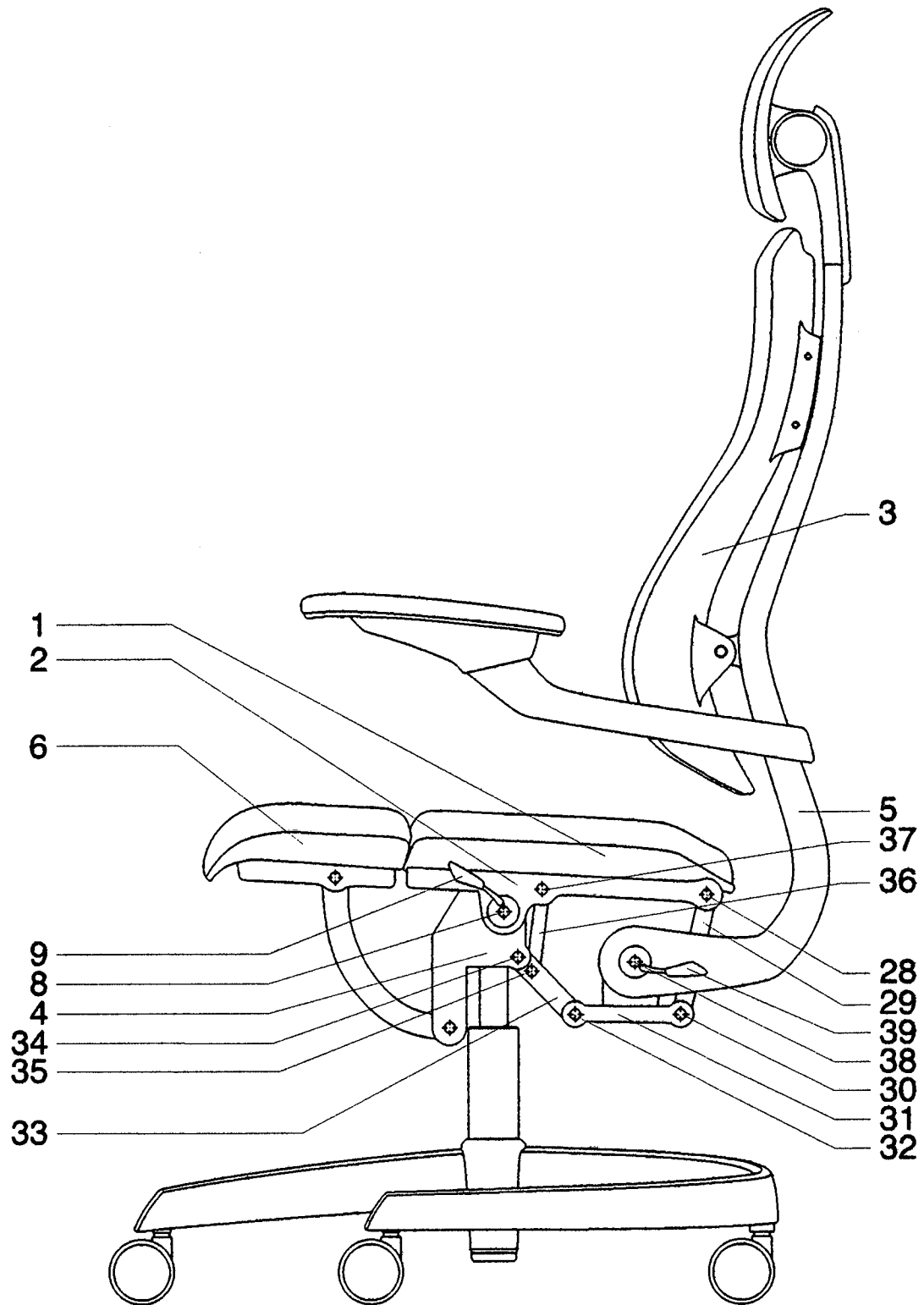


Fig. 11

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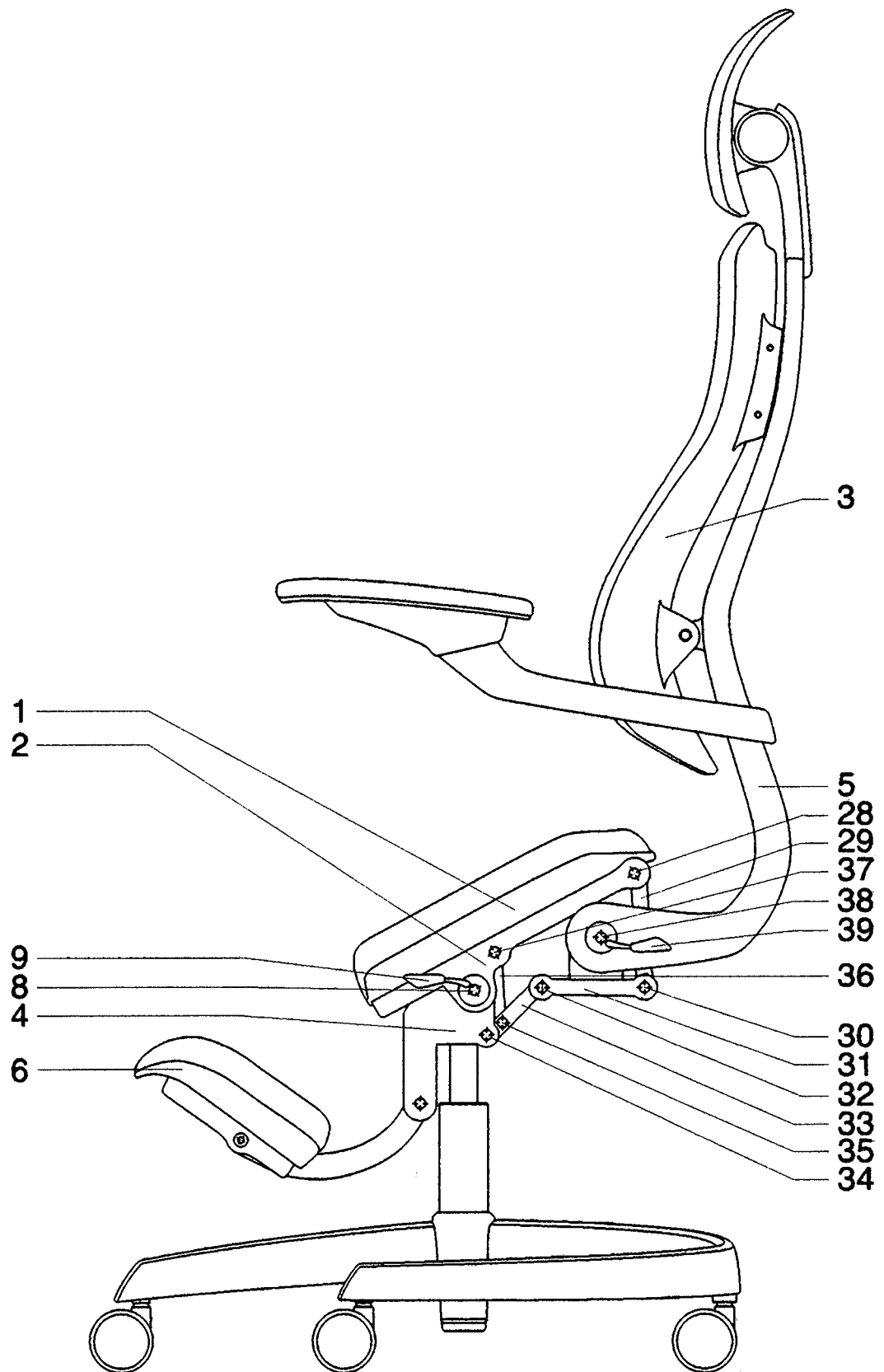


