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(54) **Title:** SEATING FURNITURE CHASSIS AND METHOD OF OPERATION

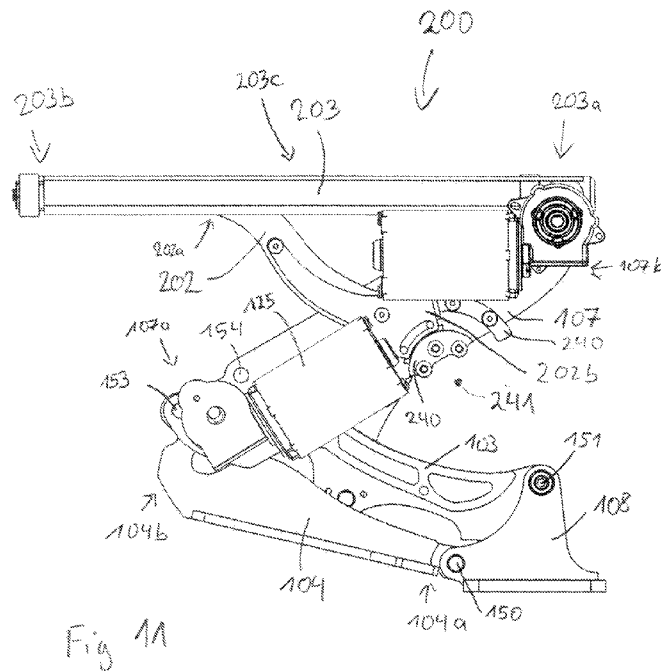


Fig. 11

(57) **Abstract:** A seating furniture chassis (100), which seating furniture chassis comprises: - a frame (105), - abase unit (108), - a tilt system, which comprises: - an elongated tilt base unit (107) having a first (107a) and a second (107b) end, - an elongated main console (104) having a first (104a) and a second end (104a), - an elongated upper main console (103) having a first (103a) and a second (103b) end, - a first linear actuator (106). The first end of the main console (104a) is pivotally connected to the base unit (108) via a first pivot linkage (150). The second end of the main console (104b) is pivotally connected to the tilt base unit via a second pivot linkage (153), which second pivot linkage is located at the first end (107a) of the tilt base unit (107). The first end of the upper main console (103a) is connected pivotally to the base unit (108) via a third pivot linkage (151) and the second end (103b) of the upper main console (103) is connected pivotally to the tilt base unit (107) via a fourth pivot linkage (154), which fourth pivot linkage is located at the first end of



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the tilt base unit (107) in a position closer to an intermediate part (107c) of the tilt base unit (107) than the position of the second pivot linkage (153). The first linear actuator (106) is located proximate and substantially parallel with the elongated tilt base unit (107) in an end to end direction. The first linear actuator (106) comprises a first actively displaceable slider (101) which is connected with a first lever (102) which is pivotally connected to the upper main console (103) via a fifth pivot linkage (152).

Seating furniture chassis and method of operation

Field of the Invention

The present invention relates to a seating furniture chassis, which seating furniture
5 chassis comprises:

- a frame,
- a base unit,
- a tilt system, which comprises:
 - an elongated tilt base unit having a first and a second end,
 - 10 - an elongated main console having a first and a second end,
 - an elongated upper main console having a first and a second end,
 - a first linear actuator,

where the first end of the main console is pivotally connected to the base unit via a
first pivot linkage, and the second end of the main console is pivotally connected to
15 the tilt base unit via a second pivot linkage, which second pivot linkage is located at
the first end of the tilt base unit,

where the first end of the upper main console is connected pivotally to the base unit
via a third pivot linkage, and the second end of the upper main console is connected
pivotally to the tilt base unit via a fourth pivot linkage, which fourth pivot linkage is
20 located at the first end of the tilt base unit in a position closer to an intermediate part
of the tilt base unit than the position of the second pivot linkage,

where the main console and the upper main console and a part of the base unit and a
part of the tilt base unit create a quadrilateral,

where the third pivot linkage is located at a higher level above the frame than a level
25 for the first pivot linkage,

where the tilt base unit is arranged for performing a tilting motion relative to the base
unit when the first linear actuator is activated, where the second end of the tilt base
unit is moved in a substantially linear direction during the tilting motion.

30 Furthermore, the present invention relates to a method to operate a seating furniture
chassis. The method allows ergonomic entry to and exit from a seat connected to the
seating furniture chassis.

Background of the Invention

From a different technical field, in WO2016/022404 A1, a device for lifting vehicles is known.

5 However, two devices are needed to lift a plate, and they have to be activated synchronously to achieve a lift. Finally, it does not achieve a tilting motion of a plate upon which a person could be lifted.

10 Furthermore, the device does not combine compact dimensions with low activation energy relative to the lifted weight. Furthermore, the device is only capable of lifting a point.

From DE 20 2015 100 170 U1 a seating furniture chassis for lifting and tilting a seat of the type described in the introduction and the preamble of claim one is known.

15 Seating furniture chassis according to the state of the art have limitations, which make them unsuitable for wheelchairs, as seating furniture chassis in wheelchairs face multiple constraints.

20 Firstly, compact outer dimensions in a closed, inactivated position are a necessity especially for installation in wheelchairs, which have severely constrained space for installation.

25 Secondly, the electrical power available in wheelchairs for operation of the seating furniture chassis is limited. Multiple factors contribute to this limitation, for example the available battery capacity and the usability with regard to recharging intervals and times as well as the power limitations of the control circuitry for activation of the seating furniture chassis.

30 There is a need for providing a seating furniture chassis which combines compact dimensions with low required input force relative to actuated weight.

There is a need for providing a seating furniture chassis which can provide a tilting and a lifting function. The tilting function allows a person in the seat to get into a

comfortable reclined position. The combination of tilting and lifting function allows easy and ergonomic entry into the chair and easy and ergonomic exit out of the chair. Furthermore, change of position, for example from sitting to standing, is assisted. Those needs are especially important for disabled and elderly persons.

5

There is a need for providing a seating furniture chassis combining all of the above needs.

Object of the Invention

10 It is an object of the invention to provide a seating furniture chassis which provides a solution to these limitations and needs.

It is an object of the invention to provide a seating furniture chassis which is both compact and can be actuated to lift the weight of a person with a limited power input.

15

It is an object of the invention to provide a seating furniture chassis which is suitable for a wheelchair or an ordinary chair.

Description of the Invention

20 This is achieved with a seating furniture chassis according to the introduction and as described in the preamble of claim 1, which is peculiar in that the first linear actuator is located substantially parallel with the elongated tilt base unit, the first linear actuator comprises a first actively displaceable slider which is connected with a first lever which is pivotally connected to the upper main console via a fifth pivot linkage.

25

The seating furniture chassis can comprise a seat. The seating furniture chassis can tilt the seat backwards in a tilting motion. The seat is thus in a reclining position. A reclining position is also referred to as a comfort position.

30 Actuation between different positions is effected with minimal input force to the first linear actuator. This is an advantage particularly for the application in wheelchairs where limited power and space is available.

The frame can be a wheeled frame or a stationary frame. The wheeled frame can be a driving unit for a wheelchair. In the present application the frame is for simplicity illustrated by a surface line in the figures.

- 5 The frame typically has a plane surface. The substantially linear motion of the second end of the tilt base unit is typically oriented vertically to the plane surface of the frame.

The base unit has a plane surface for connection with the plane surface of the frame.

10

The first actively displaceable slider pushes and pulls on the first lever, when the first linear actuator is actuated. Thus, a force is generated between the upper main console and the tilt base unit. This force brings about the tilting motion.

- 15 Pivot linkage is used as a synonym for point of interest and POI throughout this application.

The seating furniture chassis can comprise two elongated main consoles. The seating furniture chassis can comprise two elongated upper main consoles. The seating furniture chassis can comprise two elongated tilt base units. The elongated consoles of
20 elongated base units of the same type are mounted besides each other on a common axis at the pivot linkages. This has the advantage of providing an especially stable seating furniture chassis.

- 25 In a further embodiment of the invention, the seating furniture chassis is peculiar in that the fifth pivot linkage is located in a distance from a line connecting the third pivot linkage and fourth pivot linkage, where said fifth pivot linkage is located on a side of said line on which the first pivot linkage and second pivot linkage are located.

- 30 The length of the first lever is increased. Thus, the force necessary for bringing about the tilting motion is reduced. This in turn reduces the power necessary for the first actuator.

In a further embodiment of the invention, the seating furniture chassis is peculiar in that the first actively displaceable slider comprises an internal thread, and that the first linear actuator comprises a first threaded spindle on which the first actively displaceable slider is displaced and a first motor for rotating the first threaded spindle and thereby effecting the displacement of the first actively displaceable slider.

The first threaded spindle and first actively displaceable slider convert torque from the motor into a linear driving force for tilting motion.

The seating furniture chassis can comprise a controller. The controller controls the first linear actuator.

The seating furniture chassis can comprise a power source. The power source delivers power to the controller and the first linear actuator. The power source can be a battery.

In a further embodiment of the invention, the seating furniture chassis is peculiar in that the first linear actuator can actuate a load of 200 kg with an input force of 3000 to 7000 Newton, preferably 4000 to 6500 Newton, more preferably 6000 Newton.

The input force can be provided by the first motor or any other suitable means.

In a further embodiment of the invention, the seating furniture chassis is peculiar in that the first motor for rotating the first threaded spindle is connected to the first threaded spindle with a crown wheel and a pinion.

Alternatively, the first motor and the first threaded spindle can be connected using a planetary gear.

In a further embodiment of the invention, the seating furniture chassis is peculiar in that the seating furniture chassis further comprises:

- an elongated lift base plate with a first end and a second end,
- a lifting lever with a first end and a second end,
- a second linear actuator arranged parallel with the elongated lift base plate,

and in that the tilt base unit and the elongated lift base plate are connected pivotally via a sixth pivot linkage, that the second linear actuator comprises a second actively displaceable slider, that the second actively displaceable slider is pivotally connected with the first end of the lifting lever via a seventh pivot linkage, and that the lifting lever at the second end is pivotally connected to the tilt base unit.

The seating furniture chassis allows a lifting motion to be performed by actuating the first and second linear actuators. By actuating the first actuator only, a tilting motion is performed. By actuating the first and the second actuator a lift motion is performed.

Lifting motion in the present application refers to a substantially parallel displacement of the elongated lift base plate relative to the base unit, more specifically to the plane surface of the base unit.

This allows a person to get in and out of the seating furniture in a more ergonomic way. The strain on the legs is reduced. Especially for disabled and elderly persons this is a significant advantage.

The seating furniture chassis allows the seat to be tilted forward for easier entry and exit of the seating furniture. The seating furniture allows the seat to be tilted backwards for a more relaxed seating position and for resting.

Furthermore, the seating furniture chassis allows a disabled person to get in a standing position, both for medical and social purposes.

The elongated lift base plate is at its first end connected pivotally to the tilt base plate.

In a further embodiment of the invention, the seating furniture chassis is peculiar in, that the second actively displaceable slider comprises an internal thread, and that the second linear actuator comprises at least a second threaded spindle on which the second actively displaceable slider is displaced and a second motor for rotating the at least second threaded spindle and thereby effecting the displacement of the second actively displaceable slider.

The second motor can be connected to the second spindle with a crown wheel and a pinion. Alternatively, the second motor and the second threaded spindle can be connected with a planetary gear.

- 5 The second motor can be positioned on a side of the seating furniture chassis. Preferably the side the first motor is located on.

The seating furniture chassis can comprise a controller. The controller can control the second linear actuator.

10

The seating furniture chassis can comprise a power source. The power source can deliver power to the controller and the second linear actuator.

- 15 The second spindle can be positioned in the middle of the seating furniture chassis. Alternatively, the second spindle can be positioned on a side of the elongated lift base plate, preferably the side on which the second motor is located.

The seating furniture chassis can comprise a third threaded spindle.

- 20 The third threaded spindle can be connected to the second motor with a second crown wheel and a second pinion. Alternatively, the third threaded spindle can be connected to the second motor with a planetary gear.

- 25 The second and third threaded spindles can be located on opposing sides of the elongated lift base plate.

The seating furniture chassis can comprise a controller. The controller controls the first linear actuator.

- 30 The seating furniture chassis can comprise a power source. The power source delivers power to the controller and the first linear actuator.

In a further embodiment of the invention, the seating furniture chassis is peculiar in that the tilt base unit comprises a cam with its pivot axis outside of the tilt base unit,

and in that the lifting lever at its second end is adapted to cooperate with the cam to pivot around the pivot axis of the cam.

The cam can be a partial circle. The cam can be bolted to a side of the tilt base unit.

5

In a further embodiment of the invention, the seating furniture chassis is peculiar in that the second linear actuator can actuate a load of 200 kg with an input force of 3000 to 7000 Newton, preferably 4000 to 6500 Newton, more preferably 6000 Newton.

10 The low input force requirement of the second linear actuator reduces power requirements for driving the second linear actuator. This is especially important for wheelchairs where the available battery capacity and amperage of a control circuit can be limited.

15 The input force can be provided by the second motor or any other suitable means.

The input force can vary depending on the centre of gravity of the load. If the centre of gravity of the load is located close to the first end of the elongated lift base plate, the first load on the first actuator will be maximised, while there is less load on the
20 second actuator. If the centre of gravity of the load is located close to the second end of the elongated lift base plate, the load on the second actuator is maximised, while there is less load on the first actuator.

A further aspect of the invention is a method to operate a seating furniture chassis according to the invention which is peculiar in that the method comprises the following steps:
25

- actuating the first linear actuator and the second linear actuator simultaneously to perform a lift motion and optionally a first partial tilt motion of the elongated lift base plate, which first partial tilt motion is leading to a first value of a tilting angle of the
30 elongated lift base plate relative to the base unit,
- actuating the second linear actuator, to perform a tilting motion which increases the tilting angle to a second value which second value is larger than the first value.

The tilting angle is measured between a plane containing the plane surface of the base unit and a plane containing a plane surface of the elongated lift base plate.

5 The method can be performed in reverse, where performing a tilting motion reducing the value of the tilting angle is performed. Then a lowering motion is performed. The lowering motion is the opposite of the above described lift motion.

10 The technical effect achieved with this method is a more ergonomic entry and exit of a person from the seating furniture.

On exit of a person from the seat, the seat is first lifted and tilted. The lift and tilt reduces the bend on the knees of the person in the wheelchair prior to the weight of the person being transferred from the seat of the wheelchairs to the legs. This reduces the stress on the knees and the required strength of the legs of the person getting out of the wheelchair.

15 When a person is sitting down in the seating furniture the same applies. The person can lean gently against the tilted seat with straight or almost straight legs. Then the seat is tilted back into sitting position, and the seat is simultaneously tilted further back and lowered. Again stress on the knees and the required leg strength are reduced compared to stationary seating furniture.

