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(54) **Reclining lift chair**

(57) The invention relates to a reclining lift chair (1) comprising:

- a base (5);
- a seat (2);
- a first planar four bar linkage arranged between the base (5) and the seat (2) for guiding an up and down movement of the seat (2) relative to the base (5), wherein a first bar (5), is fixedly arranged to the base (5), the third bar (9) opposite of the first bar is fixedly arranged to the seat (2) and wherein there is length difference between the first and third bars (9) and / or a length difference between the second (8) and fourth bar (10) in order to provide a tilting movement of the seat (2) during up and down movement;
- a first linear actuator (16) for moving the seat (2) up and down relative to the base (5); and
- a backrest (3) hingedly arranged to the seat (2);
- a second planar four bar linkage wherein a fifth bar (11) is fixedly arranged to the seat (2), a sixth bar (12) is fixedly arranged to the backrest (3); and
- a first control rod (15) hingedly arranged between the eighth bar (14) of the second planar four bar and the fourth bar (10) of the first planar four bar linkage.

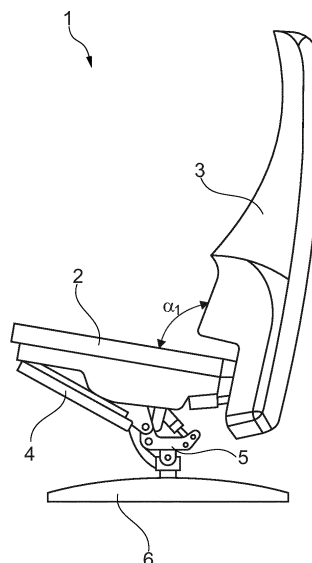


Fig. 1A

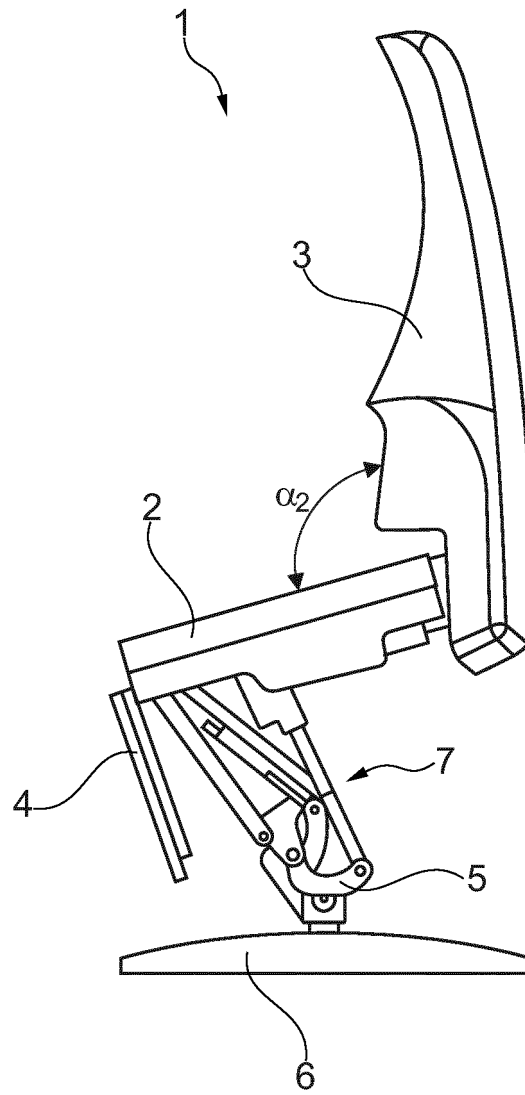


Fig. 1B

Description

[0001] The invention relates to a reclining lift chair comprising:

- a base;
- a seat;
- a first planar four bar linkage arranged between the base and the seat for guiding an up and down movement of the seat relative to the base, wherein a first bar is fixedly arranged to the base, the third bar opposite of the first bar is fixedly arranged to the seat and wherein there is length difference between the first and third bars and / or a length difference between the second and fourth bar in order to provide a tilting movement of the seat during up and down movement;
- a first linear actuator for moving the seat up and down relative to the base; and
- a backrest hingedly arranged to the seat;

[0002] Such reclining lift chairs are known and are typically useful for elderly which have difficulty in standing up from a regular chair.

[0003] The reclining chairs also provide a comfortable sitting position and even a more or less lying position because of the backrest, which can be rotated backwards. Furthermore it is known to provide a leg support which can be rotated upwardly to support the lower legs when the chair is in reclined position.