Fig. 12

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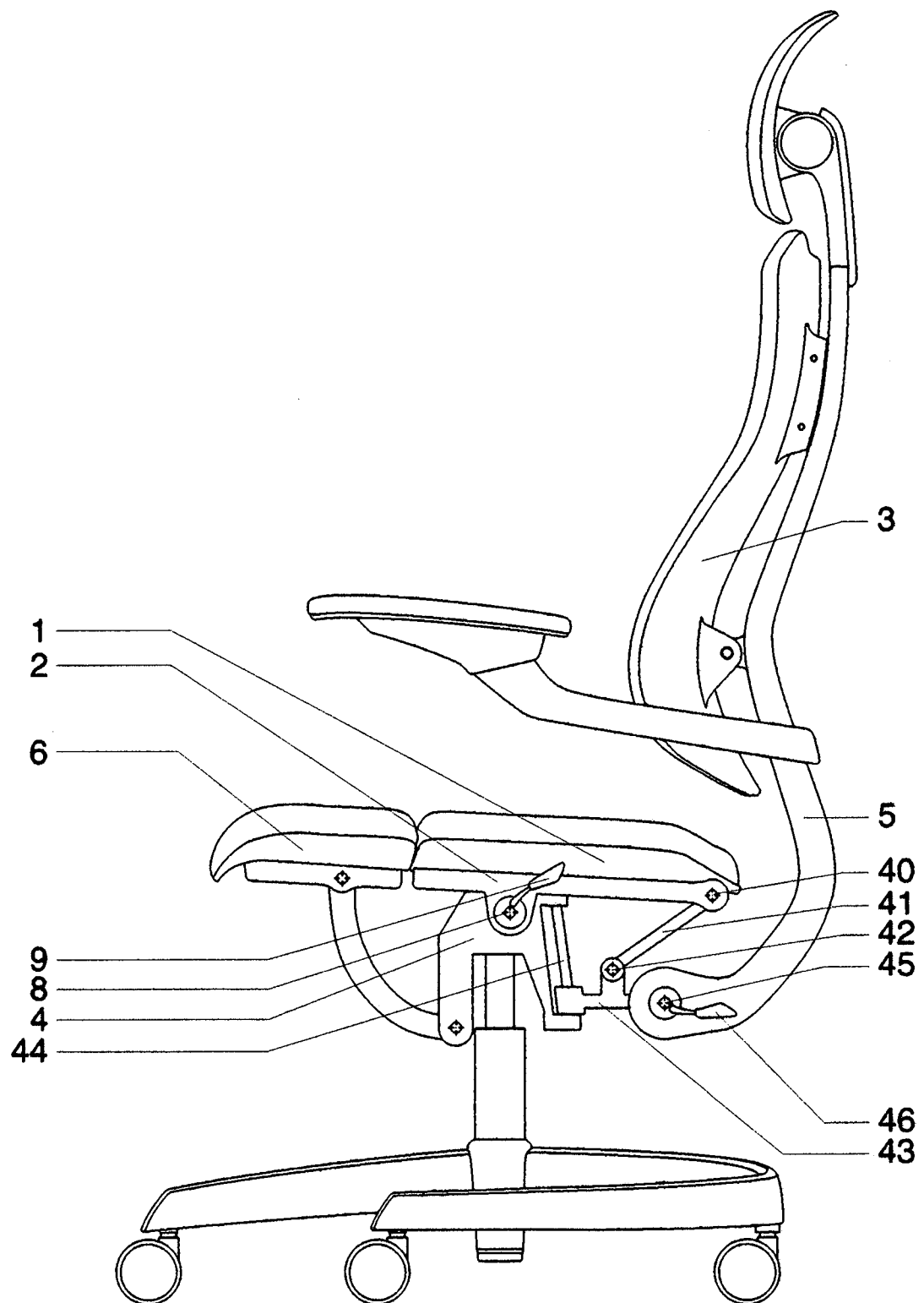