Description of the Drawing

25 The present invention will in the following be described in more detail with reference to the figures in which

- Fig. 1 shows an embodiment of the seating furniture chassis according to the invention seen from the side,
- Fig. 2 shows the same embodiment as shown in Fig. 1 seen from another side,
- 30 Fig. 3 shows the same embodiment as shown in Fig. 1-3 seen from the back,
- Fig. 4 shows the same embodiment as shown in Fig. 1-3 seen from the front,
- Fig. 5 shows the same embodiment as shown in Fig. 1-4 seen from the top,
- Fig. 6 shows the same embodiment as shown in Fig. 1-5 seen from the bottom,

- Fig. 7 shows the same embodiment as shown in Fig. 1-6 seen in a perspective view,
Fig. 8 shows the same embodiment as shown in Fig. 1-7 seen in another perspective view,
Fig. 9 shows the same embodiment as shown in Fig. 1-8 in a folded or closed position,
5 Fig. 10 shows the same embodiment as shown in Fig. 1-9 in a tilted position,
Fig. 11 shows another embodiment of the seating furniture chassis according to the invention seen from the side,
Fig. 12 shows the same embodiment as shown in Fig. 11 seen from another side,
10 Fig. 13 shows the same embodiment as shown in Fig. 11-12 seen from the back,
Fig. 14 shows the same embodiment as shown in Fig. 11-13 seen from the front,
Fig. 15 shows the same embodiment as shown in Fig. 11-14 seen from the top,
Fig. 16 shows the same embodiment as shown in Fig. 11-15 seen from the bottom,
Fig. 17 shows the same embodiment as shown in Fig. 11-16 seen in a perspective
15 view,
Fig. 18 shows the same embodiment as shown in Fig. 11-17 seen in another perspective view,
Fig. 19 shows the same embodiment as shown in Fig. 11-18 seen in another perspective view and with some parts removed,
20 Fig. 20 shows the same embodiment as shown in Fig. 11-19 in a position which is lifted and partially tilted forward,
Fig. 21 shows the same embodiment as shown in Fig. 11-20 in a position which is lifted and tilted backwards,
Fig. 22a-c show different positions of a seating furniture chassis according to the invention in different positions,
25 Fig. 23 a-c show a seating furniture chassis according to the invention in different positions,
Fig. 24 shows another embodiment of a seating furniture chassis according to the invention,
30 Fig. 25 shows another embodiment of a seating furniture chassis according to the invention
Fig. 26 shows the embodiment of a seating furniture chassis shown in Fig. 1 with a possible orientation of a seat,

Fig. 27 shows the embodiment of a seating furniture chassis shown in Fig. 11 with a possible orientation of a seat, and

Fig. 28a-c show different positions of a seating furniture chassis during a method to operate a seating furniture chassis according to the invention.

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Detailed Description of the Invention

In the following text the figures will be described one by one, and the different parts and positions seen in the figures will be numbered with the same numbers in the different figures. Not all parts and positions indicated in a specific figure will necessarily

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List of reference numerals

	100	Seating furniture chassis
	101	First actively displaceable slider
15	102	First lever
	103	Elongated upper main console
	103a	First end of elongated upper main console 103
	103b	Second end of elongated upper main console 103
	104	Elongated main console
20	104a	first end of elongated main console 104
	104b	second end of elongated main console 104
	105	Frame
	106	First linear actuator
	107	Elongated tilt base unit
25	107a	First end of elongated tilt base unit 107
	107b	Second end of elongated tilt base unit 107
	107c	Intermediate part of the elongated tilt base unit 107
	108	Base unit
	121	First threaded spindle
30	125	First motor
	126	First crown wheel
	127	First pinion
	150	First pivot linkage

	151	Third pivot linkage
	152	Fifth pivot linkage
	153	Second pivot linkage
	154	Fourth pivot linkage
5	170	Level
	180	Higher level
	200	Seating furniture chassis
	201	Seventh pivot linkage
	202	Lifting lever
10	202a	First end of the lifting lever 202
	202b	Second end of the lifting lever 202
	203	Elongated lift base plate
	203a	First end of the elongated lift base plate
	203b	Second end of the elongated lift base plate
15	203c	Intermediate part of the elongated lift base plate
	204	Second threaded spindle
	205	Sixth pivot linkage
	206	Second linear actuator
	211	Second actively displaceable slider
20	212	Second motor
	214	Third threaded spindle
	216	Second crown wheel
	217	Second pinion
	220	Distance
25	230	Line
	240	Cam
	241	Pivot axis
	250	First tilting angle
	251	Second tilting angle
30	260	Controller
	270	Power source
	280	Seat
	281	Seat surface
	282	Backrest

- 283 Leg rest
- 284 Footrest

Figure 1-8 shows an embodiment of the seating furniture chassis 100 according to the invention from different viewpoints. Fig. 1 shows the seating furniture chassis from one side. Fig. 2 shows the seating furniture chassis from another side. Fig. 3 shows the seating furniture chassis from the back. Fig. 4 shows the seating furniture chassis from the front. Fig. 5 shows the seating furniture chassis from the top. Fig. 6 shows the seating furniture chassis from the bottom. Fig. 7 shows the seating furniture chassis in a perspective view. Fig. 8 shows the seating furniture chassis in another perspective view. In Fig. 1-8 the seating furniture chassis is shown in a partially tilted position.

The seating furniture chassis comprises:

- a frame 105,
- a base unit 108,
- a tilt system, which comprises:
 - an elongated tilt base unit 107 having a first 107a and a second end 107b,
 - an elongated main console 104 having a first 104a and a second end 104b,
 - an elongated upper main console 103 having a first 103a and a second end 103b,
 - a first linear actuator 106.

The first end of the main console 104 is pivotally connected to the base unit 108 via a first pivot linkage 150, and the second end 104b of the main console 104 is pivotally connected to the tilt base unit 107 via a second pivot linkage 153. The base unit has a plane surface for connection with the plane surface of the frame 105.

The second pivot linkage 153 is located at the first end 107a of the tilt base unit 107.

The first end of the upper main console 103 is connected pivotally to the base unit 108 via a third pivot linkage 151.

The frame 105 can be a wheeled frame or a stationary frame. The wheeled frame can be a driving unit for a wheelchair.

In the present application the frame 105 is for simplicity illustrated by a surface line in the figures.

5 The second end of the upper main console 103 is connected pivotally to the tilt base unit 107 via a fourth pivot linkage 154. The fourth pivot linkage 154 is located at the first end of the tilt base unit 107 in a position closer to an intermediate part 107c of the tilt base unit 107 than the position of the second pivot linkage 153.

10 The main console 104 and the upper main console 103 and a part of the base unit 108 and a part of the tilt base unit 107 create a quadrilateral.

The third pivot linkage 151 is located at a higher level 180 above the frame 105 – in the figures the frame 105 is for convenience represented by the plane surface thereof - than a level for 170 the first pivot linkage 150.

15

The tilt base unit 107 is arranged for performing a tilting motion relative to the base unit 108 when the first linear actuator 106 is activated, where the second end 107b of the tilt base unit 107 is moved in a substantially linear direction during the tilting motion.

20

The first linear actuator 106 is located substantially parallel with the elongated tilt base unit 107.

25 The first linear actuator 106 comprises a first actively displaceable slider 101 which is connected with a first lever 102 which is pivotally connected to the upper main console 103 via a fifth pivot linkage 152.

30 The frame 105 typically has a plane surface. The substantially linear motion of the second end of the tilt base unit is typically oriented vertically to the plane surface of the frame.

The seating furniture chassis 100 comprises two elongated main consoles 104. The seating furniture chassis 100 comprises two elongated upper main consoles 103. The seating furniture chassis can comprise two elongated tilt base units 107. The elongated

consoles of elongated base units of the same type are mounted besides each other on a common axis at the pivot linkages. This has the advantage of providing an especially stable seating furniture chassis.

5 The fifth pivot linkage 152 is located in a distance 220 from a line 230 connecting the third pivot linkage 151 and fourth pivot linkage 154. The fifth pivot linkage 152 is located on a side of said line 230 on which the first pivot linkage 150 and second pivot linkage 153 are located.

10 The first actively displaceable slider 101 comprises an internal thread. The first linear actuator 106 comprises a first threaded spindle 121 on which the first actively displaceable slider 101 is displaced and a first motor 125 for rotating the first threaded spindle and thereby effecting the displacement of the first actively displaceable slider 101.

15

The first linear actuator 106 can actuate a load of 200 kg with an input force of 3000 to 7000 Newton, preferably 4000 to 6500 Newton, more preferably 6000 Newton.

20 The first motor 125 for rotating the first threaded spindle 121 is connected to the first threaded spindle with a first crown wheel 126 and a first pinion 127.

Alternatively, the first motor and the first threaded spindle can be connected using a planetary gear.

25 Fig. 9 and 10 show the same embodiment of the seating furniture chassis as shown in Fig. 1-8.

In Fig. 9 the seating furniture chassis is shown in a folded position. This position can also be referred to as lowered position.

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Fig. 10 shows the seating furniture chassis in a tilted position. A seat can be mounted on the elongated tilt base unit.

The first actively displaceable slider pushes and pulls on the first lever, when the first linear actuator 106 is actuated. Thus, a force is generated between the upper main console 103 and the tilt base unit 107. This force brings about the tilting motion.

5 Fig. 11 shows another embodiment of a seating furniture chassis according to the invention.

Figure 11-19 show another embodiment of the seating furniture chassis 200 according to the invention from different viewpoints. This embodiment is a seating furniture
10 chassis 100 comprising further elements as explained in detail below.

Fig. 11 shows the seating furniture chassis from one side. Fig. 12 shows the seating furniture chassis from another side. Fig. 13 shows the seating furniture chassis from the back. Fig. 14 shows the seating furniture chassis from the front. Fig. 15 shows the
15 seating furniture chassis from the top. Fig. 16 shows the seating furniture chassis from the bottom. Fig. 17 shows the seating furniture chassis in a perspective view. Fig. 18 and 19 show the seating furniture chassis in perspective views. In Fig. 19 parts of the seating furniture chassis are hidden for better visibility of the second threaded spindle 204 and third threaded spindle 214. Fig. 11-19 show the seating furniture chassis in a
20 partially lifted position.

The seating furniture chassis 200 comprises:

- an elongated lift base plate 203,
- a lifting lever 202 with a first end 202a and a second end 202b,
- 25 - a second linear actuator 206 arranged parallel with the elongated lift base plate 203.

The tilt base unit 107 and the elongated lift base plate 203 are connected pivotally via a sixth pivot linkage 205. The second linear actuator 206 comprises a second actively displaceable slider 211.

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The elongated lift base plate 203 has a first end 203a and a second end 203b. The pivot linkage 205 is located at the first end 203a of the elongated lift base plate.

The elongated lift base plate 203 comprises an intermediate part.

The second actively displaceable slider 211 is pivotally connected with the first end 202a of the lifting lever 202 via a seventh pivot linkage 201. The lifting lever 202 is at the second end 202b pivotally connected to the tilt base unit 107.

5 The seating furniture chassis 200 allows a lifting motion to be performed by actuating the first 106 and second 206 linear actuators. By actuating the first linear actuator 106 only, a tilting motion is performed. By actuating the first 106 and the second linear actuator 206 a lift motion is performed.

10 This allows a person (not shown) to get in and out of the seating furniture (not shown) in a more ergonomic way. The strain on the legs is reduced.

The seating furniture chassis allows the seat to be tilted forward for easier entry and exit of the seating furniture. The seating furniture allows the seat to be tilted back-
15 wards for a more relaxed seating position and for resting.

The seating furniture chassis comprises a controller 260. The controller controls the first linear actuator 106 and the second linear actuator 206.

20 The seating furniture chassis comprises a power source 270. The power source 270 delivers power to the controller 260 and the first 106 and second 206 linear actuator. The power source 270 can be a battery.

The tilt base unit 107 comprises a cam 240 with its pivot axis 241 outside of tilt base
25 unit 107. The lifting lever 202 is at its second end 202b adapted to cooperate with the cam 240 to pivot around the pivot axis 241 of the cam.

The cam 240 is a partial circle. The cam is bolted to a side of the tilt base unit 107. The cam can consist of two concentric partial circles.

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The second linear actuator 206 can actuate a load of 200 kg with an input force of 3000 to 7000 Newton, preferably 4000 to 6500 Newton, more preferably 6000 New-
ton.

The low input force requirement of the second linear actuator 206 reduces power requirements for driving the second linear actuator. This is especially important for wheelchairs where the available battery capacity and amperage of a control circuit can be limited.

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The input force can be provided by the second motor 212 or any other suitable means.

The second actively displaceable slider 211 comprises an internal thread. The second linear actuator 206 comprises at least a second threaded spindle 204, on which the second actively displaceable slider 211 is displaced.

10

The second linear actuator comprises a second motor 212 for rotating the at least second threaded spindle 204 and thereby effecting the displacement of the second actively displaceable slider 211.

15

The second linear actuator comprises a third threaded spindle 214.

The second 204 and third threaded spindle 214 are connected to the second motor 212 with a second crown wheel 216 and a second pinion 217. Alternatively the second threaded spindle 204 and the third threaded spindle 214 can be connected to the second motor 212 with a planetary gear.

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Fig. 20 shows the embodiment of the seating furniture shown in Fig. 11-19 in a partially raised and partially tilted forward position.

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Fig. 21 shows the embodiment of the seating furniture shown in Fig. 11-19 in a position which assists the user in getting out of the chair. The seating furniture chassis is in a raised or lifted position. The seating furniture chassis is also tilted. The tilting position is an extreme position. Positions with a lower tilting angle can be used to assist the user in getting out of the chair..

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Fig. 22a-c show the embodiment of the seating furniture chassis 200 shown in Fig. 11-21 in different positions.

Fig. 22a shows the seating furniture chassis 200 in a closed or folded position. In this position a seat surface (not shown) is in the lowest position.

5 Fig. 22b and Fig. 22c show the seating furniture chassis 200 in two different comfort positions.

In Fig. 22b the seating furniture chassis 200 is in a partially lifted and partially tilted position. If a seat (not shown) is mounted on the seating furniture chassis in the orientation shown in Fig. 27, the tilt would be backwards oriented. A user (not shown) seated in the seat (not shown) would be in a reclined position.

10

Fig. 22c shows the seating furniture chassis 200 in an extreme position. If a seat (not shown) is mounted on the seating furniture chassis in the orientation shown in Fig. 27, the tilt would be backwards oriented. A user (not shown) seated in the seat (not shown) would be in a fully reclined position.

15

Fig. 23 a-c show a seating furniture chassis 200 according to the invention in different positions. Fig. 23a shows the seating furniture chassis in closed or folded position. Fig. 23b shows the seating furniture chassis in a partially lifted position. Fig. 23c shows the seating furniture chassis in fully lifted position.

20

Fig. 24 and 25 show two further embodiments of the invention. The description above applies to these embodiments as well.

25 Fig. 26 shows the embodiment of the seating furniture chassis 100 shown in Fig. 1 with a possible orientation of a seat 280. The seat 280 comprises a seat surface 281 and a backrest 282. The seat 280 further comprises an optional leg rest 283 and an optional footrest 284.

30 The seat 280 is in a reclined position. This position is also referred to as comfort position.

The backrest 282 can pivot relative to the seat surface 281 during operation of the seating furniture chassis 100. This assures an ergonomic position of the user of the seat at all times during the operation of the seating furniture chassis 100.

5 The leg rest 283 and footrest 282 can pivot relative to the seat surface 281 during operation of the seat furniture chassis 100. This assures an ergonomic position of the user of the seat at all times during the operation of the seating furniture chassis 100.

10 Fig. 27 shows the embodiment of the seating furniture chassis 200 shown in Fig. 11 with a possible orientation of a seat 280. The seat 280 comprises a seat surface 281 and a backrest 282. The seat 280 further comprises an optional leg rest 283 and an optional footrest 284.

The seat 280 is in upright position.

15

The backrest 282 can pivot relative to the seat surface 281 during operation of the seating furniture chassis 200. This assures an ergonomic position of the user of the seat at all times during the operation of the seating furniture chassis 200.

20 The leg rest 283 and footrest 282 can pivot relative to the seat surface 281 during operation of the seat furniture chassis 200. This assures an ergonomic position of the user of the seat at all times during the operation of the seating furniture chassis 200.

25 The seat can also be rotated 180 degrees relative to the position of the seat 280 shown in fig. 26 and Fig. 27.

Fig. 28a-c show different positions of a seating furniture chassis during a method to operate a seating furniture chassis according to the invention.

30 The method comprises the following step:

- actuating the first linear actuator 106 and the second linear actuator 206 simultaneously to perform a lift motion and optionally a first partial tilt motion of the elongated lift base plate 203, which first partial tilt motion is leading to a first value of a tilting angle of the elongated lift base plate 203 relative to the base unit 108.

