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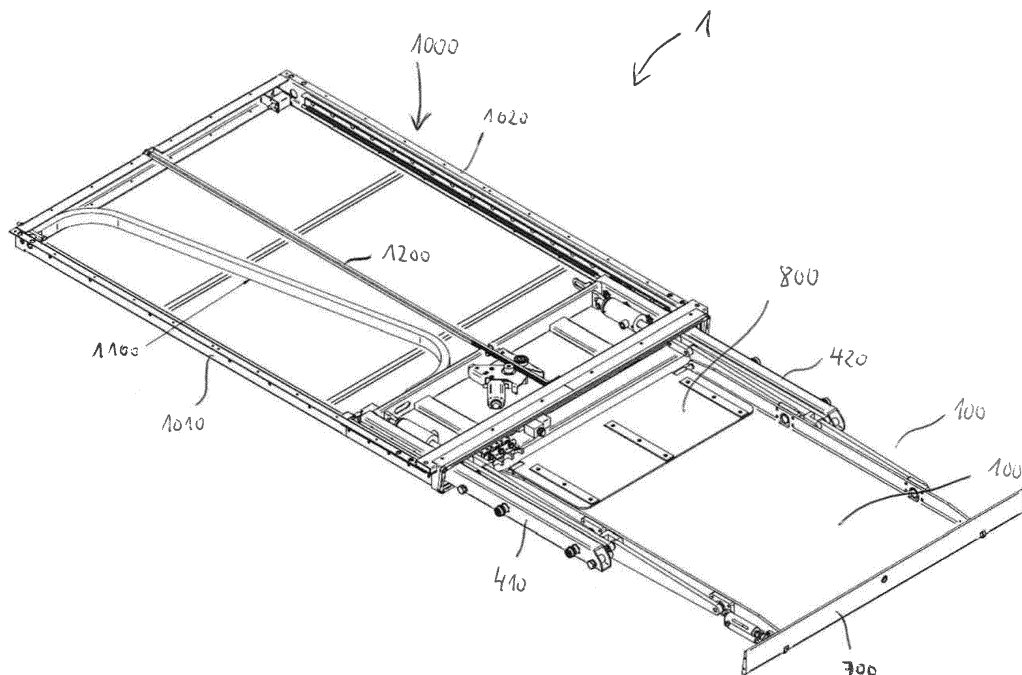
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(54) **WHEELCHAIR LIFT FOR MOUNTING TO A BOTTOM SIDE OF A VEHICLE**

(57) A wheelchair lift (1) for mounting to a bottom side of a vehicle comprises a platform assembly (100) being configured to support a wheelchair, at least a first and a second lifting arm (10, 20) to lift the platform assembly (100), a force-transmitting element (300) rotationally coupled to the at least one first and second lifting arm (10, 20), and a power unit (200) to provide a tensile

force to move the platform assembly (100) from one of the stowed and ground position to the entry level position. The force-transmitting element (300) is configured to transmit the tensile force provided by the power unit (200) to the at least one first and second lifting arm (10, 20) to move the platform assembly (100) from one of the stowed and ground position to the entry level position.

FIG 1



EP 3 106 141 A1

Description

Technical Field

[0001] The invention is directed to a wheelchair lift for mounting to a bottom side of a vehicle, such as a car.

Background

[0002] A vehicular wheelchair lift is utilized to facilitate lifting of a wheelchair into a vehicle. The wheelchair lift usually comprises a platform assembly to load a wheelchair, a lifting device to lift the platform assembly and a power unit to provide power for driving the lifting device. The platform assembly may be lifted by the lifting device from a ground position outside the vehicle to an entry level position having the level of the floor of the vehicle so that a person sitting in the wheelchair can enter the vehicle.