Fig. 13

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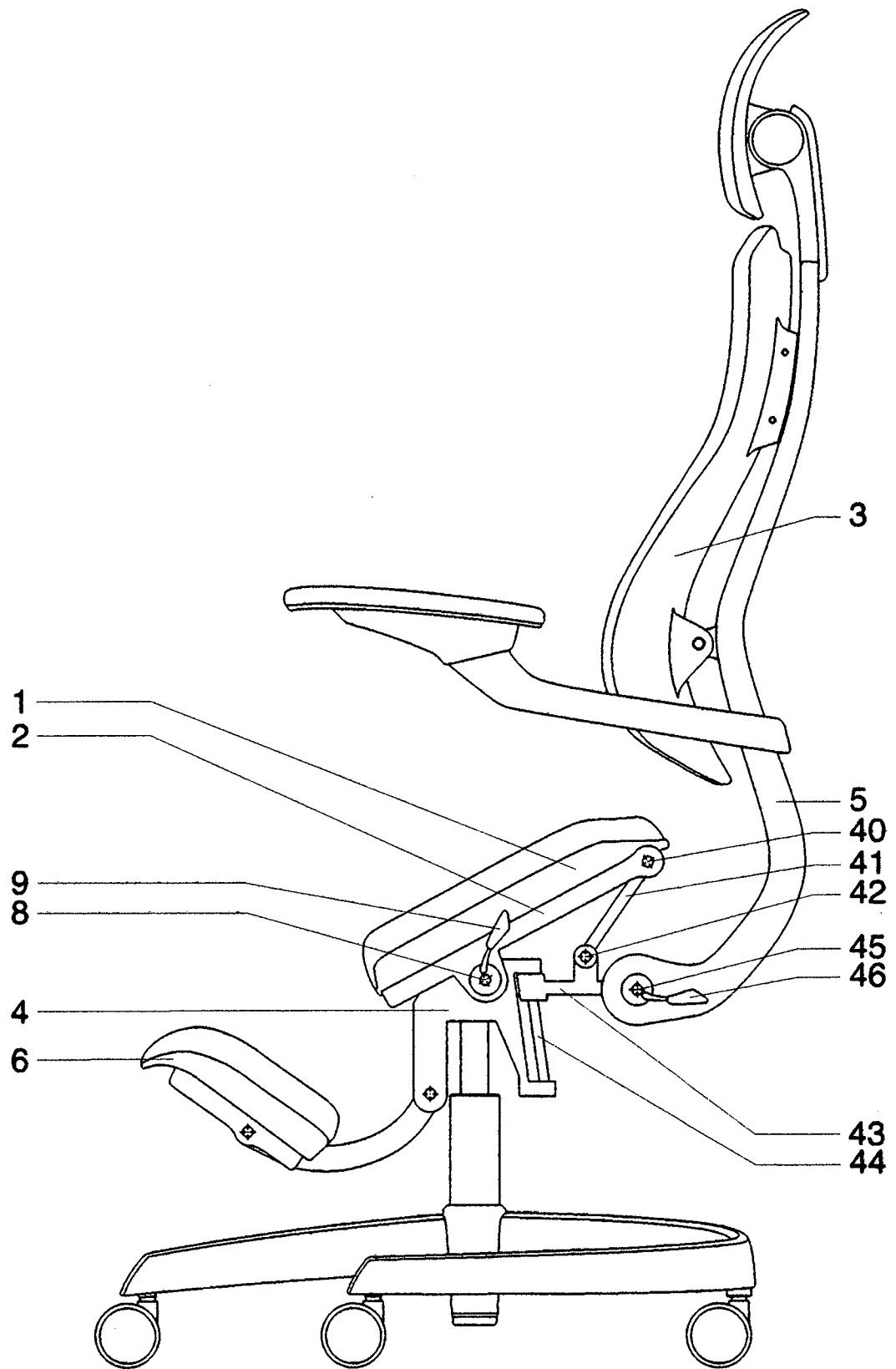


Fig. 14

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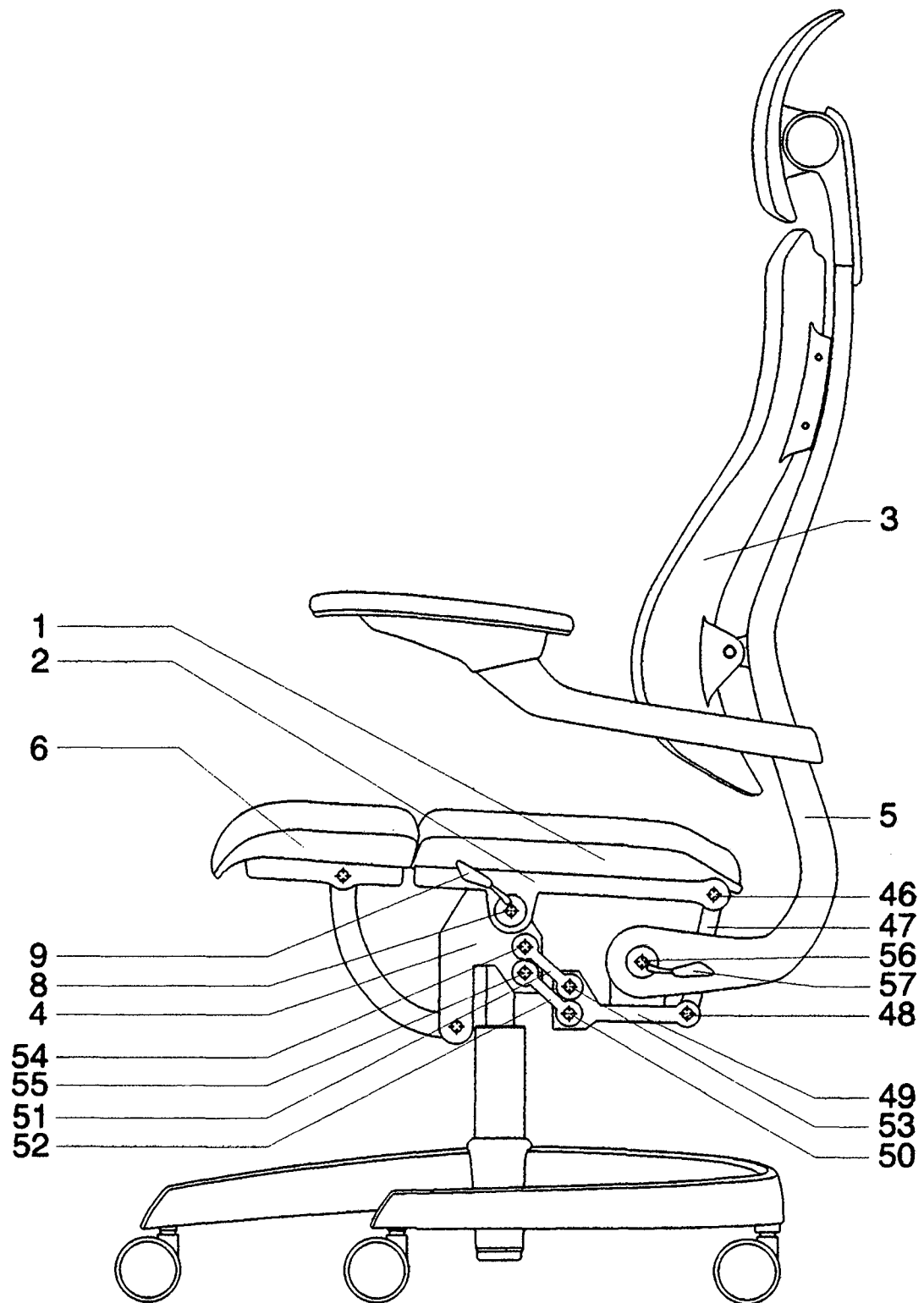