Fig. 28a shows the seating furniture chassis in its closed or folded position. When the step described above is executed, the seating furniture chassis 200 is transformed into the position shown in fig. 28b.

5 The method further comprises the following step:

- actuating the second linear actuator 206, to perform a tilting motion which increases a first value of a tilting angle 250 to a second value 251 which second value is larger than the first tilting value.

10 Execution of this step of the method transforms the seating furniture chassis from the position shown in fig. 28b into the position shown in fig. 28c.

The technical effect achieved with this method is a more ergonomic entry and exit of a person from the seating furniture.

15

On exit, the seat is first lifted and tilted. The lift and tilt reduce the bend on the knees of the person in the wheelchair prior to the weight of the person being transferred from the seat of the wheelchairs to the legs. This reduces the stress on the knees and the required strength of the legs of the person getting out of the wheelchair.

20

When a person is sitting down in the seating furniture the same applies. The person can lean gently against the tilted seat with straight or almost straight legs. Then the seat is tilted back into sitting position, and the seat is simultaneously tilted further back and lowered. Again stress on the knees and the required leg strength are reduced compared to stationary seating furniture.

25

CLAIMS

1. A seating furniture chassis (100), which seating furniture chassis comprises:
- a frame (105),
 - 5 - a base unit (108),
 - a tilt system, which comprises:
 - an elongated tilt base unit (107) having a first (107a) and a second end (107b),
 - an elongated main console (104) having a first (104a) and a second end (104b),
 - an elongated upper main console (103) having a first (103a) and a second end
 - 10 (103b),
 - a first linear actuator (106),
- where the first end of the main console (104) is pivotally connected to the base unit (108) via a first pivot linkage (150), and the second end (104b) of the main console (104) is pivotally connected to the tilt base unit (107) via a second pivot linkage (153),
- 15 which second pivot linkage (153) is located at the first end (107a) of the tilt base unit (107),
- where the first end of the upper main console (103) is connected pivotally to the base unit (108) via a third pivot linkage (151), and the second end of the upper main console (103) is connected pivotally to the tilt base unit (107) via a fourth pivot linkage
- 20 (154), which fourth pivot linkage (154) is located at the first end of the tilt base unit (107) in a position closer to an intermediate part (107c) of the tilt base unit (107) than the position of the second pivot linkage (153),
- where the main console (104) and the upper main console (103) and a part of the base unit (108) and a part of the tilt base unit (107) create a quadrilateral,
- 25 where the third pivot linkage (151) is located at a higher level (180) above the frame (105) than a level for (170) the first pivot linkage (150),
- where the tilt base unit (107) is arranged for performing a tilting motion relative to the base unit (108) when the first linear actuator (106) is activated, where the second end (107b) of the tilt base unit (107) is moved in a substantially linear direction during the
- 30 tilting motion, **characterised in**, that the first linear actuator (106) is located substantially parallel with the elongated tilt base unit (107),
- the first linear actuator (106) comprises a first actively displaceable slider (101) which is connected with a first lever (102) which is pivotally connected to the upper main console (103) via a fifth pivot linkage (152).

2. Seating furniture chassis according to claim 1, **characterised in**, that the fifth pivot linkage (152) is located in a distance (220) from a line (230) connecting the third pivot linkage (151) and fourth pivot linkage (154), where said fifth pivot linkage (152) is located on a side of said line (230) on which the first pivot linkage (150) and second pivot linkage (153) are located.

3. Seating furniture chassis according to any one of the preceding claims, **characterised in**, that the first actively displaceable slider (101) comprises an internal thread, and that the first linear actuator (106) comprises a first threaded spindle (121) on which the first actively displaceable slider (101) is displaced and a first motor (125) for rotating the first threaded spindle and thereby effecting the displacement of the first actively displaceable slider (101).

4. Seating furniture chassis according to any one of the preceding claims, **characterised in**, that the first linear actuator (106) can actuate a load of 200 kg with an input force of 3000 to 7000 Newton, preferably 3000 to 6500 Newton, more preferably 6000 Newton.

5. Seating furniture chassis according to claim 3, **characterised in**, that the first motor (125) for rotating the first threaded spindle (121) is connected to the first threaded spindle with a first crown wheel (126) and a first pinion (127).

6. Seating furniture chassis (200) according to any one of the preceding claims, **characterised in**, that the seating furniture chassis further comprises:

- an elongated lift base plate (203) with a first end (203a) and a second end (203b),
- a lifting lever (202) with a first end (202a) and a second end (202b),
- a second linear actuator (206) arranged parallel with the elongated lift base plate (203),

that the tilt base unit (107) and the elongated lift base plate (203) are connected pivotally via a sixth pivot linkage (205), that the second linear actuator (206) comprises a second actively displaceable slider (211), that the second actively displaceable slider (211) is pivotally connected with the first end (202a) of the lifting lever (202) via a seventh pivot linkage (201), and that the lifting lever (202) at the second end (202b) is pivotally connected to the tilt base unit (107).

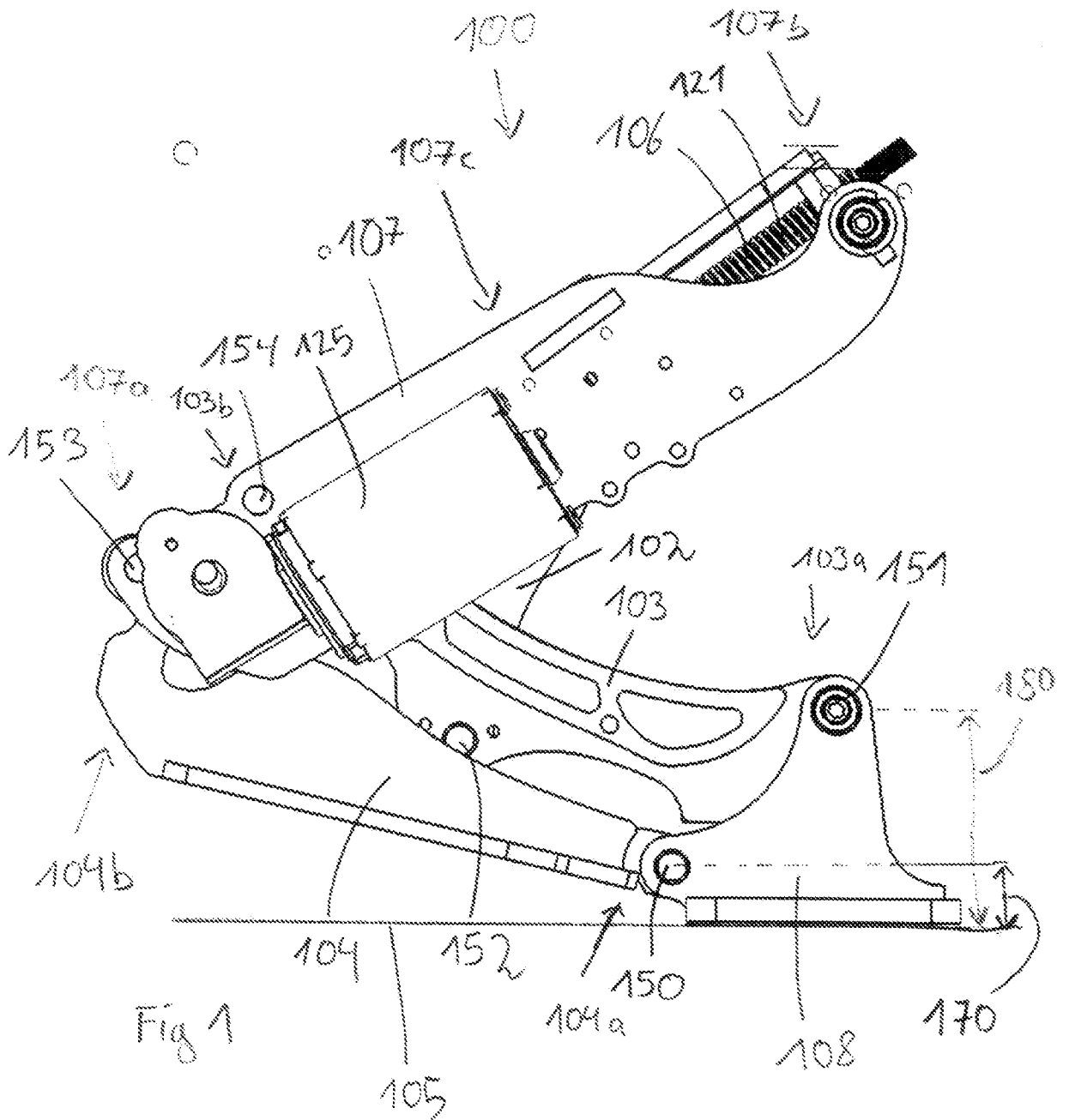
7. Seating furniture chassis (200) according to any one of the preceding claims, **characterised in**, that the second actively displaceable slider (211) comprises an internal thread and that the second linear actuator (206) comprises at least a second threaded spindle (204) on which the second actively displaceable slider (211) is displaced and a second motor (212) for rotating the at least second threaded spindle (204) and thereby effecting the displacement of the second actively displaceable slider (211).

8. Seating furniture chassis according to any claims 6 - 7, **characterised in**, that the tilt base unit (107) comprises a cam (240) with its pivot axis (241) outside of tilt base unit (107), that the lifting lever (202) at its second end is adapted to cooperate with the cam to pivot around the pivot axis of the cam.

9. Seating furniture chassis according to any one of the claims 6 - 8, **characterised in**, that the second linear actuator (206) can actuate a load of 200 kg with an input force of 3000 to 7000 Newton, preferably 4000 to 6500 Newton, more preferably 6000 Newton.

10. Method to operate a seating furniture chassis according to the claims 6 - 9, **characterised in**, that the method comprises the following steps:

- actuating the first linear actuator (106) and the second linear actuator (206) simultaneously to perform a lift motion and optionally a first partial tilt motion of the elongated lift base plate (203), which first partial tilt motion is leading to a first value of a tilting angle (250) of the elongated lift base plate (203) relative to the base unit (108),
- actuating the second linear actuator (206), to perform a tilting motion which increases the tilting angle (250) to a second value which second value is larger than the first value.