[0003] The wheelchair lift may be disposed inside the vehicle. However, wheelchair lifts which are mounted inside the car are usually bulky devices which waste a lot of area inside the vehicle. Another generation of wheelchair lifts, the so called underfloor lifts, are mounted to a bottom side of the vehicle. An underfloor wheelchair lift usually comprises a cassette in which the platform assembly and the mechanical components, such as the lifting device, and the power unit are housed.

[0004] The underfloor wheelchair lift has to be constructed with a low construction height so that the cassette of the wheelchair lift may be mounted to the bottom side of the vehicle with sufficient distance from the ground. Furthermore, the construction of the underfloor wheelchair lift should ensure that the wheelchair lift can be mounted to the bottom side of the vehicle without modifying components of the vehicle, such as a tank or an exhaust system, or modifying the arrangement of such components.

[0005] There is need to provide a wheelchair lift for mounting to a bottom side of a vehicle without the need to modify components of the vehicle and having a low construction height.

Summary

[0006] An embodiment of a wheelchair lift for mounting to a bottom side of a vehicle is specified in claim 1.

[0007] According to an embodiment of the wheelchair lift for mounting to a bottom side of a vehicle, the wheelchair lift comprises a platform assembly being configured to support a wheelchair and to be moved between an entry level position, a stowed position and a ground position, wherein the entry level position is above the stowed position and above the ground position, and wherein the stowed position is between the entry level position and the ground position.

[0008] The wheelchair lift comprises a power unit to provide a tensile force to move the platform assembly

from one of the stowed and ground position to the entry level position and at least a first and second lifting arm respectively being coupled to the platform assembly to lift the platform assembly. The at least one first and the at least one second lifting arm are rotationally coupled to the platform assembly. The wheelchair lift further comprises a force-transmitting element being coupled to the at least one first and second lifting arm to transmit the tensile force provided by the power unit to the at least one first and second lifting arm to move the platform assembly from said one of the stowed and ground position to the entry level position.

[0009] The platform assembly is moved by means of the at least one first and second lifting arm from one of the stowed and ground position to the entry level position, wherein the power unit provides a tensile force exerted to the force-transmitting element so that the at least one first and second lifting arm swing up from said one of the stowed and ground position to the entry level position. The use of a tensile force exerted to the force-transmitting element enables mechanical components of the wheelchair lift, especially the force-transmitting element, to be provided with a low construction height.

[0010] The force-transmitting element may be configured as a small bar or even a chain. The embodiment of the underfloor wheelchair lift based on lifting up the platform assembly by a tensile force allows the lift to be provided with a construction height of the cassette of about only 70 mm to ensure sufficient clearance height between the cassette of the wheelchair lift and the ground level under the vehicle. Furthermore, the compact design of the underfloor wheelchair lift allows that the wheelchair lift can be mounted to the bottom side of the vehicle without modifying the arrangement of components of the vehicle, or modifying the components themselves.

[0011] It is to be understood that both the foregoing general description and the following detailed description present embodiments and are intended to provide an overview or a framework for understanding the nature and character of the disclosure. The accompanying drawings are included to provide a further understanding, and are incorporated into and constitute a part of this specification. The drawings illustrate various embodiments and, together with the description, serve to explain the principles and operation of the concepts disclosed.

Brief Description of the Drawings

[0012]

Figure 1 shows an embodiment of an underfloor wheelchair lift comprising a platform assembly and a cassette to house the platform assembly.

Figure 2 shows an embodiment of an underfloor wheelchair lift in a stowed/neutral position without the housing cassette.

Figure 3 shows an embodiment of an underfloor wheelchair lift with the platform assembly lifted to an entry level position without the cassette.

Figure 4 shows an embodiment of a wheelchair lift with a platform assembly lowered to a ground position without the cassette.

Figure 5 shows an embodiment of a lifting arm of the underfloor wheelchair lift.

Detailed Description

[0013] Embodiments of the wheelchair lift 1 for mounting to a bottom side of a vehicle, for example a car, are explained in the following with reference to Figures 1 to 5.