Fig. 15

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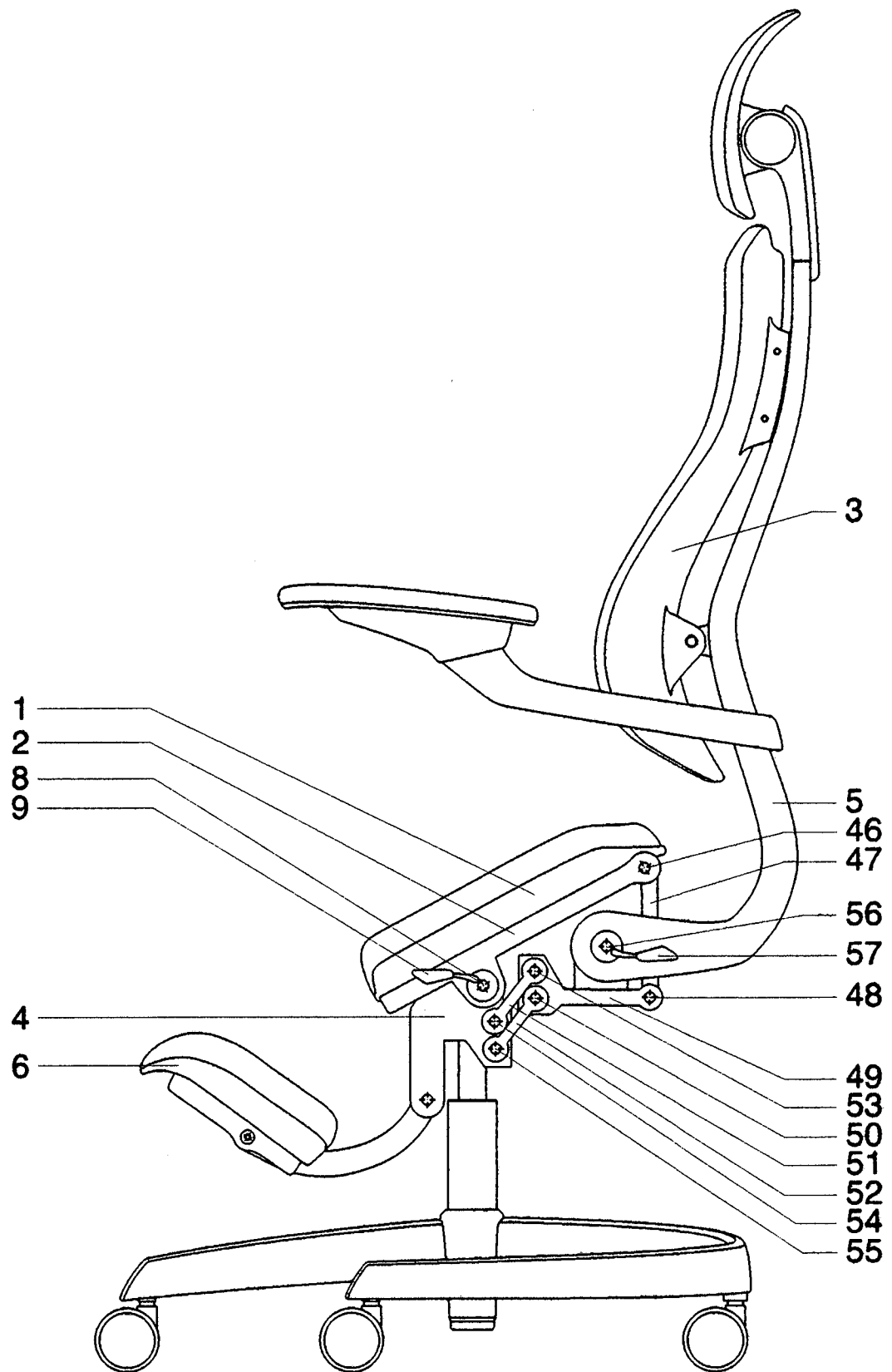