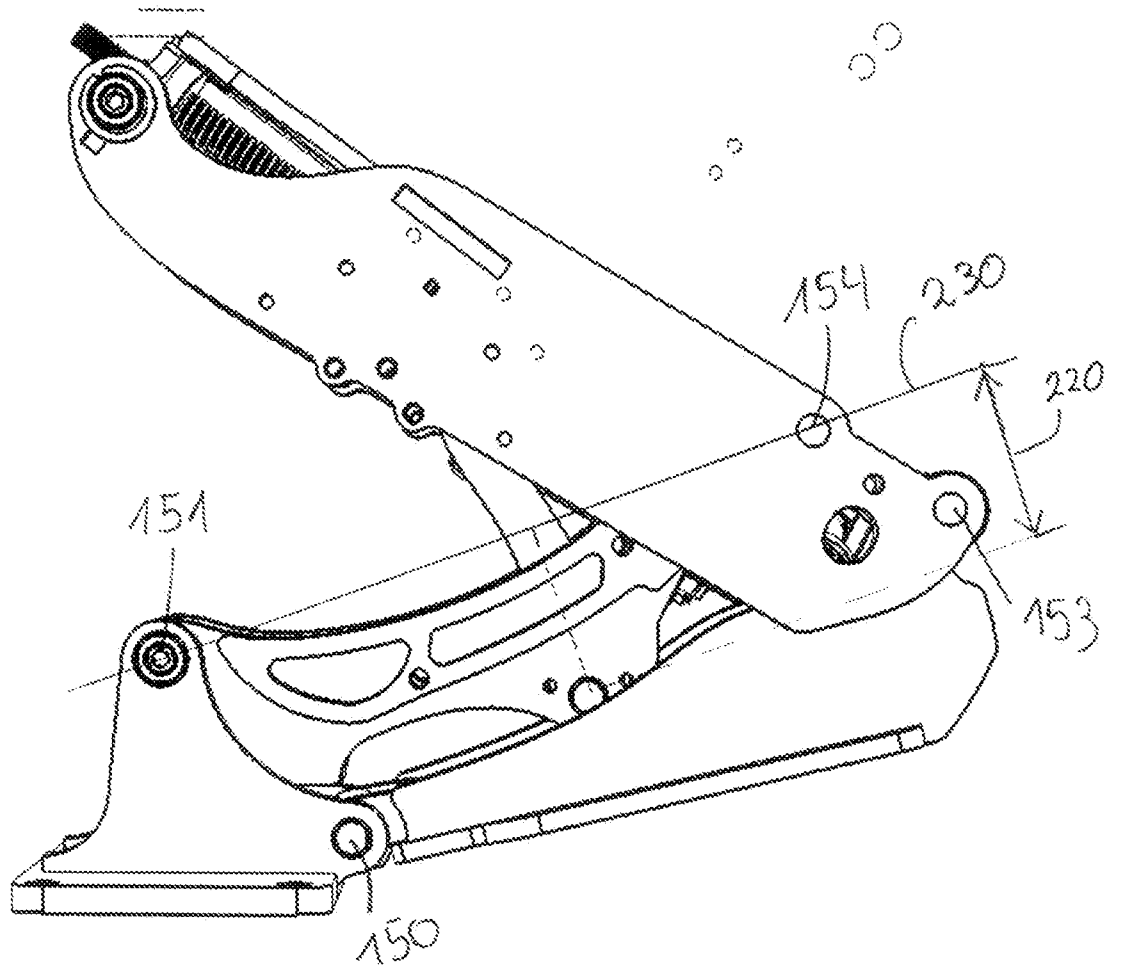


FIG 2

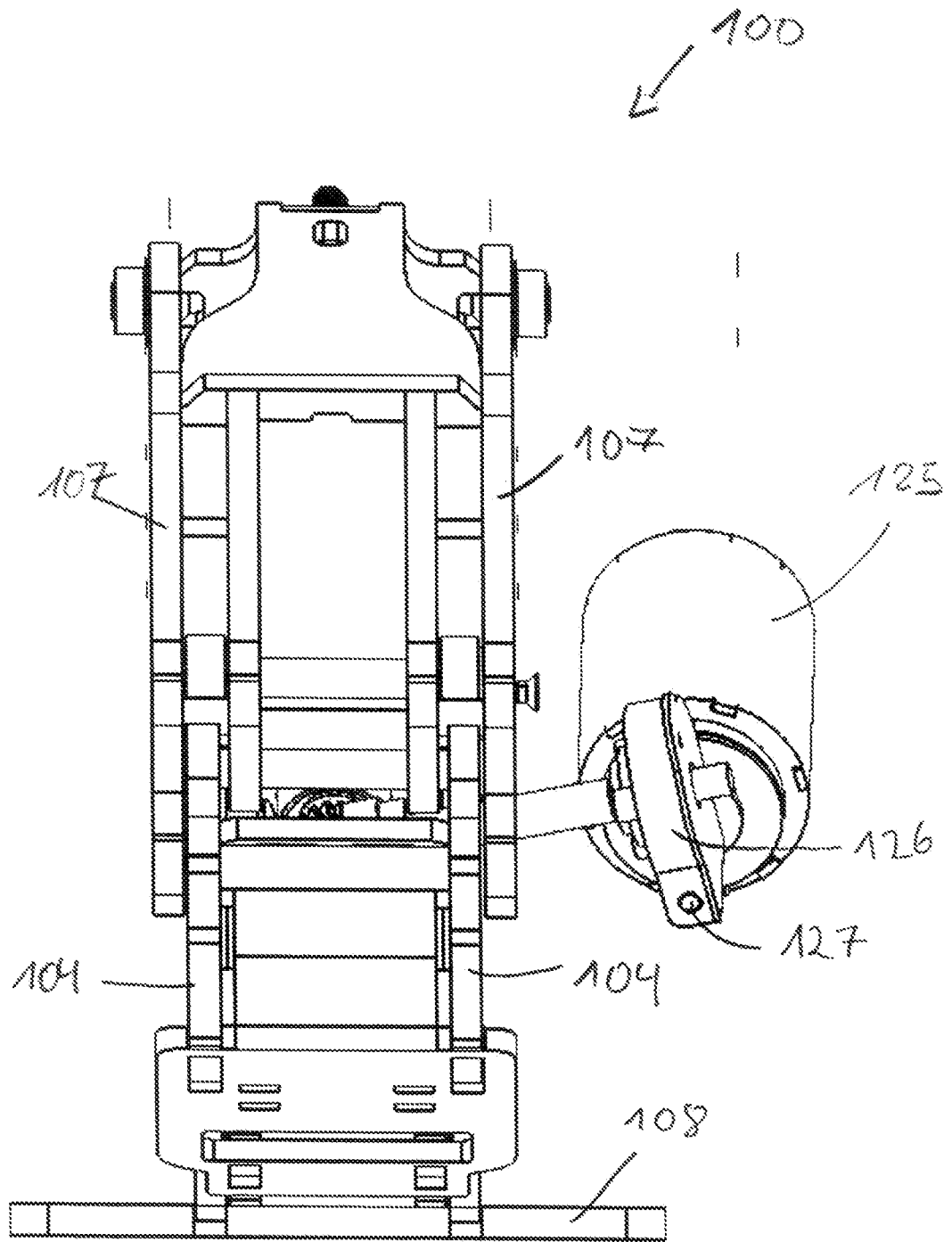


Fig. 3

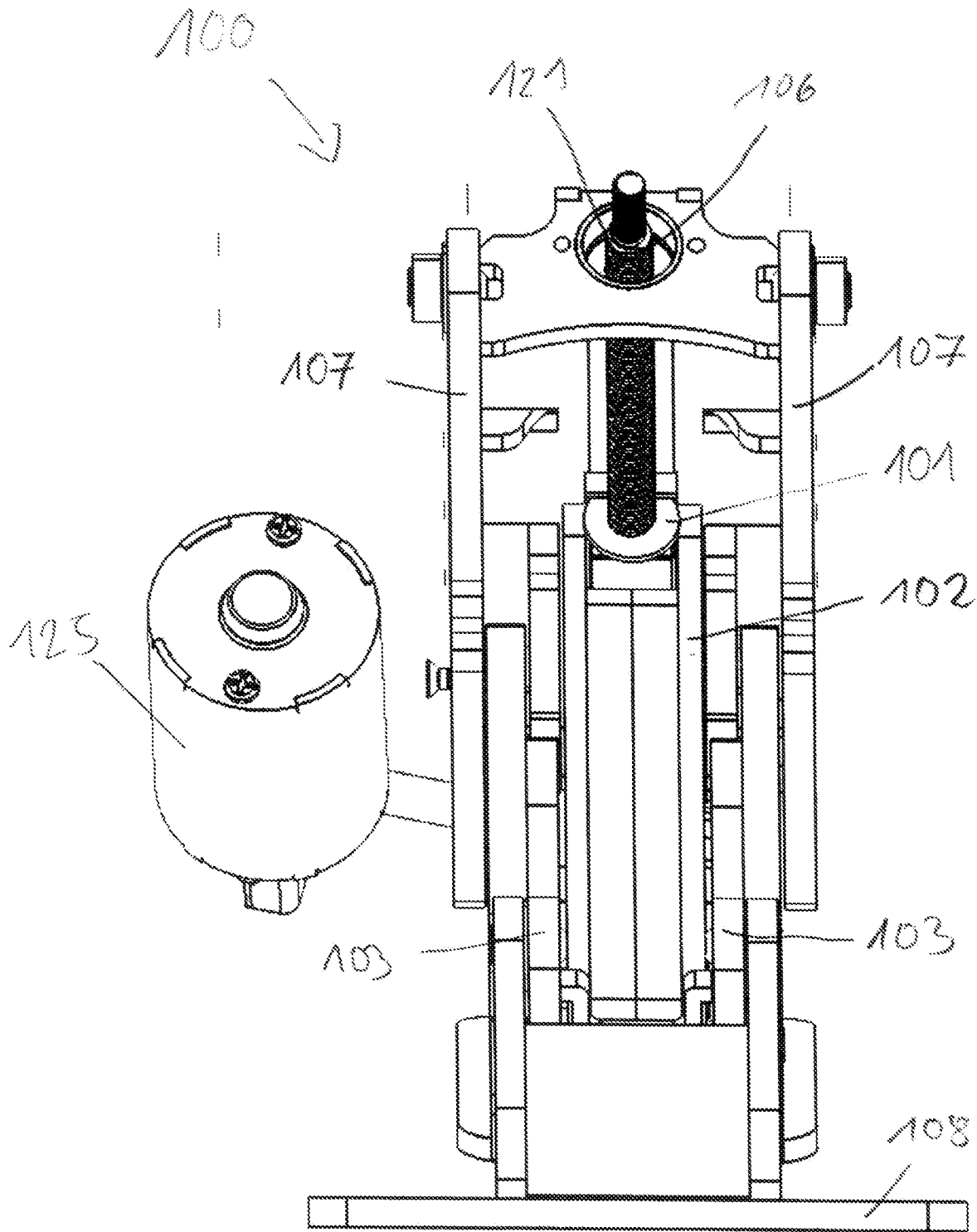
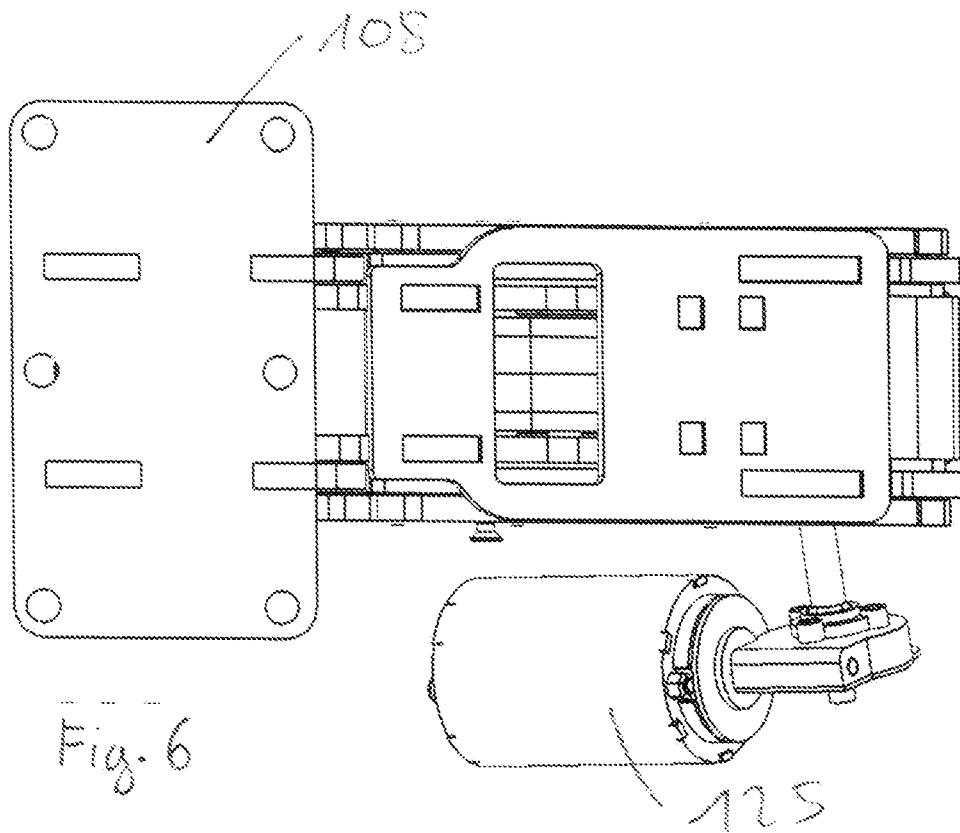
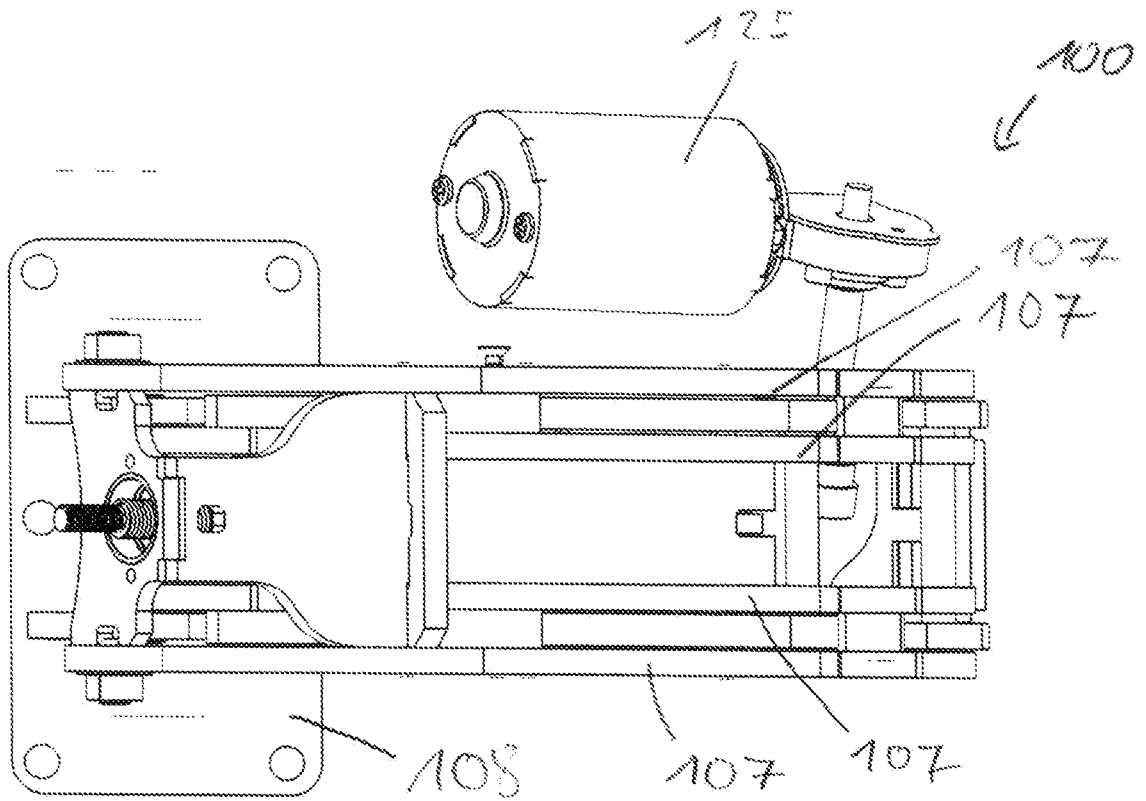