[0014] Figure 1 shows the wheelchair lift comprising a platform assembly 100 and the mechanics to move the platform assembly as well as a cassette 1000 for housing the platform assembly and the mechanics. Figures 2 to 4 show the wheelchair lift, wherein the platform assembly is moved to different levels. Figure 2 shows the platform assembly moved to a neutral or stowed position for being inserted in the cassette 1000. Figure 3 shows the platform assembly 100 moved to an entry level position at the level of the floor of a vehicle, and Figure 4 shows the wheelchair lift 1 with the platform assembly 100 lowered to the ground position. Figure 5 illustrates details of a lifting arm to lift and lower the platform assembly.

[0015] The wheelchair lift 1 comprises a platform assembly 100 being configured to support a wheelchair and to be moved between an entry level position, a stowed or neutral position and a ground position. The entry level position is above the stowed position and above the ground position, and the stowed position is between the entry level position and the ground position. The platform assembly may comprise a plate 110 to be loaded by wheelchair and side panels 120 and 130.

[0016] The wheelchair lift 1 comprises a power unit 200 to provide a tensile force to move the platform assembly 100 from one of the stowed and ground position to the entry level position. The power unit may comprise a hydraulic pressure cylinder 201 to provide the tensile force. The power unit 200 may comprise a plunger 202 extending out of the cylinder 201 to exert a tensile force to the components coupled to the plunger 202.

[0017] The wheelchair lift 1 further comprises at least a first and a second lifting arm 10, 20 coupled to the platform assembly to lift the platform assembly 100. The at least one first and second lifting arm 10, 20 is rotationally coupled to the platform assembly 100 so that the plate 110 of the platform assembly is kept in a vertical position during the movement of the lifting arms.

[0018] The wheelchair lift 1 comprises a force-transmitting element 300 rotationally coupled to the at least one first and second lifting arm 10, 20 to transmit the tensile force provided by the power unit 200 to the first and second lifting arm 10, 20 to move the platform as-

sembly 100 from one of the stowed and ground position to the entry level position. The force-transmitting element may be rotationally coupled to the lifting arms 10, 20 so that the lifting arms can be moved upwards, when the force-transmitting element is drawn towards the power unit 200.

[0019] The force-transmitting element 300 may be configured as one of a drawbar and a chain. The power unit 200 is mechanically coupled to the force-transmitting element 300. The power unit may be coupled to the force-transmitting element 300 by means of an intermediate element 60. The intermediate element 60 may be embodied to balance any possible offset between the mounting of the power unit 200 and the force-transmitting element 300. The intermediate element 60 may be coupled to the force-transmitting element 300 by a hinge element 61. The plunger 201 may be coupled to the intermediate element 60 to exert the tensile force via the intermediate element 60 to the force-transmitting element 300.

[0020] The wheelchair 1 comprise a frame 400 to which the power unit 200 and the at least one first and second lifting arm 10 and 20 are moveably mounted. The frame 400 may comprise longitudinal rails 410, 420 and lateral rails 430, 440. The power unit 200 is moveably, i.e. flexibly, mounted to the lateral rail 430. The at least one first and second lifting arm 10 and 20 are rotatably mounted to the longitudinal rail 410. The at least one first and second lifting arm 10, 20 respectively comprise an end section E10a, E20a as well as a hinge element 11, 21 and a hinge element 12, 22. The respective hinge element 11, 21 of the at least one first and second lifting arm 10, 20 is disposed at the respective end section E10a, E20a of the at least one first and second lifting arm 10, 20 and the frame 400, especially at the longitudinal rail 410, to rotationally couple the at least one first and second lifting arm 10, 20 to the frame 400. The respective hinge element 12, 22 of the at least one first and second lifting arm 10, 20 is disposed at the respective end section E10a, E20a of the at least one first and second lifting arms 10, 20 and the force-transmitting element 300 to rotationally couple the at least one first and second lifting arm 10, 20 to the force-transmitting element 300.