[0004] However, when the known chairs are moved from a sitting position into a standing position, the backrest typically maintains the same angle relative to the seat. This will provide an uncomfortable position for the person standing up out of the chair. It is known to electronically control the angle of the backrest of the chair, while moving toward the standing position, but this result in an additional actuator for controlling the backrest and additional sensors and electronics to synchronize the up and down movement of the seat with the angle of the backrest. This will provide a complex system and increase the costs of such a reclining lift chair.

[0005] In some chair designs also a leg support needs to be controlled to be able to move the seat up and down. This requires the leg support first to be rotated outwardly, after which the seat can be moved up. However, this rotating of the leg support will hinder the person sitting in the chair and wanting to stand up.

[0006] Accordingly, it is the object of the invention to provide a reclining lift chair in which the above mentioned disadvantages are reduced or even removed.

[0007] This object is achieved with a reclining lift chair according to the preamble, which is characterized by:

- a second planar four bar linkage wherein a fifth bar is fixedly arranged to the seat, a sixth bar is fixedly arranged to the backrest; and
- a first control rod hingedly arranged between the

eight bar of the second planar four bar linkage and the fourth bar of the first planar four bar linkage.

[0008] The first control rod ensures that a link is present between the first linkage used for guiding the up and down movement of the chair with the second linkage used for controlling the angle between the backrest and the seat. So, when the seat moves up, the first control rod ensures that the angle of the backrest with the seat is also changed. As a result the angle will increase when the seat is moved up, in order to prevent the backrest from pushing the user out of the chair, as could occur in chairs according to the prior art.

[0009] As a result an even and smooth movement of the seat and the backrest are obtained, which is typically not the case in prior art systems. Also, a compact mechanism is provided which allows for more design freedom of the chair.

[0010] Although a planar four bar linkage is well known to the person skilled in the art, it will be further explained. A four bar linkage is constructed from four links connected in a loop by four one degree of freedom joints, typically a hinged joint.

[0011] In a preferred embodiment of the reclining lift chair according to the invention the seventh bar of the second planar four bar linkage comprises a second linear actuator for changing the length of the seventh bar.

[0012] With the second linear actuator it is possible to change the angle of the backrest relative to the seat, while the seat remains in position. This allows the user to bring the chair for example in the reclining position, simply by controlling the second linear actuator.

[0013] A further preferred embodiment of the reclining lift chair according to the invention further comprises:

- a leg support hingedly arranged to the seat opposite of the backrest;
- a planar, crossed four bar linkage wherein the ninth bar is fixedly arranged to the leg support, the tenth bar is fixedly arranged to the second bar of the first planar four bar linkage and the tenth and twelfth bar are crossed; and
- a second control rod hingedly arranged between the first bar of the first planar four bar linkage and the eleventh bar.

[0014] The leg support provides additional comfort for the user especially in a reclined position. The planar, crossed four bar linkage ensures that even in fully retracted position of the leg support, the leg support will be rotated slightly outwardly when the seat is moved up, in order not to block the movement of the seat in the retracted position of the leg support.

[0015] The crossed four bar linkage, which is linked by the second control rod, provides a smooth and even movement of the leg support, when the seat is moved up and down.

[0016] Preferably, the second control rod comprises a

third linear actuator for changing the length of the second control rod.

[0017] By changing the length of the second control rod, the angle between the seat and the leg support is easily controlled for example with a remote control operated by the user.

[0018] As will be obvious for a person skilled in the art at least the hinge axes between the seat and the backrest and the hinge axes of the first and second planar four bar linkages are parallel.

[0019] In yet another embodiment of the reclining lift chair according to the invention the base comprises a foot rotatable around a rotation axis, which is perpendicular to the hinge axes of at least the first planar four bar linkage.

[0020] The rotatable foot provides the possibility of a swivel chair and allows more flexibility in the use of the chair.

[0021] It is known to provide blocking means on the rotatable foot to block the rotation of foot, when the seat is moved up and the chair into a standing position. Typical in the prior art, such a blocking is achieved by yet again a separate actuator, which actuates a brake on the foot. This also needs to be controlled by electronics in combination with the other actuators as used in the prior art.

[0022] A further preferred embodiment of the reclining lift chair according to the invention, further comprises:

- a brake lever is hingedly arranged with one end to the base, wherein the hinge axis is perpendicular to the rotation axis, such that the brake lever can hinge into contact with the foot; and
- a third control rod arranged between the other end of the brake lever and a hinge point on the second bar of the first planar four bar linkage at a distance of the hinge point of the second bar with the first bar.

[0023] Due to the third control rod, the brake lever is controlled to a braking position, when the seat is moved up, while the foot is free to rotate, when the chair is in the sitting position.

[0024] In a preferred embodiment of the reclining lift chair according to the invention the path of the hinge point on the second bar of the third control rod during up and down movement of the seat comprises a dead center.