Fig. 16

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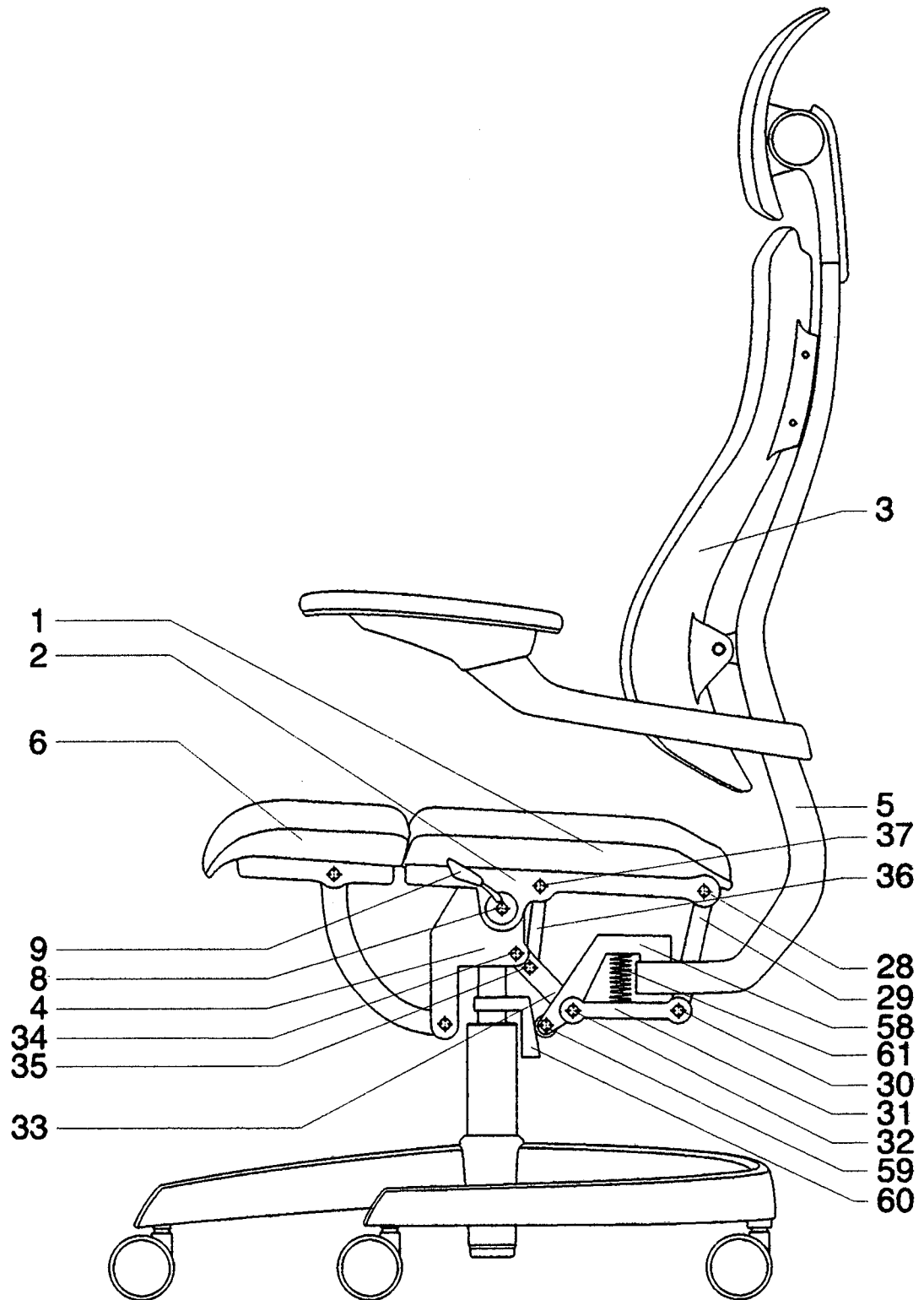


Fig. 17

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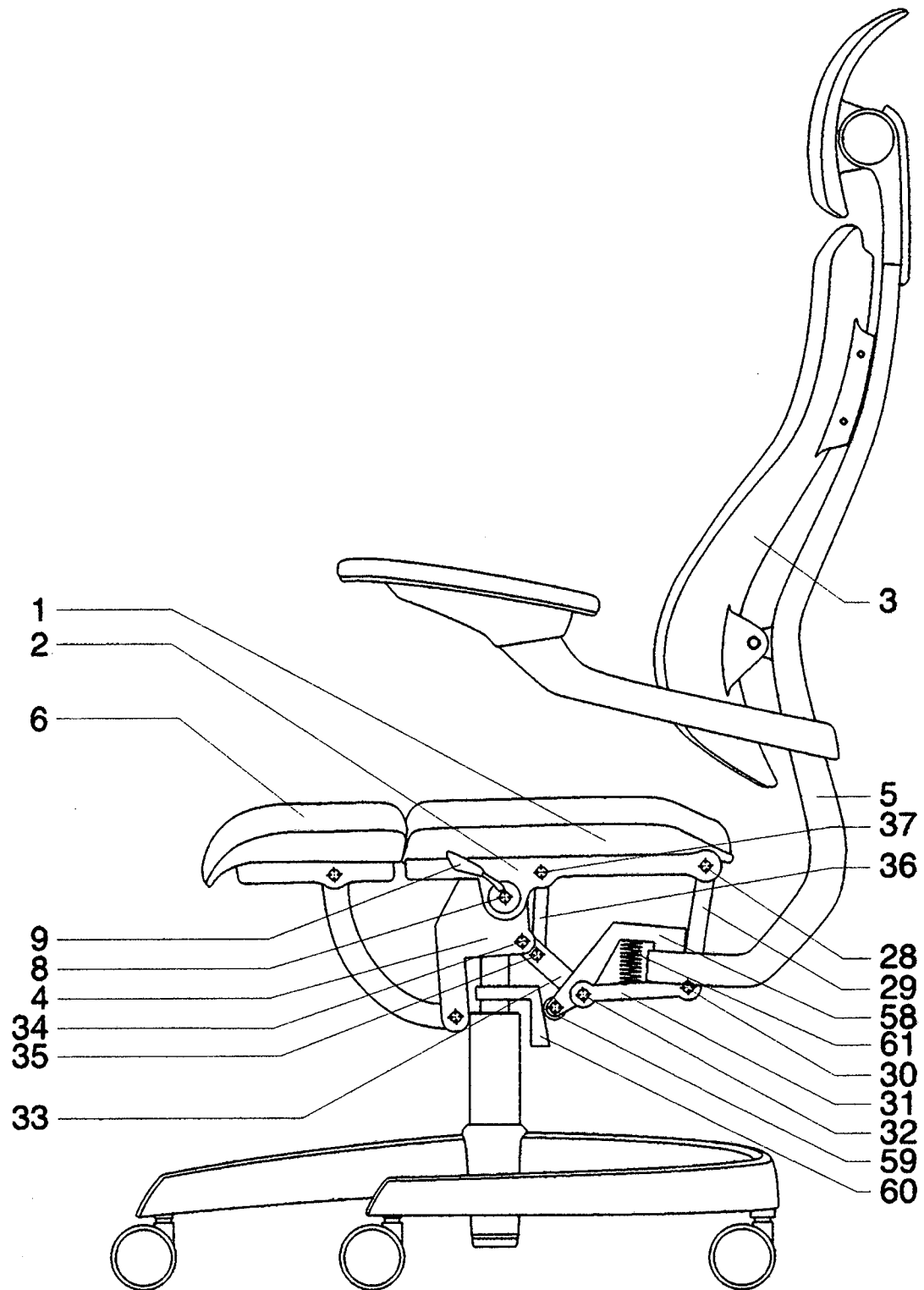