[0021] The platform assembly 100 has a side S100a from which the platform assembly is accessible by the wheelchair in the entry level position, for example from the floor of the vehicle to which the platform assembly is lifted, and a side S100b from which the platform assembly 100 is accessible by the wheelchair in the ground position, for example from the soil to which the platform assembly is lowered. The at least one first lifting arm is rotationally coupled to the platform assembly at a location L1 of the platform assembly 100. The at least one second lifting arm 20 is rotationally coupled to the platform assembly 100 at a location L2 of the platform assembly 100. The location L1 of the platform assembly 100 is arranged closer to the side S100a of the platform assembly 100 than the location L2 of the platform assembly 100.

The location L2 of the platform assembly 100 is arranged closer to the side S100b of the platform assembly 100 than the location L1 of the platform assembly 100. The locations L1 and L2 may be placed at the side panel 120.

[0022] The at least one first and second lifting arm 10, 20 of the wheelchair lift 1 respectively comprise an end section E10b, E20b. The at least one first and second lifting arm 10, 20 respectively comprise a hinge element 13, 23. The hinge element 13 of the at least one first lifting arm 10 is disposed at the end section E10b of the at least one first lifting arm 10 and the location L1 of the platform assembly 100 to rotationally couple the at least one first lifting arm 10 to the platform assembly 100. The hinge element 23 of the at least one second lifting arm 20 is disposed at the end section E20b of the at least one second lifting arm 20 and the location L2 of the platform assembly 100 to rotationally couple the at least one lifting arm 20 to the platform assembly 100.

[0023] The wheelchair lift 1 comprises at least a third and a fourth lifting arm 30, 40 to lift the platform assembly 100. The at least one third lifting arm 30 is rotationally coupled to the platform assembly 100 at a location L3 of the platform assembly 100. The at least one fourth lifting arm 40 is rotationally coupled to the platform assembly 100 at a location L4 of the platform assembly 100. The location L3 of the platform assembly 100 is arranged closer to the side S100a of the platform assembly 100 than the location L4 of the platform assembly 100 and arranged opposite to the location L1 of the platform assembly 100. The location L4 of the platform assembly 100 is arranged closer to the side S100b of the platform assembly 100 than the location L3 of the platform assembly 100 and arranged opposite to the location L2 of the platform assembly 100. The locations L3 and L4 are placed at the side panel 420 of the frame 400.

[0024] At least one of the at least one third and fourth lifting arm 30, 40 is coupled to at least one of the first and second lifting arm 10, 20 so that the movement of the at least one third and fourth lifting arm 30, 40 is performed simultaneously to the movement of the at least one first and second lifting arm 10, 20.

[0025] The wheelchair lift 1 may comprise another force-transmitting element 310. The at least one third and fourth lifting arm 30, 40 are moveably coupled to the force-transmitting element 310 to couple the movement of the at least one fourth lifting arm 40 to the movement of the at least one third lifting arm 30.

[0026] According to an embodiment of the wheelchair lift 1, the wheelchair lift may comprise another power unit 210. The power unit 200 provides a first amount of the tensile force and the other power unit 210 provides a second amount of the tensile force. The force-transmitting element 300 is mechanically coupled to the power unit 200 so that the power unit 200 exerts the first amount of the tensile force to the force-transmitting element 300, for example by means of the plunger 201 and via the intermediate element 60. The force-transmitting element 310 is mechanically coupled to the power unit 210 so that

the power unit 210 exerts the second amount of the tensile force to the force-transmitting element 310.

[0027] The power unit 210 may be embodied in the same way as the power unit 200. The power unit 210 may comprise a hydraulic pressure cylinder 201 to provide the tensile force. The power unit 210 may comprise a plunger 202 extending out of the cylinder 201 to exert a tensile force to the components coupled to the plunger 202.