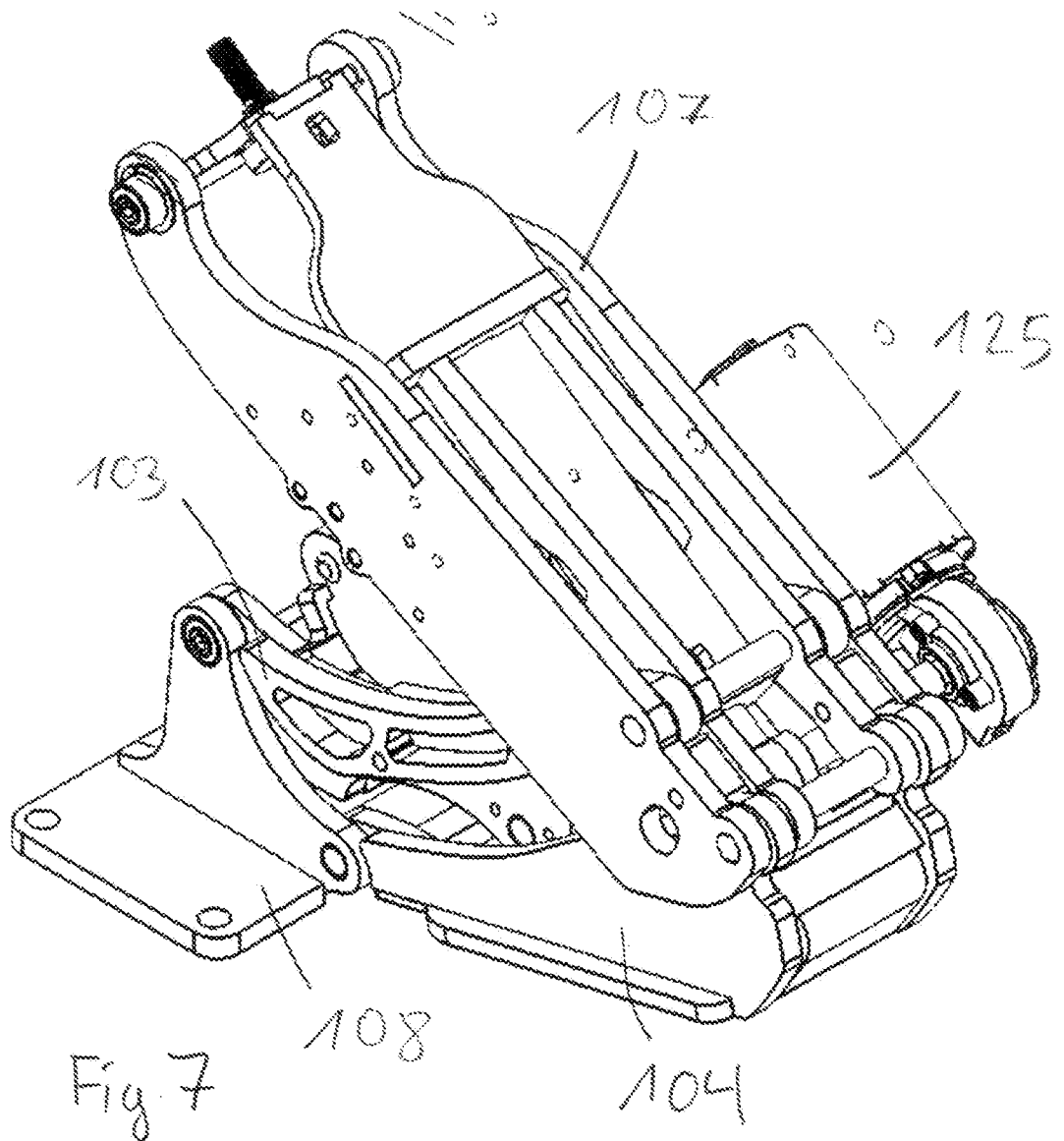
Fig. 4

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700



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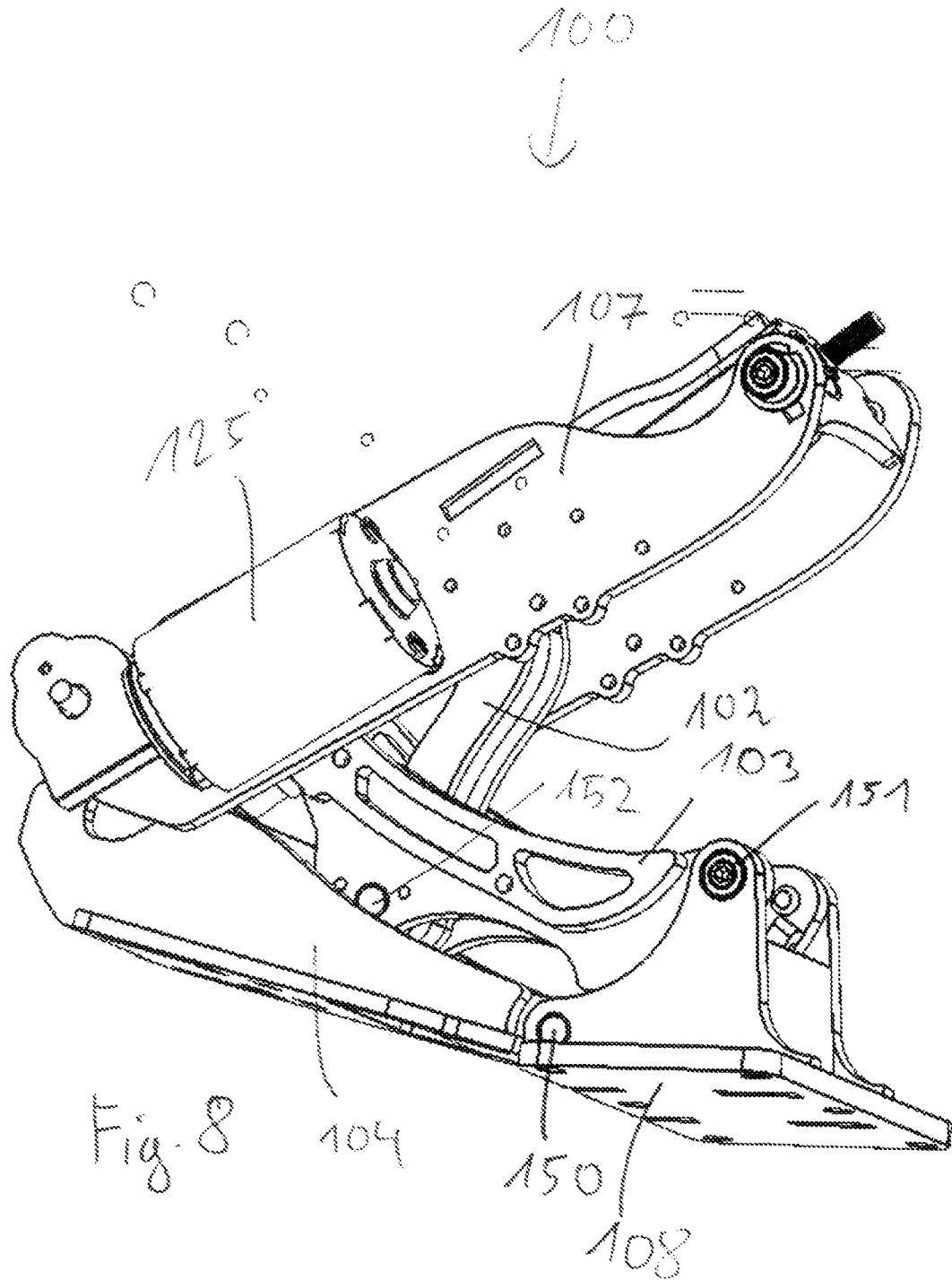
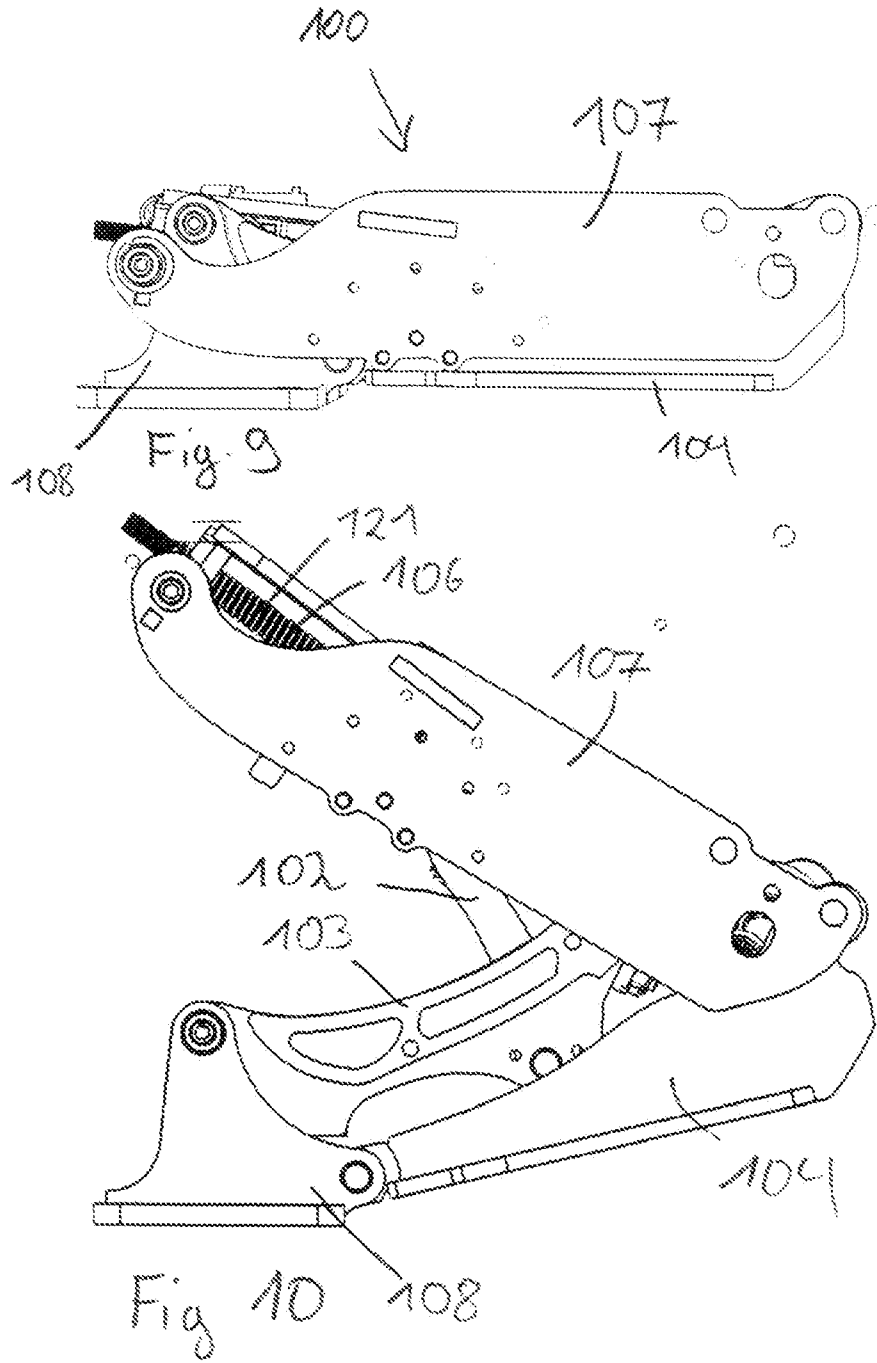


Fig. 8

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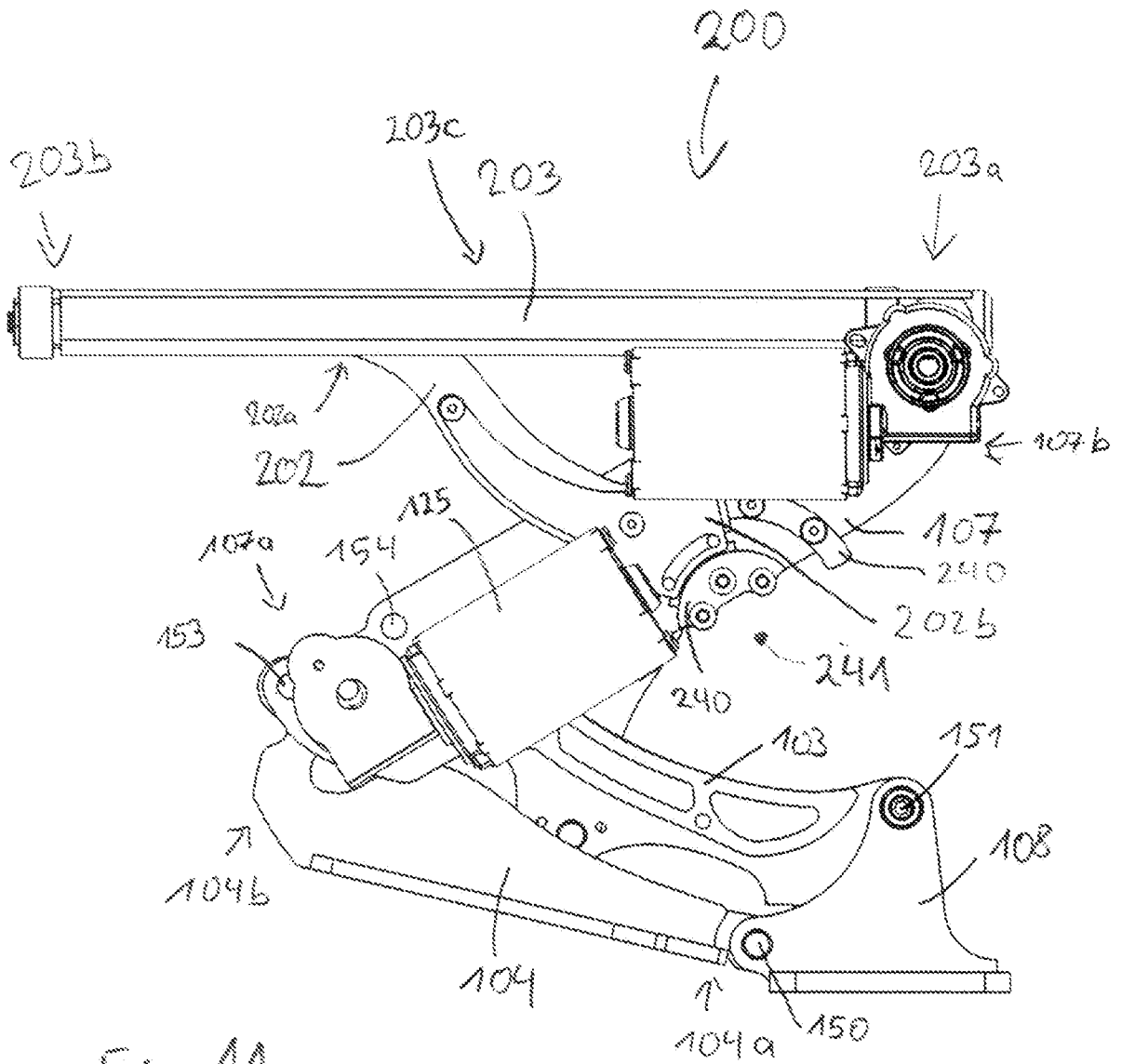


Fig 11

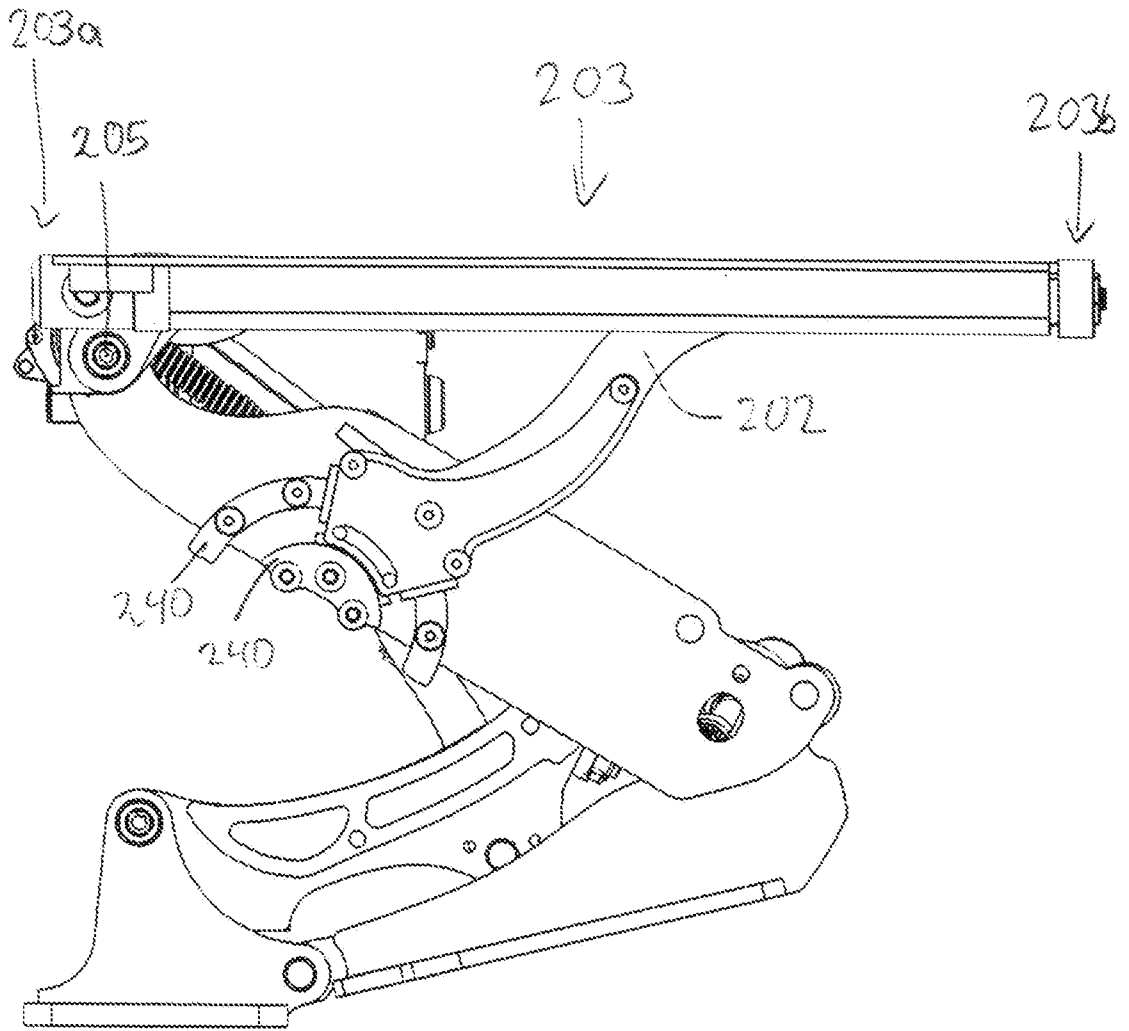


Fig. 12

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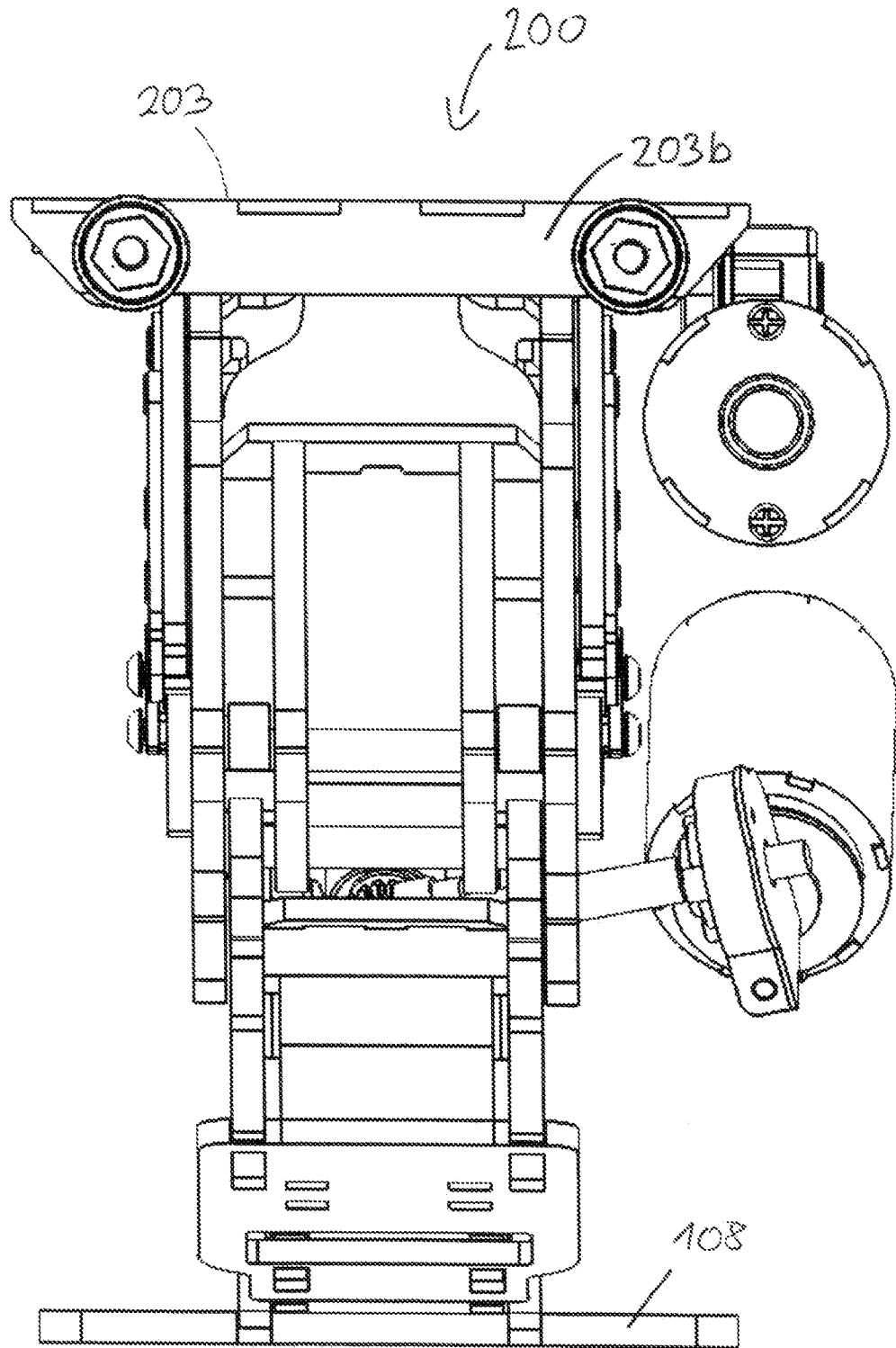