Fig. 18

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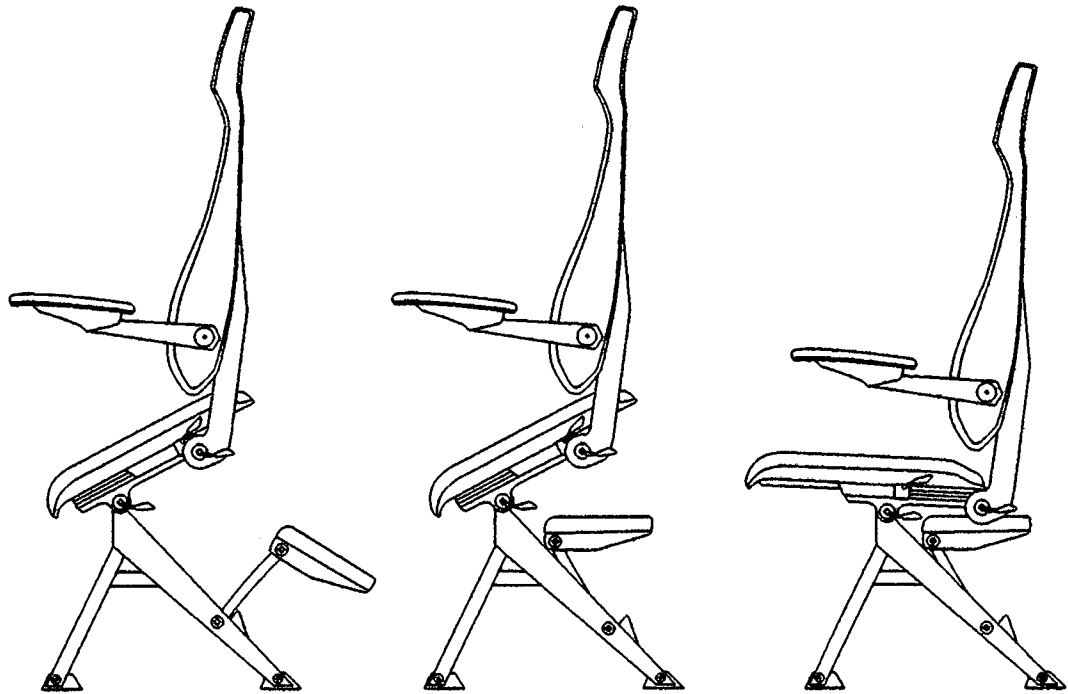