[0028] The other power unit 210 and the at least one third and fourth lifting arm 30, 40 are moveably mounted to the frame 400. The force-transmitting element 310 may be embodied in the same way as the force-transmitting element 310, i.e. the force-transmitting element 310 may be configured as one of a drawbar and a chain. The power unit 210 is mechanically coupled to force-transmitting element 310. The power unit may be coupled to the force-transmitting element 310 by means of an intermediate element 60. The intermediate element 60 may be embodied to balance any possible offset between the mounting of the power unit 210 and the force-transmitting element 310. The intermediate element 60 may be coupled to the force-transmitting element 310 by a hinge element 61. The plunger 201 may be coupled to the intermediate element 60 to exert the tensile force via the intermediate element 60 to the force-transmitting element 310. The construction allows to lift the platform assembly 100 from one of the stowed and ground position to the entry level position by drawing the force-transmitting element 310 towards the power unit 210 which causes rising of the lifting arms 30 and 40.

[0029] The at least one third and fourth lifting arm 30, 40 respectively comprise a first end portion E30a, E40a. The at least one third and fourth lifting arm 30, 40 respectively comprise a hinge element 31, 41 and a hinge element 32, 42. The respective hinge element 31, 41 of the at least one third and fourth lifting arm 30, 40 is disposed at the respective end section E30a of the at least one third and fourth lifting arm 30, 40 and the frame 400, especially the longitudinal rail 420 of the frame, to rotationally couple the at least one third and fourth lifting arm 30, 40 to the frame 400. The respective hinge element 32, 42 of the at least one third and fourth lifting arm 30, 40 is disposed at the respective end section E30a, E40a of the at least one third and fourth lifting arm 30, 40 and the force-transmitting element 310 to rotationally couple the at least one third and fourth lifting arm 30, 40 to the force-transmitting element 310.

[0030] The at least one third and fourth lifting arm 30, 40 respectively comprise an end section E30b, E40b. The at least one third and fourth lifting arm 30, 40 respectively comprise a hinge element 33, 43. The hinge element 33 of the at least one third lifting arm 30 is disposed at the end section E30b of the at least one lifting arm 30 and the location L3 of the platform assembly 100 to rotationally couple the at least one third lifting arm 30 to the platform assembly 100. The hinge element 43 of the at least one fourth lifting arm 40 is disposed at the second

end section E40b of the at least one fourth lifting arm 40 and the location L4 of the platform assembly 100 to rotationally couple the at least one fourth lifting arm 40 to the platform assembly 100.

[0031] According to an embodiment of the wheelchair lift, the wheelchair lift 1 comprises a connecting rod 50 to connect the at least one first lifting arm 10 to the at least one third lifting arm 30. An end E50a of the connecting rod 50 is fixed to the at least one first lifting arm 10 and another end E50b of the connecting rod 50 is fixed to the at least one third lifting arm 30 so that the outer surface S50 of the connecting rod 50 rotates around the longitudinal axis of the connecting rod 50 by the rotational movement of the at least one first and third lifting arm 30, 40 around the pivot points 31 and 41.

[0032] According to the embodiment of the wheelchair lift all of the lifting arms 10, 20, 30 and 40 are mechanically coupled to each other. The at least one first and second lifting arm 10 and 20 are mechanically coupled by the force-transmitting element 300, and the at least one third and fourth lifting arm 30 and 40 are mechanically coupled by the force-transmitting element 310. The at least one first and third lifting arm 10 and 30 are mechanically coupled by the connecting element 50. The mechanical coupling of the lifting arms enables that the respective movement of the lifting arms is coupled to each other so that the lifting arms 10, 20, 30 and 40 are moved simultaneously and synchronously.