Fig. 13

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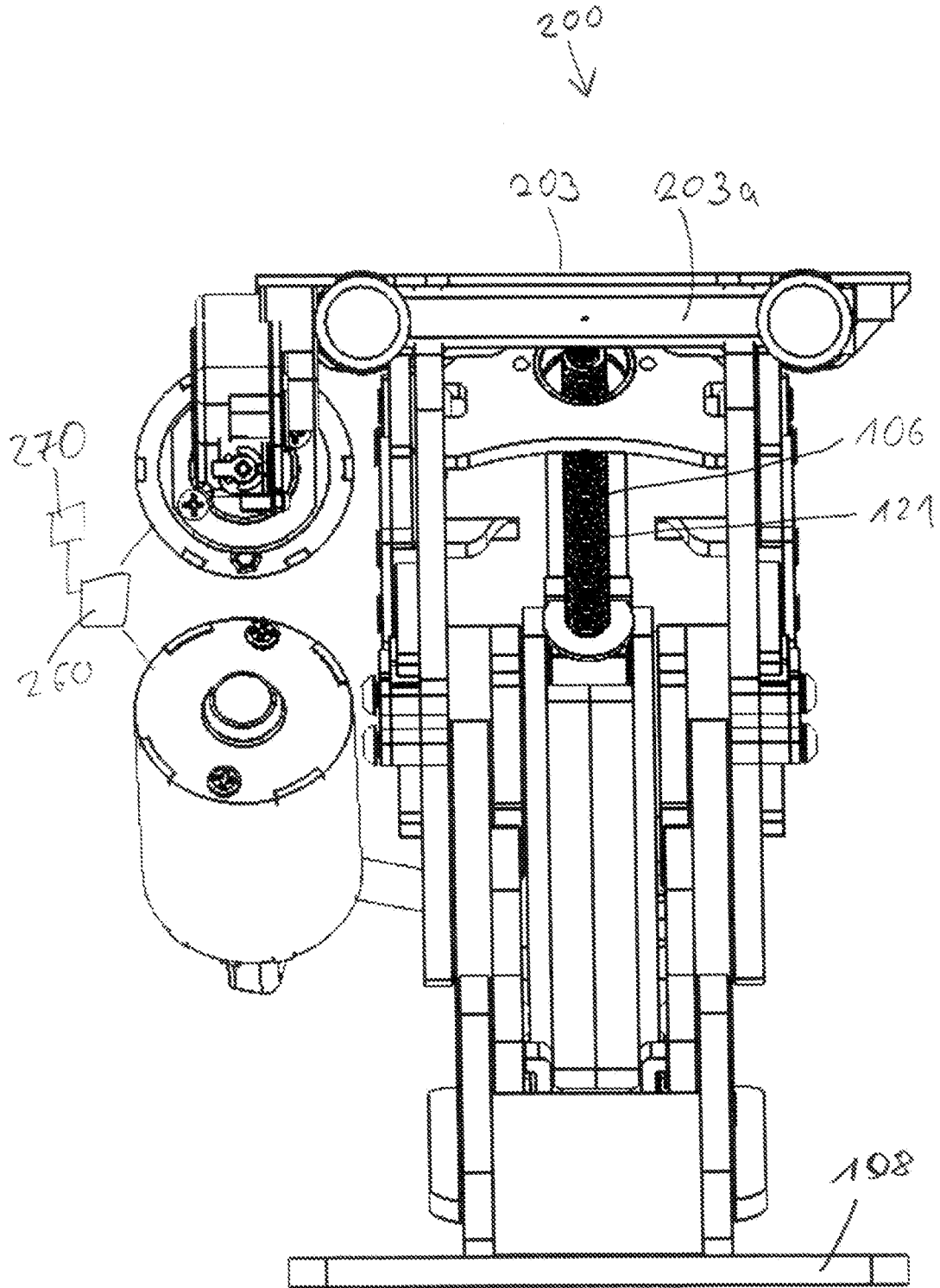


Fig. 14

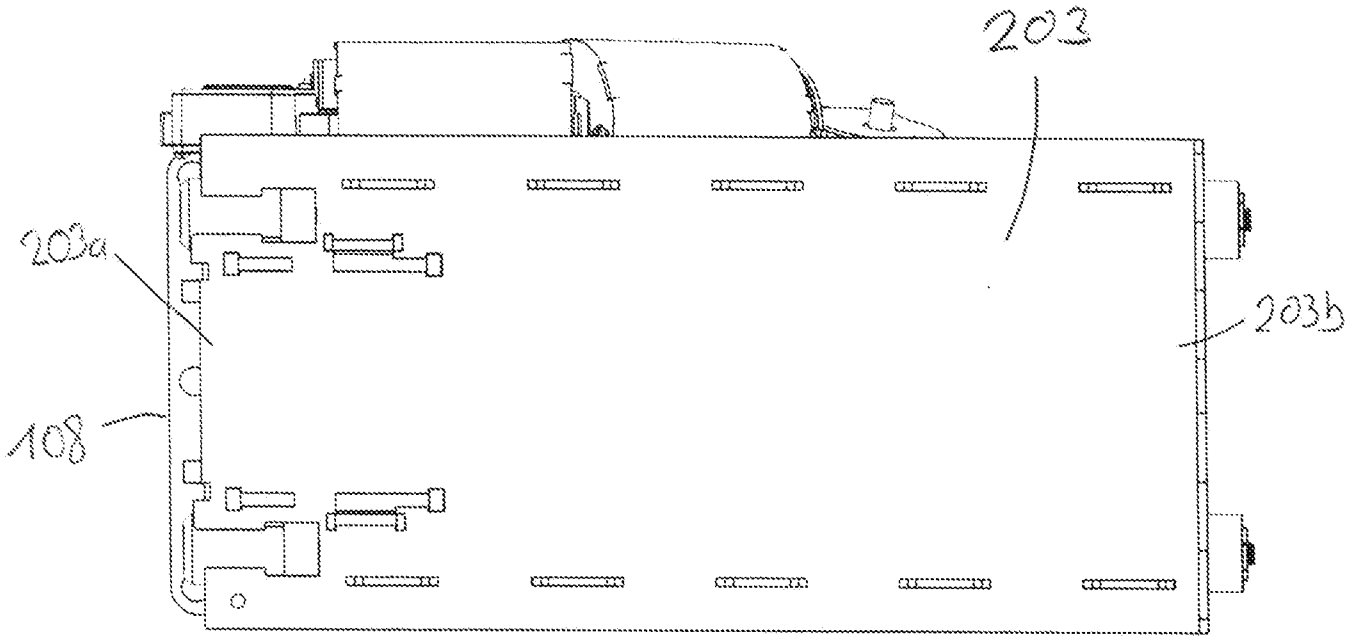


Fig 15

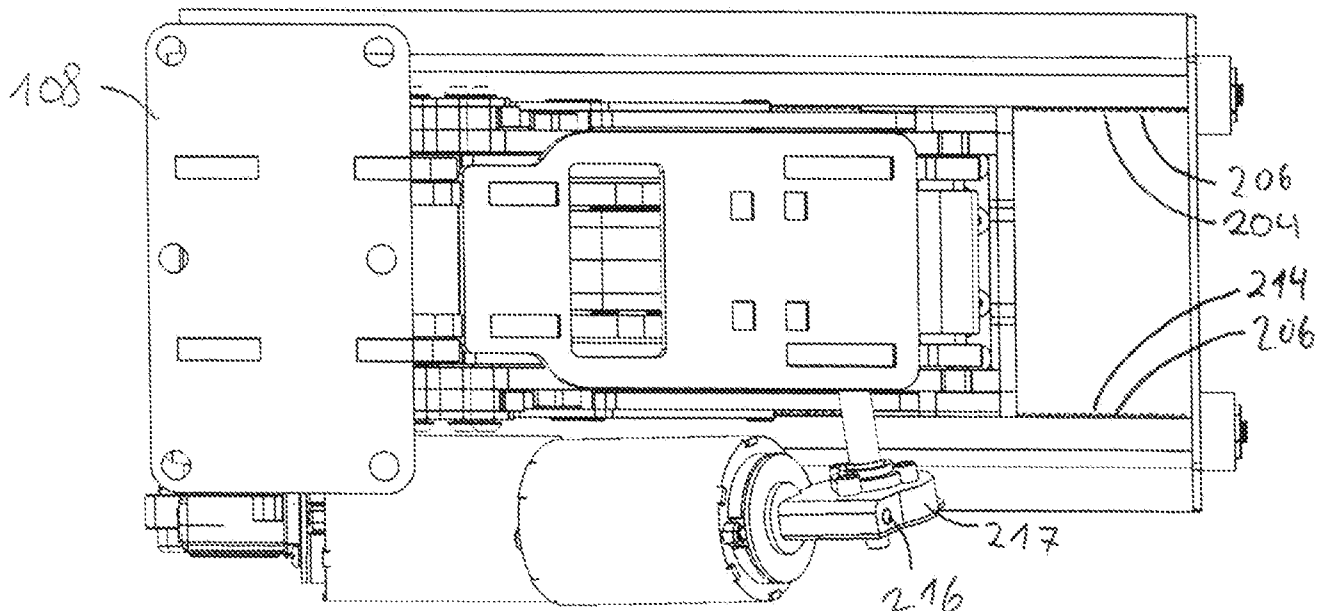
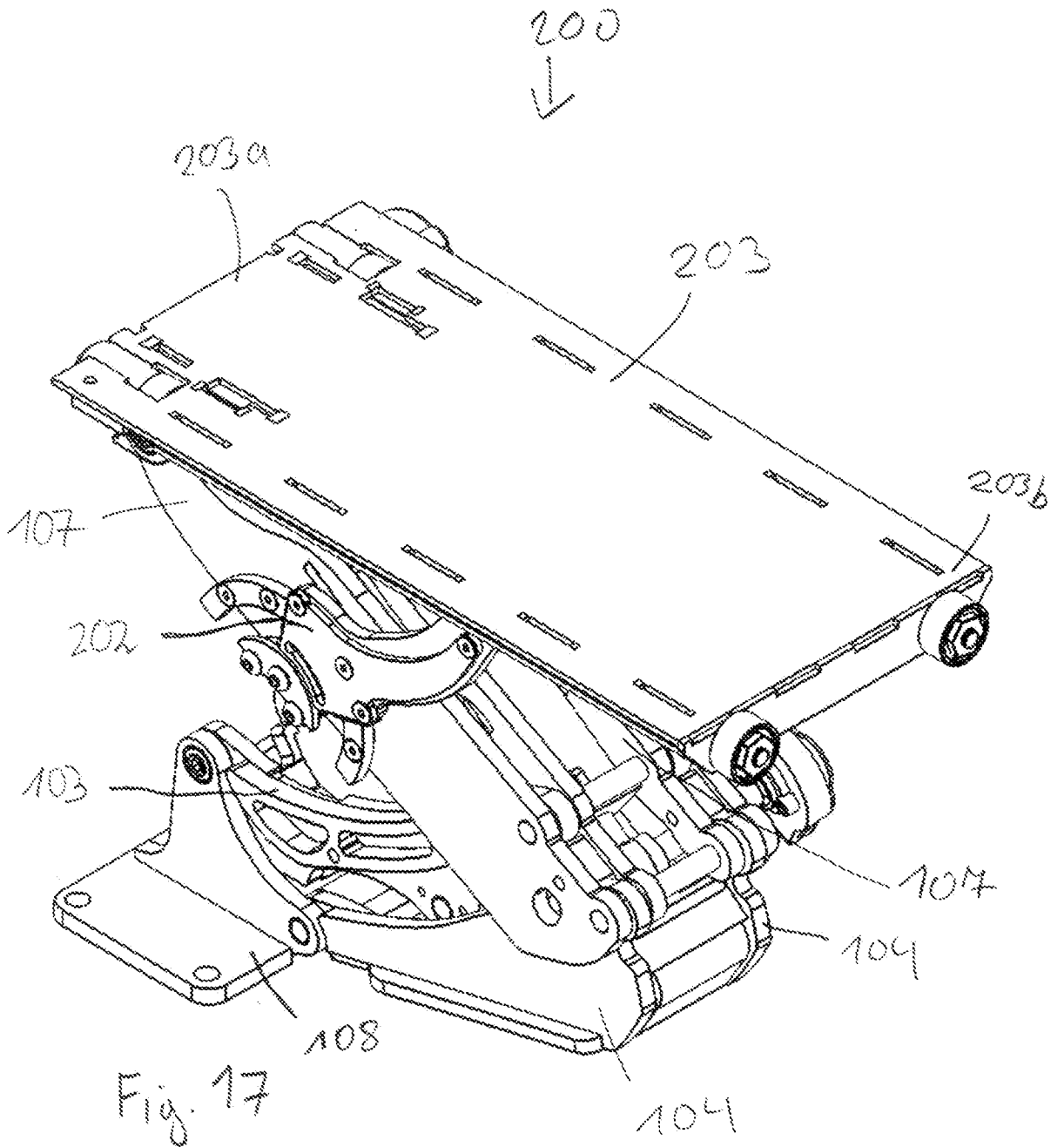