[0025] With the dead center in the path the brake lever can be brought into a braking position, while the seat can move further up. The brake lever will stay in the braking position and will not prevent the chair from moving further in the upward direction.

[0026] Preferably, the brake lever comprises a friction layer facing the foot. The friction layer is typically somewhat flexible.

[0027] In yet another embodiment of the reclining lift chair according to the invention, the brake lever comprises a ring enveloping the rotation axis of the foot and wherein the hinge axis of the brake lever intersects with

the rotation axis.

[0028] The ring will be tilted around the rotation axis such that on opposite sides of the rotation axis, the ring will engage a friction force. This provides a firmer grip and is independent of any play in any hinge points of the brake lever.

[0029] These and other features of the invention will be elucidated in conjunction with the accompanying drawings.

Figures 1A and 1B show an embodiment of a reclining lift chair according to the invention.

Figure 2 shows a schematic view of the chair of figures 1A and 1B.

Figures 3A and 3B show a first variant of the chair of figure 1 in two positions.

Figures 4A and 4B show a second variant of the chair of figure 1 in two positions.

Figure 5 shows a third variant of the chair of figure 1.

[0030] Figures 1A and 1B show an embodiment 1 of a reclining lift chair according to the invention. Figure 1A shows the chair 1 in a sitting position, while figure 1B shows the chair 1 in a standing position.

[0031] The chair 1 has a seat 2, a backrest 3 and a leg support 4, all supported on a base 5. The base 5 is provided with a foot 6, which is rotatably arranged to the base 5.

[0032] Due to the linkage system 7 arranged between the base 5 and the seat 2, backrest 3 and leg support 4, the angle α_1 in the sitting position increases to angle α_2 when the seat 2 is moved up towards the standing position as shown in figure 1B. Also the leg support 4 is tilted to provide space for the linkage system 7.

[0033] Figure 2 shows a schematic view of the chair of figures 1A and 1B and in particular the linkage system 7.

[0034] The linkage system 7 has a first planar four bar linkage with which the movement of the seat 2 relative to the base 5 and foot 6 is guided.

[0035] The first planar four bar linkage has connected in a loop by hinges a first bar 5, being the base 5, a second bar 8, a third bar 9, which is fixedly arranged to the seat 2, and a fourth bar 10. Because the effective length between the respective hinges of the base 5 is larger than the effective length of the third bar, the seat 2 will be tilted when the seat is moved up.

[0036] The linkage system 7 has furthermore a second planar four linkage having a fifth bar 11, which is fixedly connected to the seat 2, a sixth bar 12, which is fixedly connected to the backrest 3, a seventh bar 13 and an eighth bar 14. Furthermore, a first control rod 15 is arranged between the fourth bar 10 and the eighth bar 14. This control rod 15 ensures that the angle α_1 is increased to the angle α_2 when the seat 2 is moved up by the actuator 16, which is arranged between the seat 2 and the base 5.

[0037] The linkage system 7 has also a planar, crossed four bar linkage comprising a ninth bar 17, which is fixedly

arranged to the leg support 4, a tenth bar 18, 19, an eleventh bar 20 and a twelfth bar 21. The tenth 18, 19 and twelfth bar 21 are crossed. Furthermore, the tenth bar 18, 19 is in this embodiment provided by two bar parts, but could also be one bar. The bar part 19 is fixedly arranged to the second bar 8.

[0038] A second control rod 22 is arranged between the base 5 and the eleventh bar 20. By changing the length of the second control rod 22 with the actuator 23 the position of the leg support 4 can be independently changed, while the crossed four bar linkage 17, 18, 19, 20, 21 ensures that the leg support 4 is tilted away when the seat 2 moves up.

[0039] Figures 3A and 3B show a first variant of the chair of figure 1 in two positions.

[0040] The base 5 is rotatable arranged with a foot 6 via axle 24. As the chair 1 may not rotate when in standing position, a brake lever 25 is hingedly arranged with one end to the base 5. The other end of the brake lever 25 is connected to a third control rod 26, which is in turn connected to the second bar 8.

[0041] Figure 3A shows the position, in which the chair 1 is in standing position. The brake lever 25 is pushed down, such that the brake part 27 of the brake lever 25 is pushed against the axle 24 and rotation is blocked.

[0042] When the chair 1 is brought into the sitting position, as shown in figure 3B, the brake lever 25 is pulled up by the third control rod 26 and the axle 24 is released such that rotation of the foot 6 is possible.

[0043] Figures 4A and 4B show a second variant of the chair 1 of figure 1 in two positions. In this variant the brake lever 28 comprises a ring 29, which is arranged around the axle 24. The hinge axis 30 of the brake lever 28 intersects with the rotation axis of the axle 24.