[0033] According to an embodiment of the wheelchair lift, the wheelchair lift 1 comprises a cassette 1000 to house the power units 200, 210, the force-transmitting elements 300, 310 and the lifting arms 10, 20, 30 and 40. The wheelchair lift comprises a motor 900 to move the platform assembly 100 in and out of the cassette 1000. The motor 900 may slide along a bar 1200 of the cassette 1000. The cassette 1000 comprises two longitudinal guiding rails 1010 and 1020. A roll unit 450 is mounted to each of the longitudinal rails 410 and 420 of the frame 400. The rolls of the roll unit 450 slides in the guiding rails 1010 and 1020 to move the platform assembly 100 in and out of the cassette 1000.

[0034] According to an embodiment of the wheelchair lift, the wheelchair lift 1 may comprise at least one sensor 610, 620, 630 to detect a position of the platform assembly 100. The at least one sensor 610, 620, 630 is firmly mounted to the frame 400. According to the exemplary embodiment of the wheelchair lift 1 shown in Figures 1 to 4, a first sensor 610, a second sensor 620 and a third sensor 630 are firmly mounted to the lateral rail 440 of the frame 400.

[0035] The connecting rod 50 comprises at least one structured profile 510, 520, 530 being arranged on the outer surface S50 of the connecting rod 50 so that the at least one structured profile 510, 520, 530 rotates around the longitudinal axis of the connecting rod 50 and moves in relation to the at least one sensor 610, 620, 630 during the movement of the at least one first and third lifting arm 10, 30. The at least one sensor 610, 620, 630 is config-

ured to detect the position of the platform assembly 100 in dependence on the position of the structured profile in relation to the position of the at least one sensor 610, 620, 630.

[0036] The wheelchair lift 1 may comprise a roll stop means 700 being moveably disposed at the side S100b of the platform assembly 100 and a link bridge 800 being moveably arranged at the side S100a of the platform assembly 100. The roll stop means 700 is configured to be moved in dependence on the detecting of the position of the platform assembly 100 by means of the at least one sensor 610, 620, 630. The wheelchair lift 1 is configured to be moved in the cassette 1000 by the motor 900 in dependence on the detecting of the position of the platform assembly 100 by means of the at least one sensor 610, 620, 630. Furthermore, the power unit 200 and the other power unit 210 may be configured to be activated to provide the tensile force to the force-transmitting elements 300, 310 to move the platform assembly 100 in dependence on the detecting of the position of the platform assembly 100 by means of the at least one sensor 610, 620 and 630.

[0037] According to a possible embodiment, the wheelchair lift may comprise a first, a second and a third sensor 610, 620 and 630 being respectively configured as a micro-switch. The at least one structured profile may comprise a first profile 510, a second profile 520 and a third profile 530. Each of the sensors 610, 620 and 630 may be activated by one of the profiles 510, 520 and 530 by rotating the connecting rod 50 during the movement of the lifting arms 10 and 30 and the movement of the platform assembly 100.

[0038] When embodied as a micro-switch, the first sensor 610 may be activated so that the motor 900 is turned on to move the platform assembly 100 into the cassette 1000. The sensor 610 is activated/turned on by the structured profile 510 when the connecting rod 50 and thus the structured profile 510 rotates around the longitudinal axis of the connecting element 50 during the movement of the platform assembly 100 and the platform reaches the neutral/stowed position.

[0039] When embodied as a micro-switch, the second sensor 620 may be activated such that the power units 200, 210 are controlled to provide or stop providing the tensile force to move the platform assembly 100. According to a possible embodiment, the sensor 620 is activated/turned on by the structured profile 520 when the connecting rod 50 and thus the structured profile 520 rotates around the longitudinal axis of the connecting element 50 during the movement of the platform assembly 100 and the platform reaches the entry level position. When the entry level position is detected by the activation of the sensor 620, the power units 200, 210 are controlled to stop providing the tensile force so that the movement of the platform assembly 100 is stopped.