Fig 16



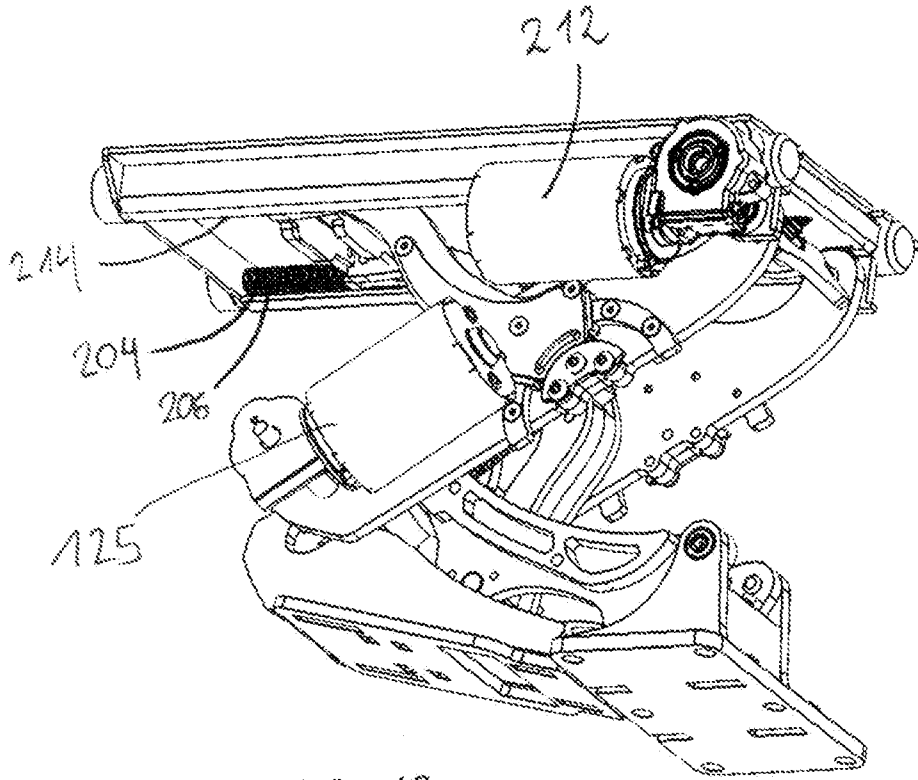


Fig 18

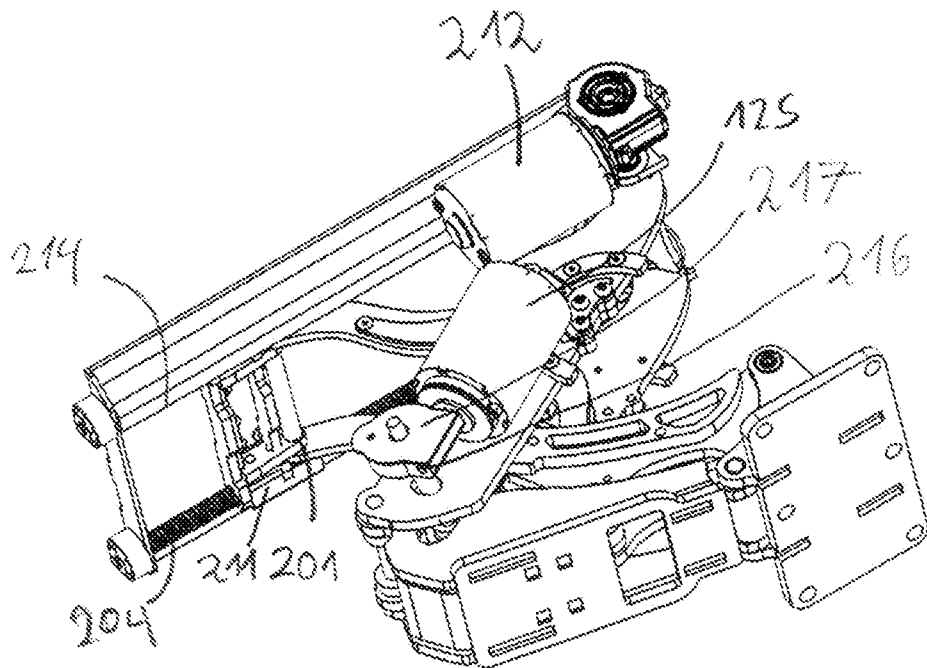


Fig 19

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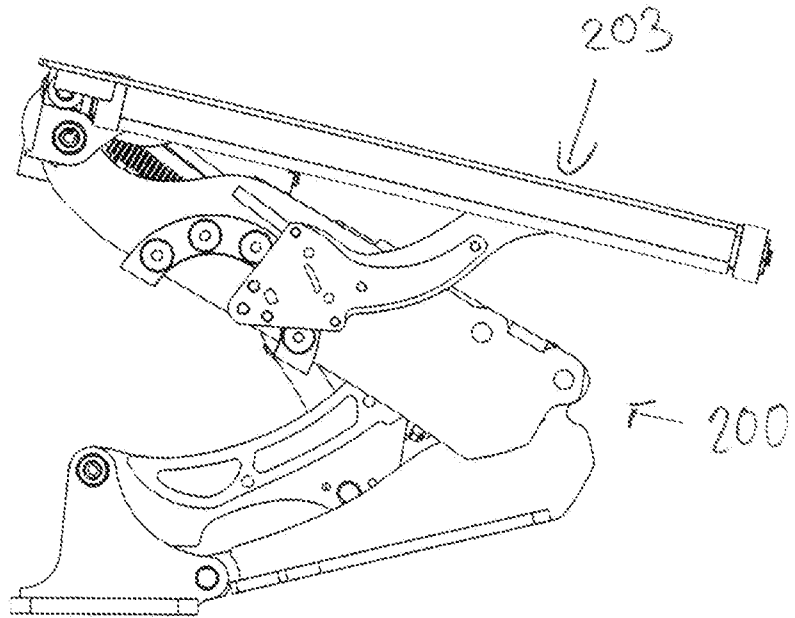


Fig 20

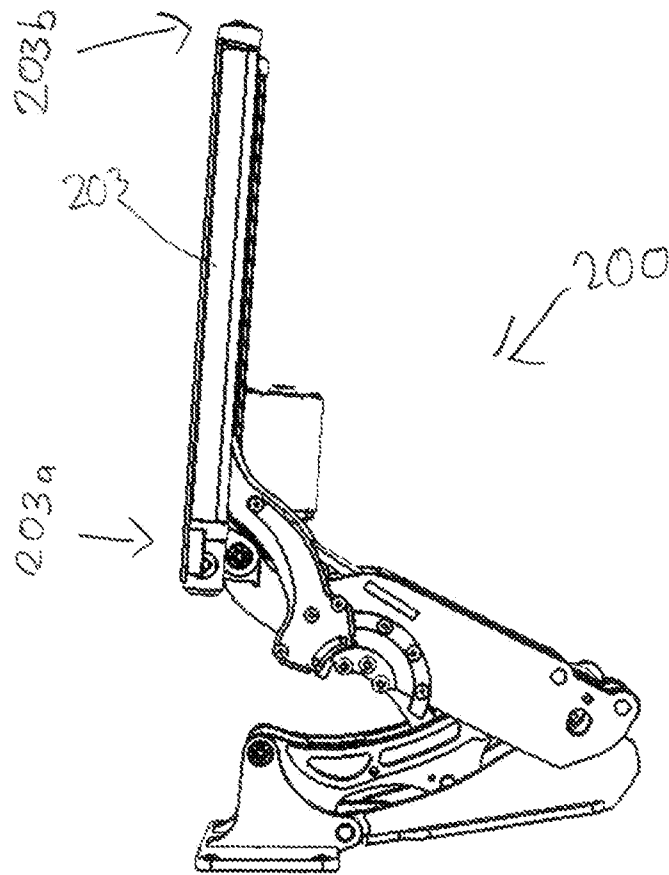
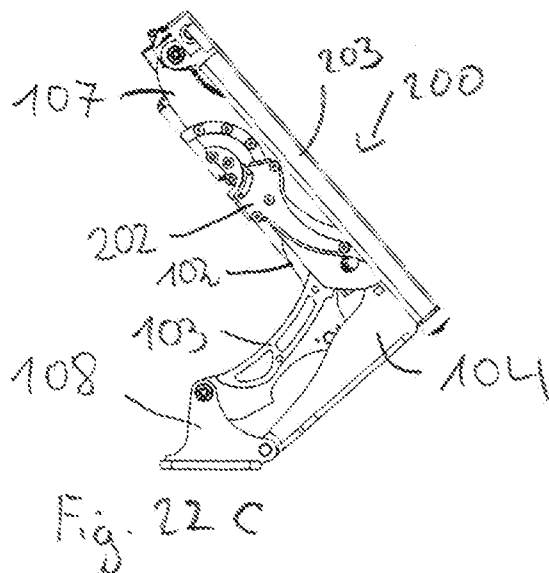
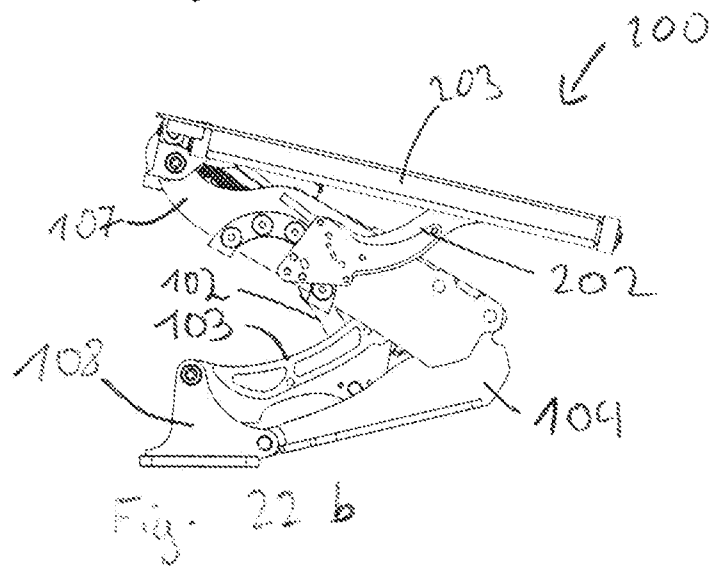
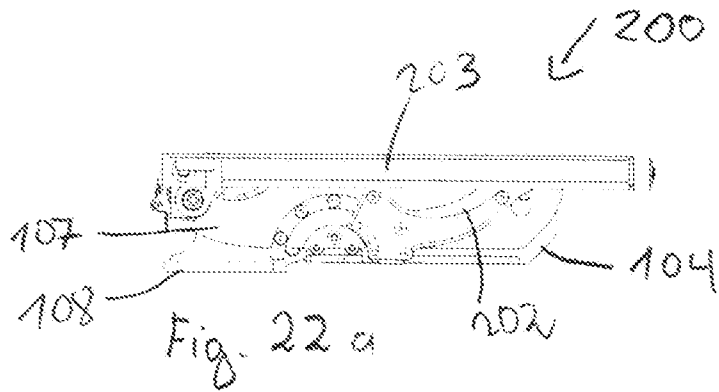
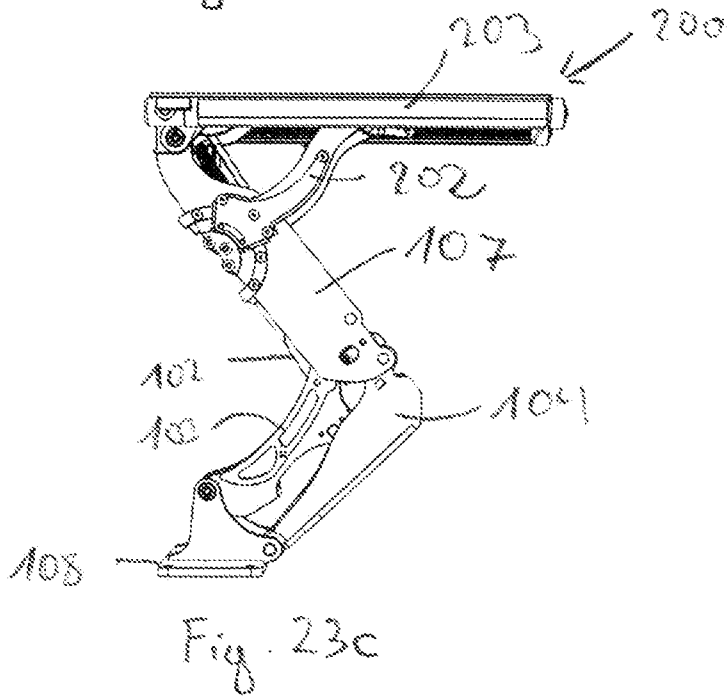
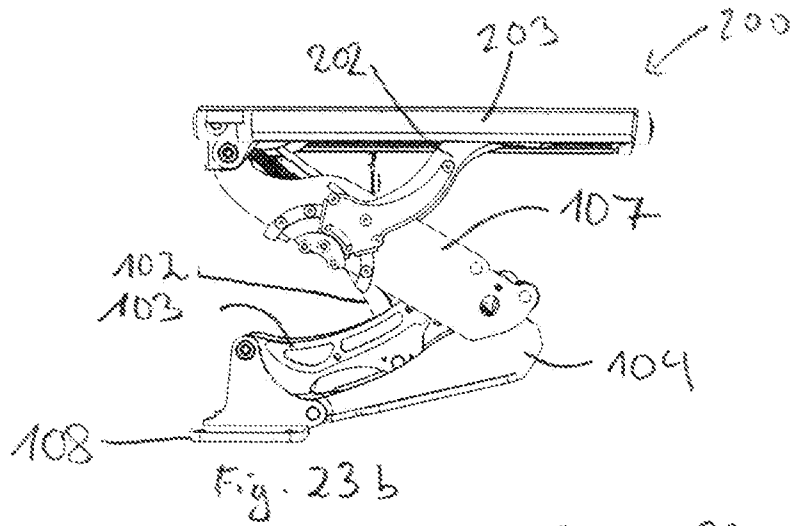
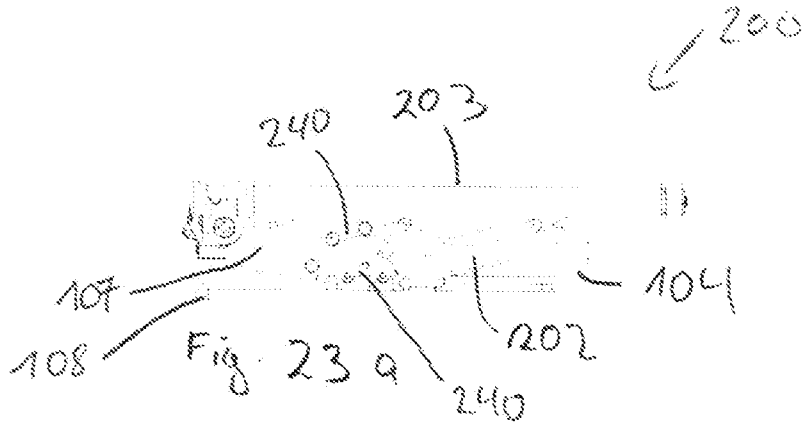