[0044] As shown in figure 4B, the control rod 26 will push the brake lever 28 down, when the chair 1 is in standing position. This causes the ring 29 to tilt around the axle 24 and block rotation.

[0045] When the chair 1 is moved to the sitting position as shown in figure 4B, the ring 29 is moved to a concentric position relative to the axle 24 to release the axle 24 and allow rotation of the foot 6 relative to the base 5.

[0046] Figure 5 shows a third variant of the chair 1 of figure 1. In this variant, the base 5 is provided with an additional rotation axis 40, with which the base 5 is connected to a second base part 41 to which the foot 6 is rotatably arranged.

[0047] This additional rotation axis 40 provides a so-called zero gravity reclining function, which allows the chair to tilt backwards as a whole, so seat 2, backrest 3 and leg support 4 together, without much effort of the user of the chair.

Claims

1. Reclining lift chair comprising:

- a base;
- a seat;
- a first planar four bar linkage arranged between the base and the seat for guiding an up and down movement of the seat relative to the base, wherein a first bar is fixedly arranged to the base, the third bar opposite of the first bar is fixedly arranged to the seat and wherein there is length difference between the first and third bars and / or a length difference between the second and fourth bar in order to provide a tilting movement of the seat during up and down movement;
- a first linear actuator for moving the seat up and down relative to the base; and
- a backrest hingedly arranged to the seat;

characterized by

- a second planar four bar linkage wherein a fifth bar is fixedly arranged to the seat, a sixth bar is fixedly arranged to the backrest; and
- a first control rod hingedly arranged between the eighth bar of the second planar four bar linkage and the fourth bar of the first planar four bar linkage.

2. Reclining lift chair according to claim 1, wherein the seventh bar of the second planar four bar linkage comprises a second linear actuator for changing the length of the seventh bar.
3. Reclining lift chair according to claim 1 or 2, further comprising:

- a leg support hingedly arranged to the seat opposite of the backrest;
- a planar, crossed four bar linkage wherein the ninth bar is fixedly arranged to the leg support, the tenth bar is fixedly arranged to the second bar of the first planar four bar linkage and the tenth and twelfth bar are crossed; and
- a second control rod hingedly arranged between the first bar of the first planar four bar linkage and the eleventh bar.

4. Reclining lift chair according to claim 3, wherein the second control rod comprises a third linear actuator for changing the length of the second control rod.
5. Reclining lift chair according to any of the preceding claims, wherein at least the hinge axes between the seat and the backrest and the hinge axes of the first and second planar four bar linkages are parallel.
6. Reclining lift chair according to any of the preceding claims, wherein the base comprises a foot rotatable around a rotation axis, which is perpendicular to the hinge axes of at least the first planar four bar linkage.

7. Reclining lift chair according to claim 6, further comprising:

- a brake lever is hingedly arranged with one end to the base, wherein the hinge axis is perpendicular to the rotation axis, such that the brake lever can hinge into contact with the foot; and
- a third control rod arranged between the other end of the brake lever and a hinge point on the second bar of the first planar four bar linkage at a distance of the hinge point of the second bar with the first bar.

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8. Reclining lift chair according to claim 7, wherein the path of the hinge point on the second bar of the third control rod during up and down movement of the seat comprises a dead center.

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9. Reclining lift chair according to claim 7 or 8, wherein the brake lever comprises a friction layer facing the foot.

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10. Reclining lift chair according to claim 7, 8 or 9, wherein the brake lever comprises a ring enveloping the rotation axis of the foot and wherein the hinge axis of the brake lever intersects with the rotation axis.

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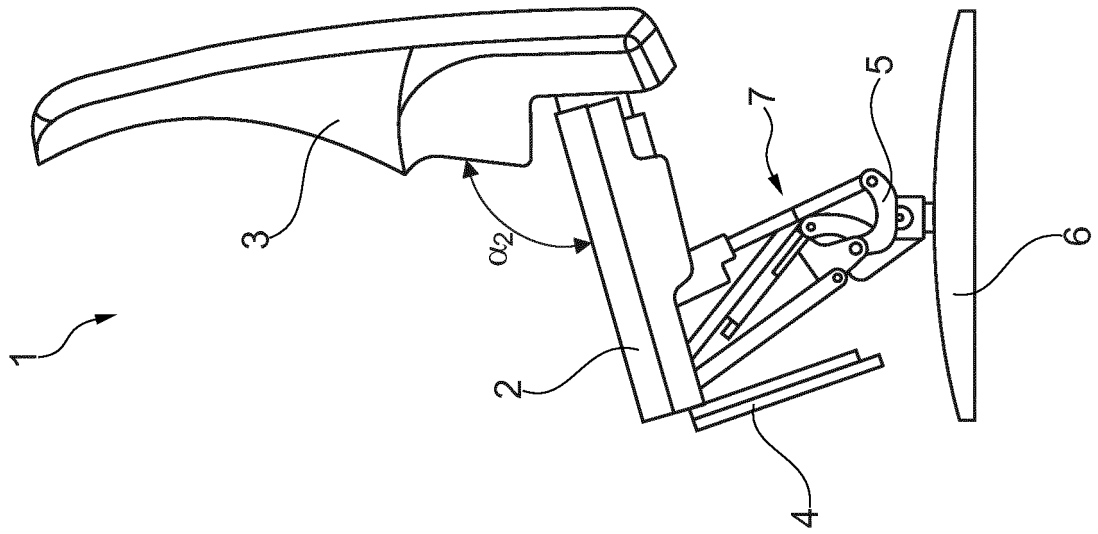