Fig. 19

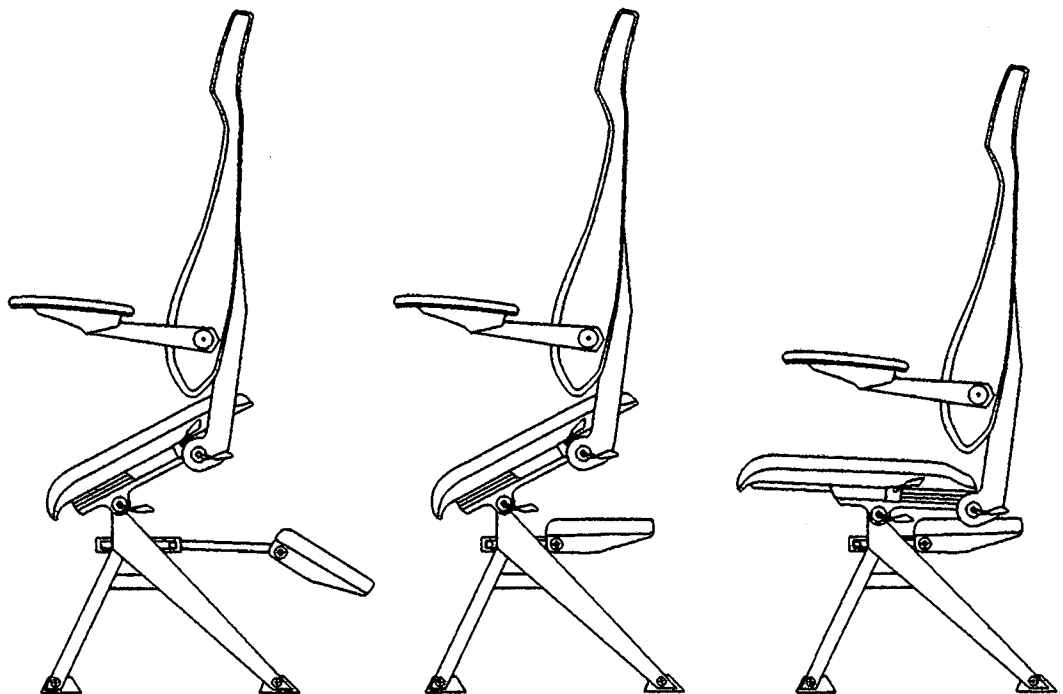


Fig. 20

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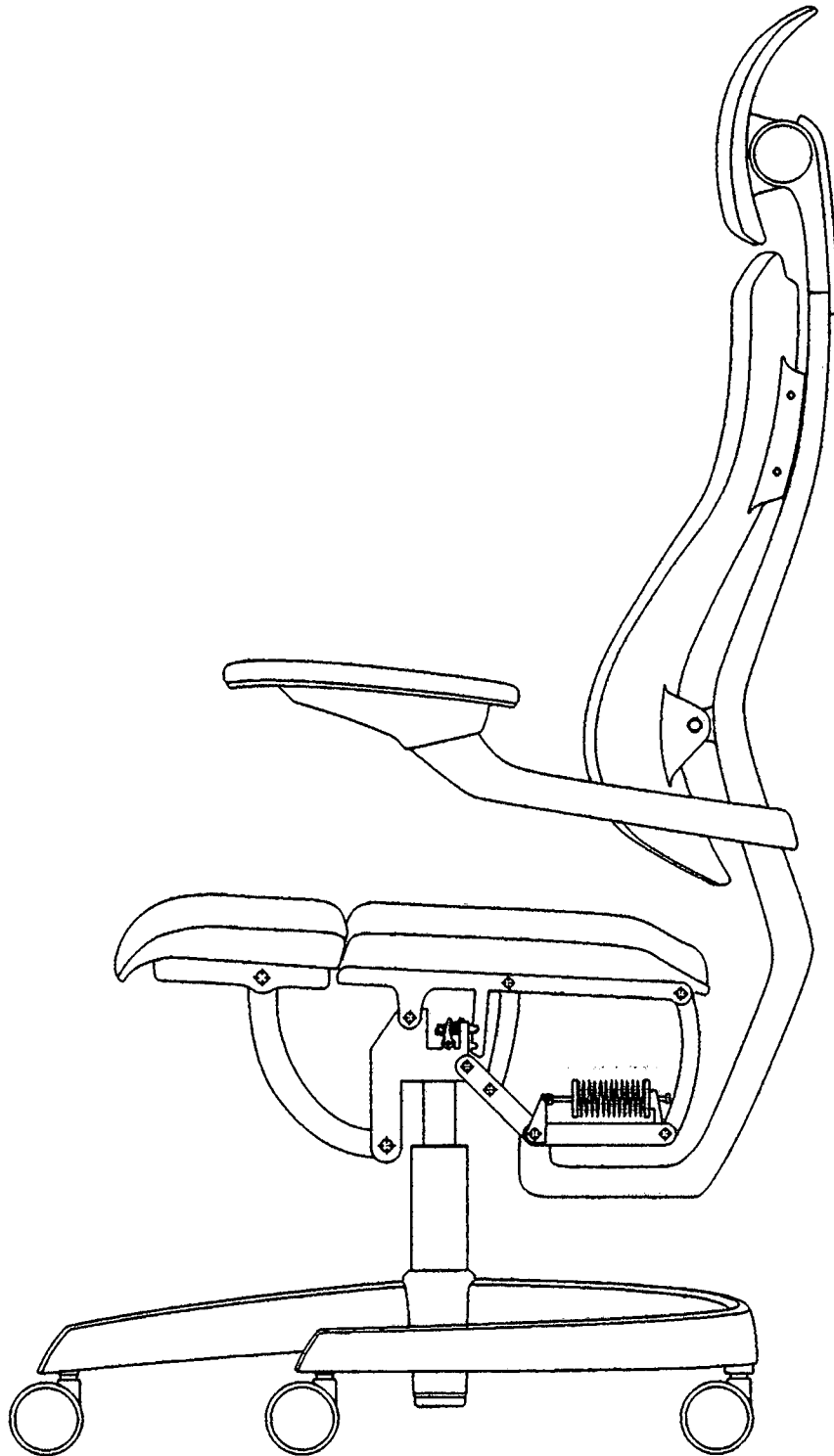


Fig. 21

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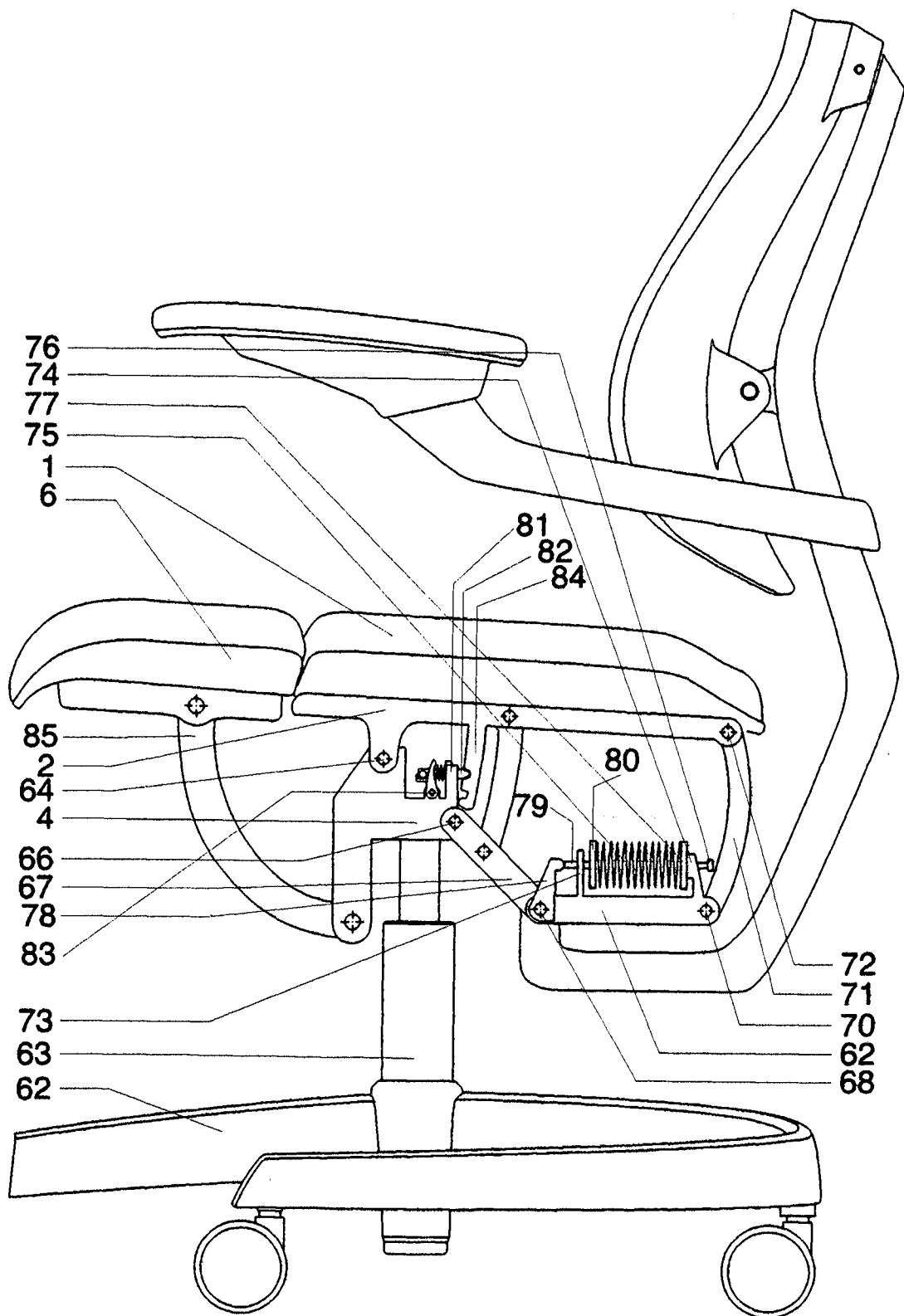