Fig 21

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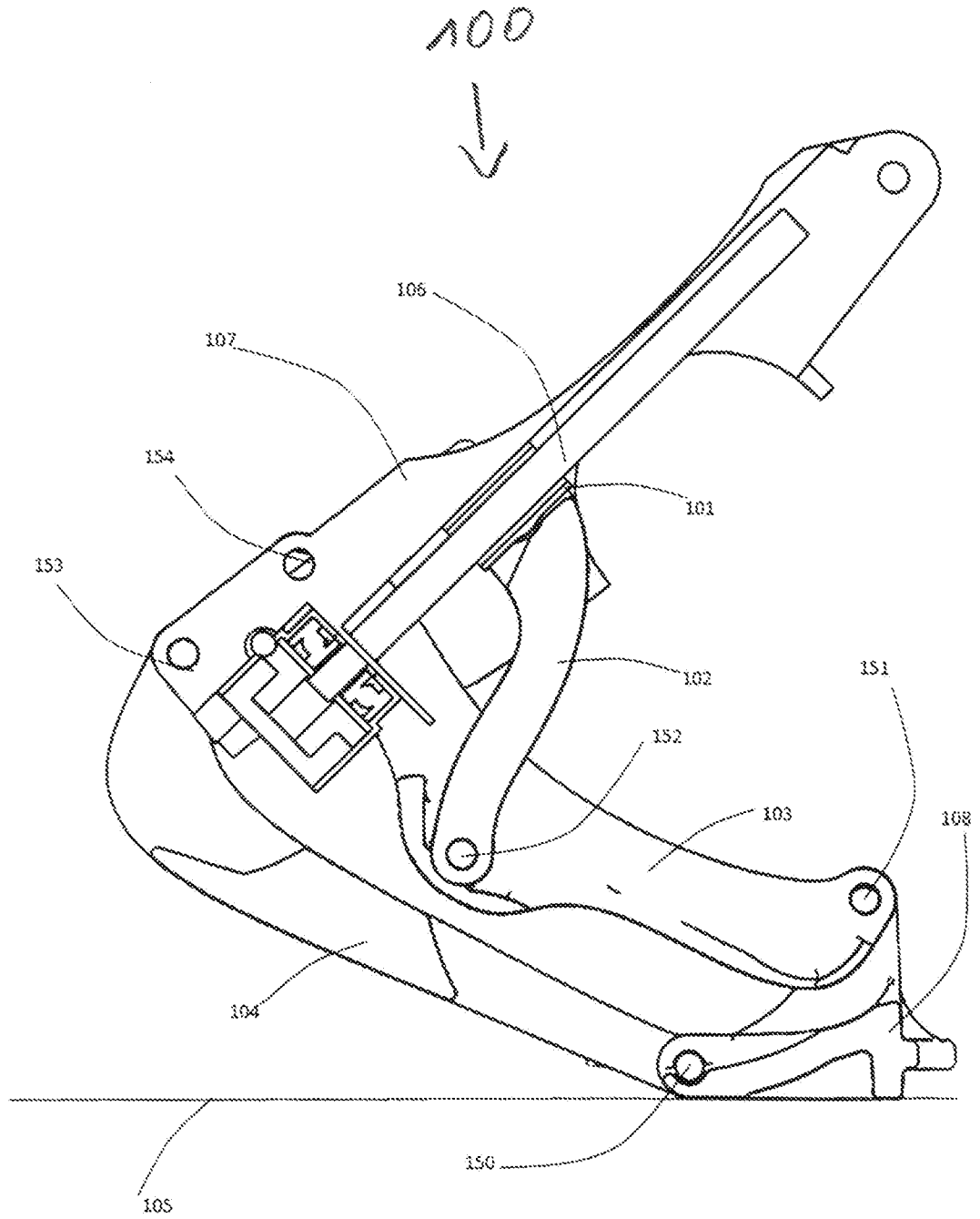


Fig. 24

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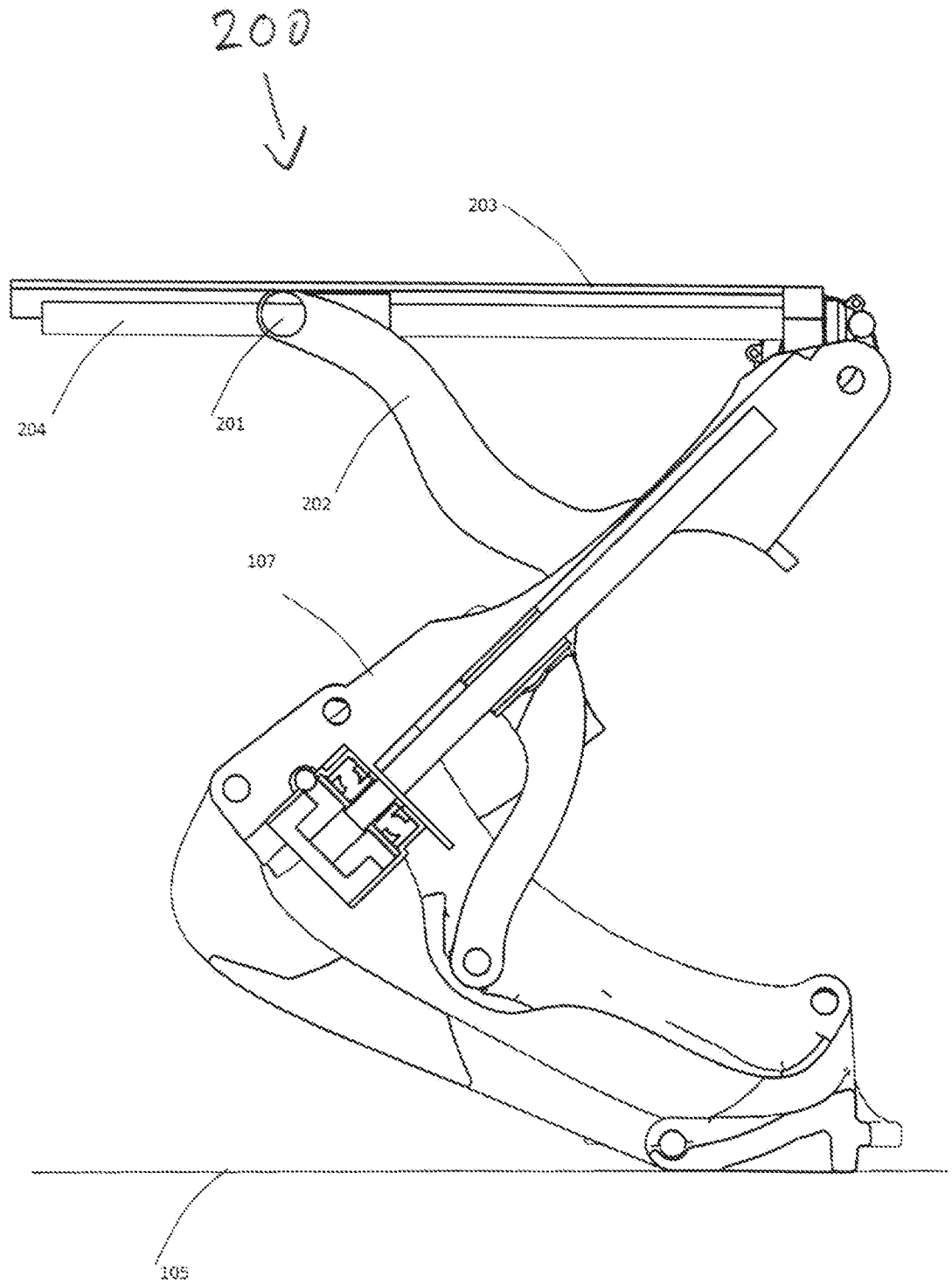
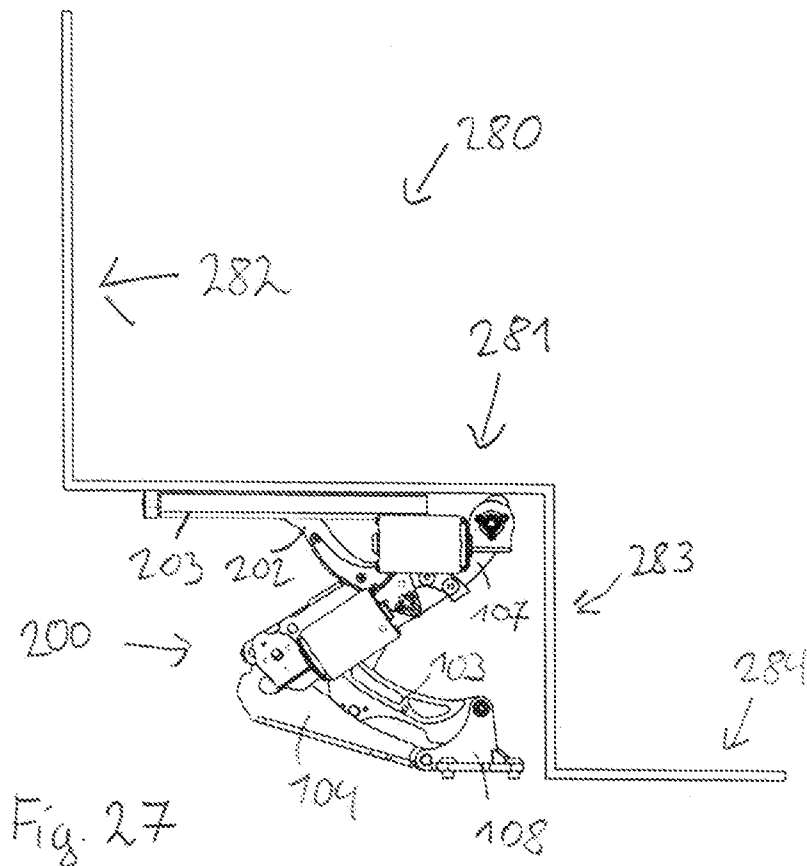
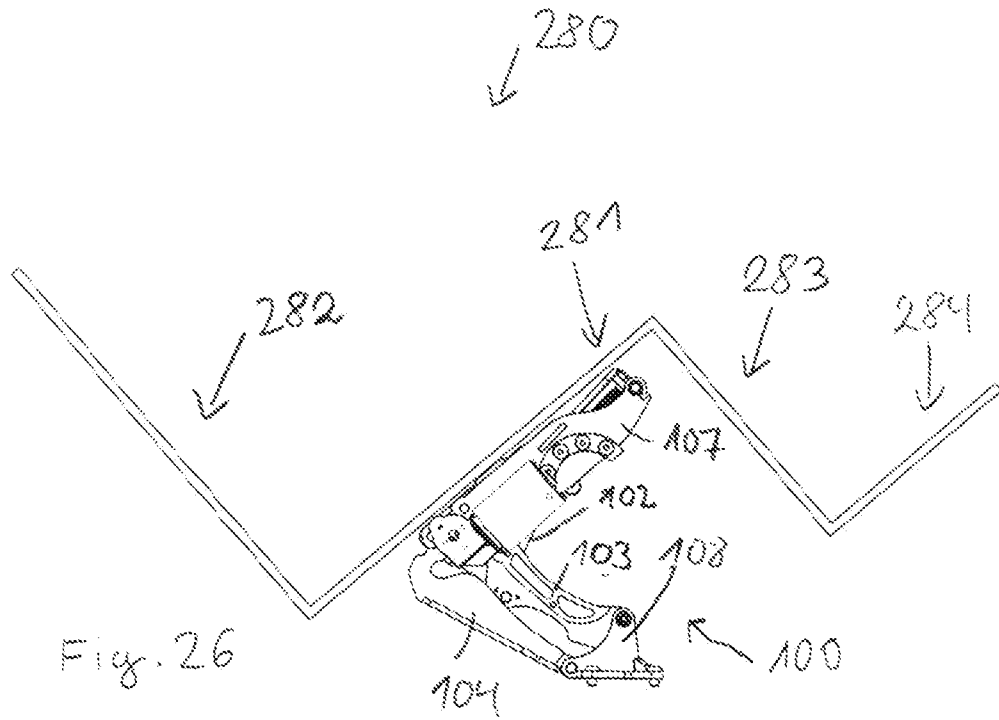
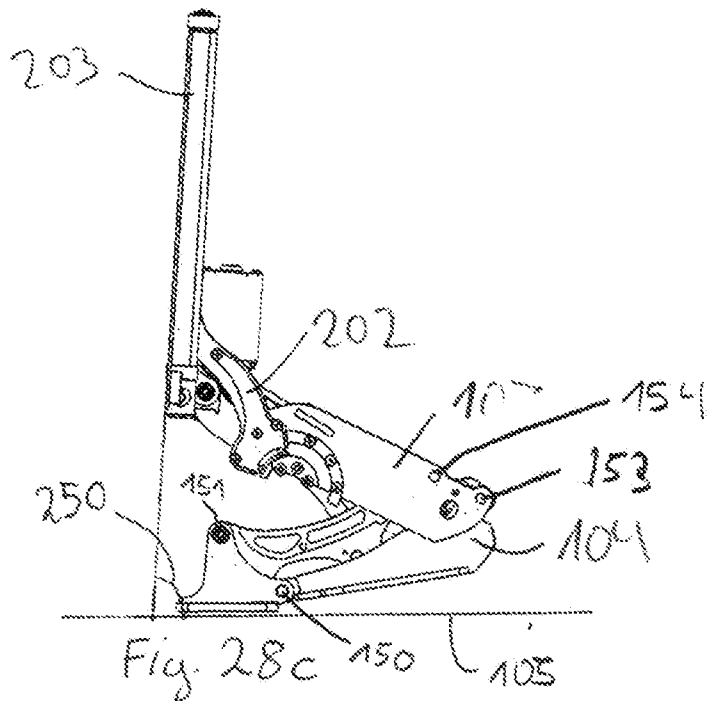
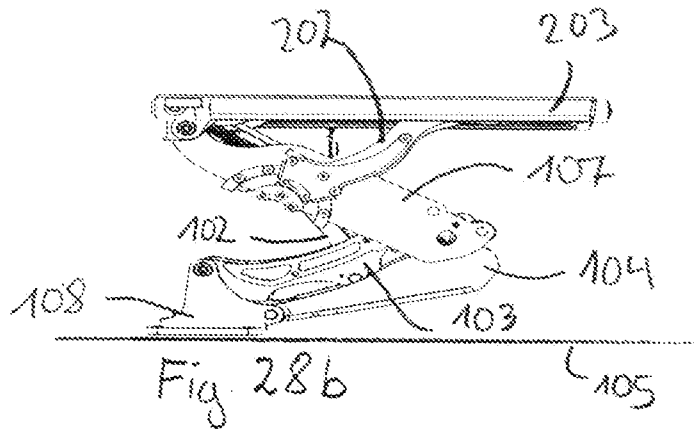
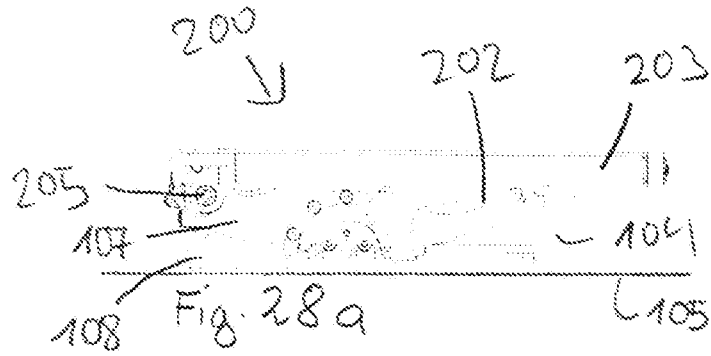


Fig. 25



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INTERNATIONAL SEARCH REPORT

International application No.

PCT/DK2019/050065

A. CLASSIFICATION OF SUBJECT MATTER		
A61G 5/14 (2005.01); A61G 5/104 (2013.01); A61G 5/1059 (2013.01)		
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) IPC: A47C, A61G CPC: A47C, A61G, B66F		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched DK, NO, SE, FI: Classes as above.		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) WPI, EPODOC, English Fulltext		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2017/0296411 (MACKERT) 2017.10.19 See description paras. [0030]-[0035]; Fig. 1-3	1-10
A	US 2009/0218784 A1 (PORCHERON) 2009.09.03 See entire document	1-10
A	US 6155642 A (KAWAKAMI et al.) 2000.12.05 See entire document	1-10
A	US 5004206 A (ANDERSON) 1991.04.02 See entire document	1-10
A	WO 9215271 A1 (HAND PRO AS) 1992.09.17 See entire document	1-10
A	US 6371456 B1 (RITCHIE et al.) 2002.04.16 See entire document	1-10
A	US 3215386 A (SWENSON) 1965.11.02 See entire document	1-10
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C.		<input checked="" type="checkbox"/> See patent family annex.
* Special categories of cited documents:	<p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&" document member of the same patent family</p>	
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05/04/2019	12/04/2019	
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/DK2019/050065

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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A	US 6354556 B1 (RITCHIE et al.) 2002.03.12 See entire document	1-10
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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/DK2019/050065

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