Fig. 1A

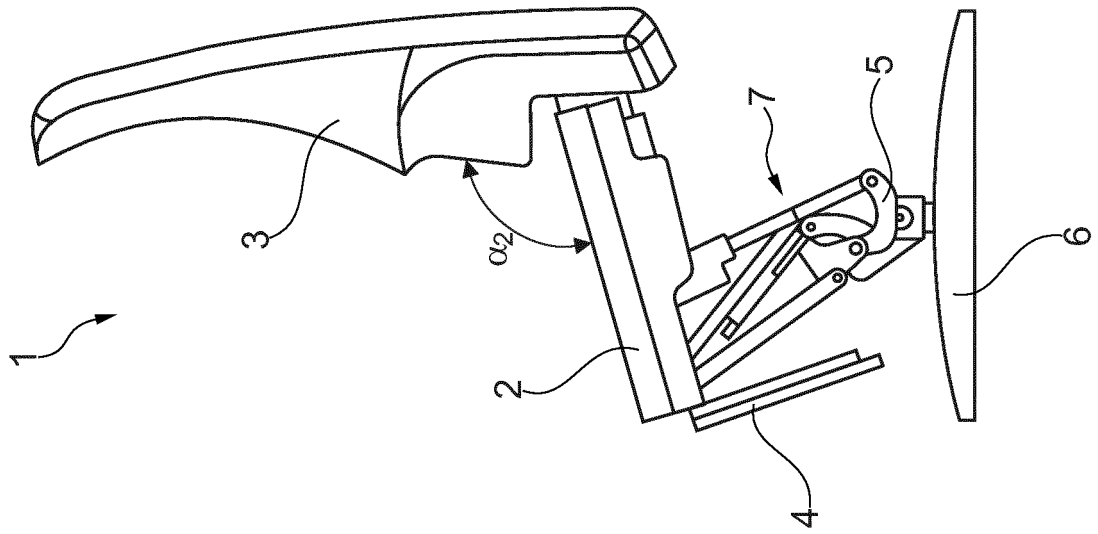


Fig. 1B

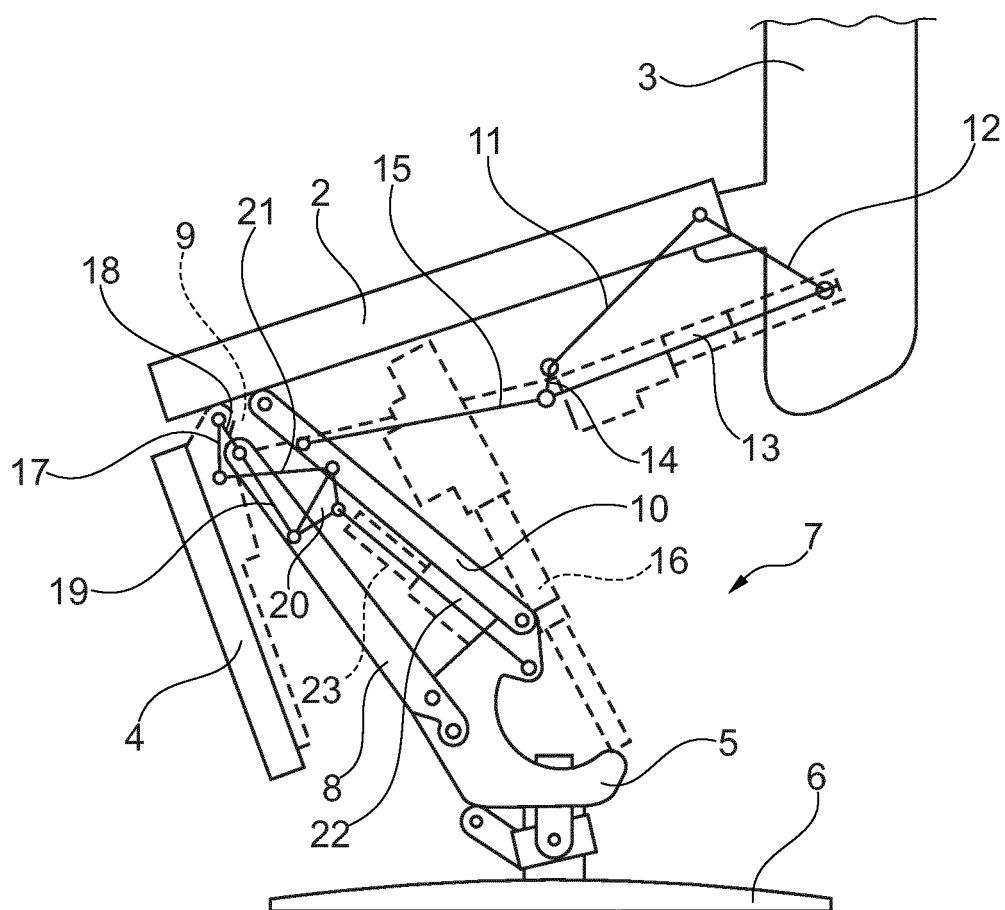


Fig. 2

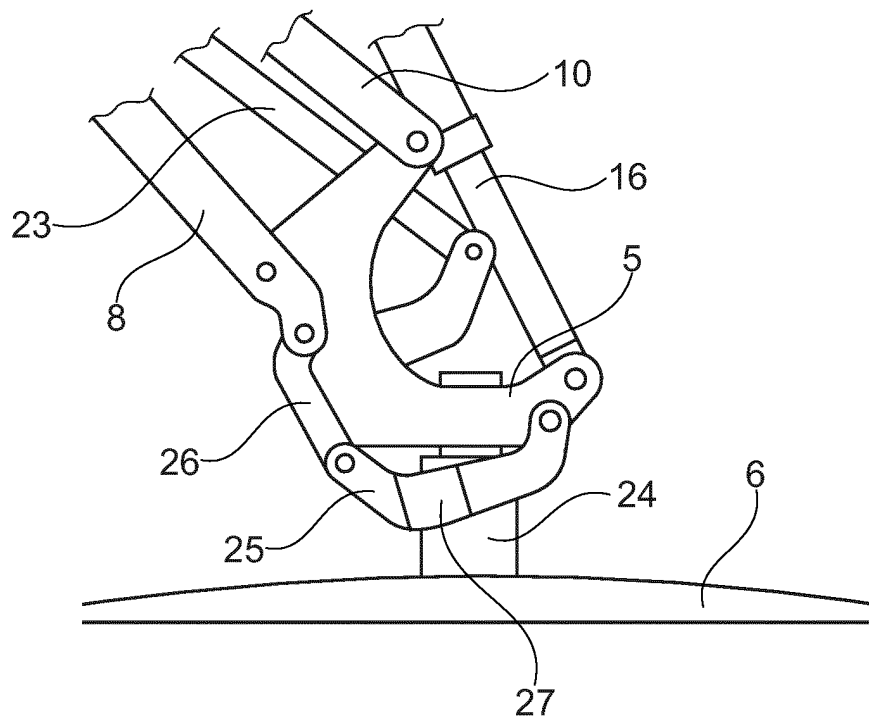


Fig. 3A