Fig. 22

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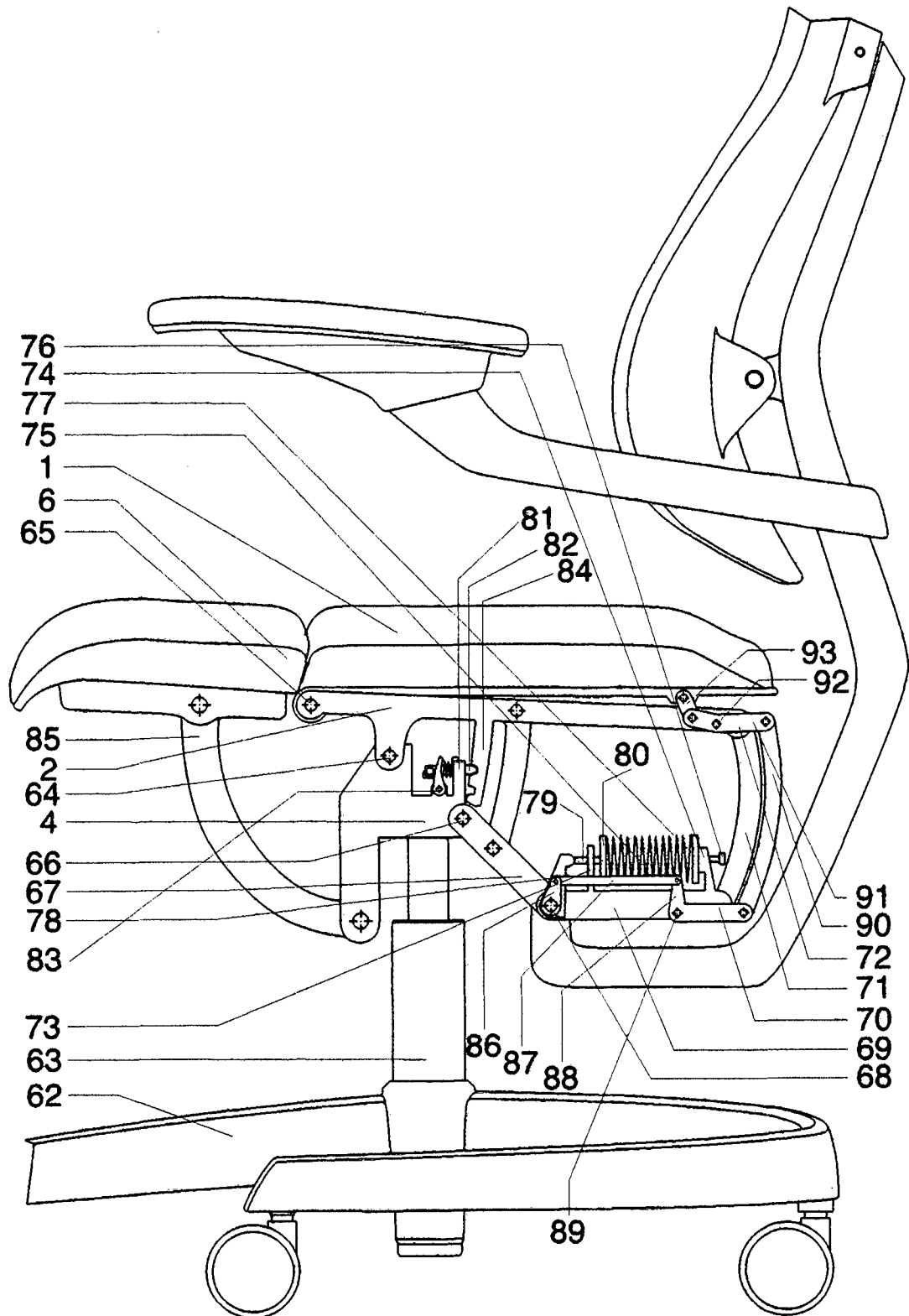


Fig. 23

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2016/000982A. CLASSIFICATION OF SUBJECT MATTER
INV. A47C7/02 A47C9/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A47C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2013/124718 A1 (HUMAN PLUS S C) 29 August 2013 (2013-08-29) page 8, lines 3-17; figures -----	1-3,7-9
X	US 5 667 278 A (LI) 16 September 1997 (1997-09-16) figures -----	1-3,7,8
X	US 2007/063569 A1 (MAYS) 22 March 2007 (2007-03-22) figures -----	1,2



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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Information on patent family members

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