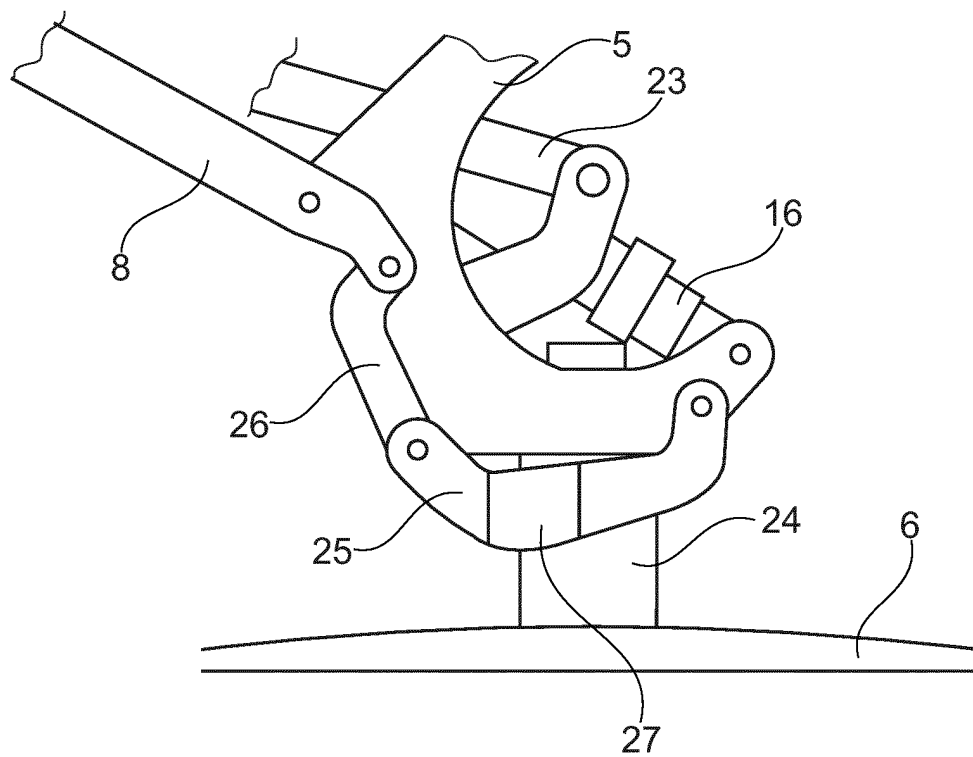


Fig. 3B

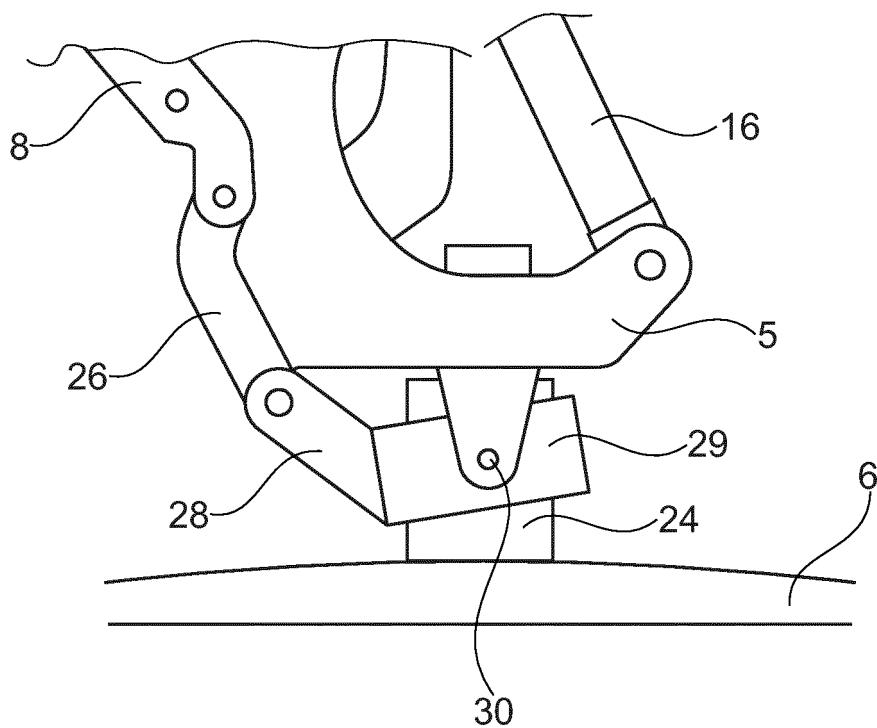


Fig. 4A

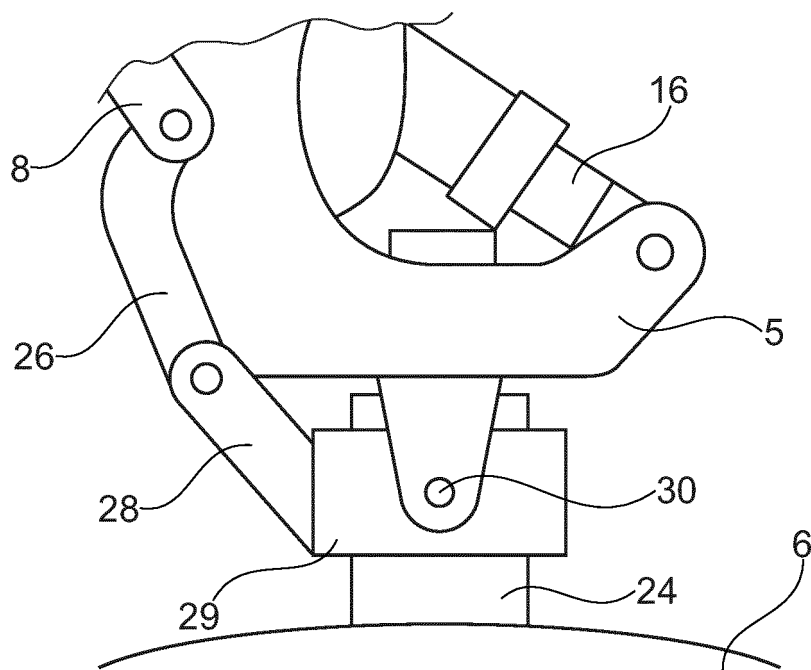


Fig. 4B

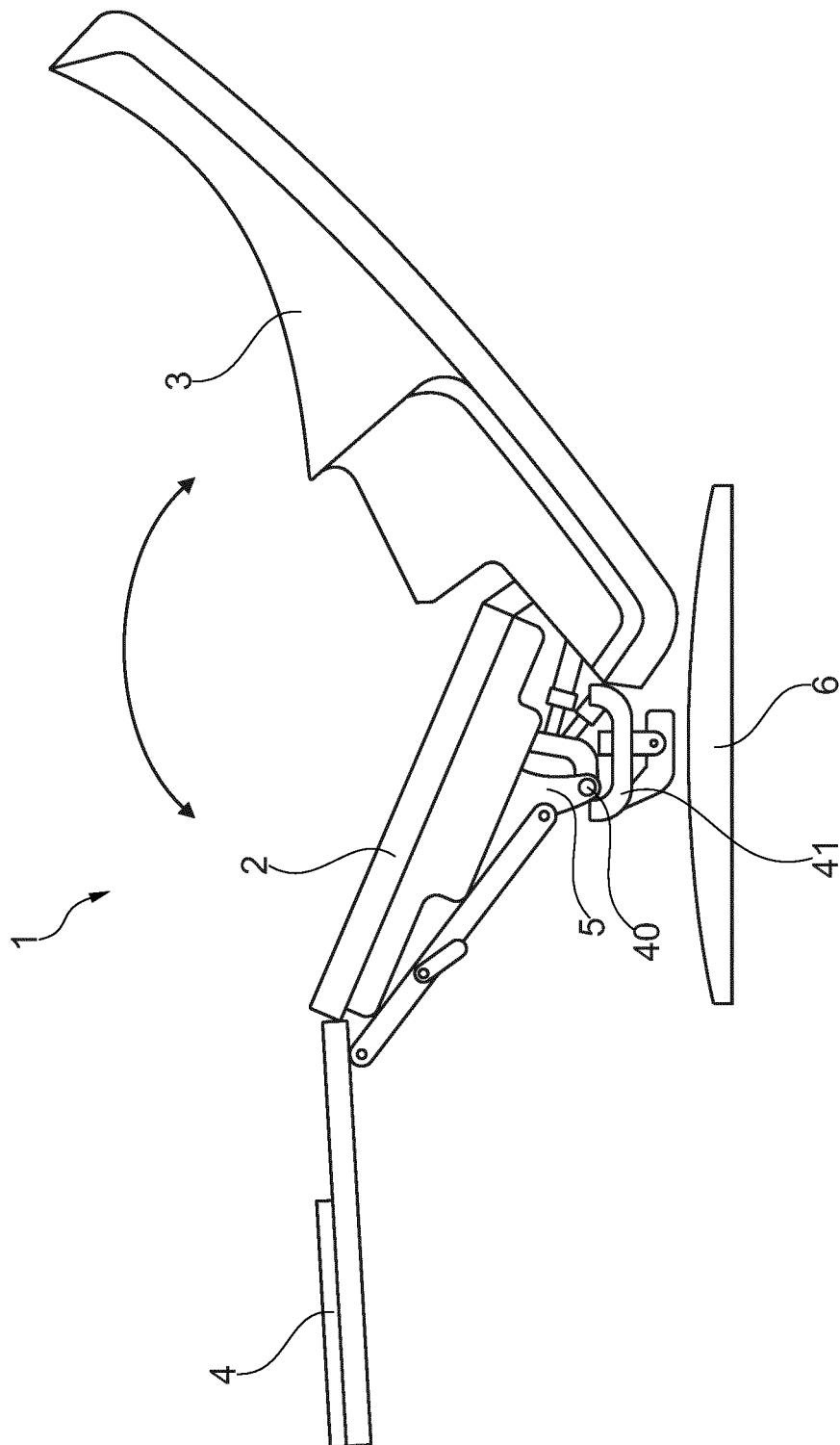


Fig. 5



EUROPEAN SEARCH REPORT

Application Number
EP 15 15 3460

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			TECHNICAL FIELDS SEARCHED (IPC)
			A61G A47C
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 7 July 2015	Examiner Kus, Slawomir
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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