[0040] When embodied as a micro-switch, the third sensor 630 may be activated to lower the roll-stop means 700. The sensor 630 is activated/turned on by the struc-

tured profile 530 when the connecting rod 50 and thus the structured profile 530 rotates around the longitudinal axis of the connecting element 50 during the movement of the platform assembly 100 and the platform reaches a pre-defined distance, for example a distance of 5 cm above the ground.

[0041] Figure 5 shows a possible embodiment of the lifting arms, wherein for reasons of simplicity only the first lifting arm 10 is illustrated in Figure 5. The second, third and fourth lifting arm 20, 30 and 40 are embodied in the same manner. The lifting arm comprises holes 11' and 12' located at the end section E10a and a hole 13' located at the end section E10b of the lifting arm. The hole 11' is configured to receive the hinge element 11, and the hole 12' is configured to receive the hinge element 12. The hinge element 13' is disposed in the hole 13'. The holes 11' and 12' are disposed by an offset at the end section E10a of the lifting arm to ensure that the platform assembly is not moved in a dead center when the platform arrives at the stowed/neutral position.

[0042] The function of the wheelchair lift 1 is described in the following with reference to the above-discussed embodiments shown in Figure 1 to 5. The cassette 1000 of the wheelchair lift with the platform assembly 100 and the mechanics to move the platform assembly housed within the cassette is mounted to the bottom side of a vehicle. In order to use the wheelchair lift for loading a wheelchair and moving the wheelchair between the ground position and the entry level position or vice versa, the platform assembly 100 has to be moved out of the cassette 1000.

[0043] If the first sensor 610 detects that the platform assembly 100 is situated in the neutral/stowed position, the platform assembly may be moved out of the cassette 1000 by means of the motor 900. Figure 1 shows the platform assembly 100 moved out of the cassette 1000. The lifting arms 10, 20, 30 and 40 are arranged in parallel to the plate 110 of the platform assembly 100. The respective plungers 202 of the power units 200 and 210 are in a medium position between a fully extended position and a fully retracted position. The roll stop means 700 is flapped to a vertical position and the link bridge 800 is folded towards the plate 110 of the platform assembly. When the plate 110 of the platform assembly is completely moved out of the cassette 1000, the link bridge 800 rises by a spring mechanism in a vertical position as shown in Figure 4.

[0044] In order to lift up the platform assembly 100 from the stowed/neutral position into the entry level position, the power unit 200 and the other power unit 210 are activated to provide the tensile force to move the platform assembly 100. In order to generate the tensile force, the respective plungers 202 of the power units 200 and 210 are retracted so that the force-transmitting element 300 and the other force-transmitting element 310 are retracted in the direction towards the power units 200, 210 and the crossbar 430 of the frame 400. As a consequence, the lifting arms 10, 20, 30 and 40 are turned around their

respective hinge element 11, 21, 31 and 41 representing the pivotal point of the rotational movement of the lifting arms 10, 20, 30 and 40. The lifting arms 10, 20, 30 and 40 swing up so that the platform assembly 100 is lifted up to the entry level position as shown in Figure 3. The mechanical coupling of the lifting arms 10, 20, 30 and 40 among each other by means of the force-transmitting elements 300, 310 and the connecting rod 50 enable the lifting arms to be moved simultaneously.

[0045] During the rotational movement of the lifting arms 10 and 30 around the hinge elements 11 and 31, the connecting rod 50 which is centred with its longitudinal axis to the respective pivotal point of the lifting arms 10 and 30, i.e. the hinge elements 11 and 31, is rotated around its longitudinal axis so that the structured profiles 510, 520 and 530 also perform a rotational movement around the longitudinal axis of the connecting rod. The structured profile 530 activates the sensor 630, for example, a micro-switch to detect when the platform assembly 100 arrives at the entry level position. When the sensor 630 detects the entry level position by means of the current position of the rotated structured profile 530, the power units 200 and 210 stop providing the tensile force to further retract the force-transmitting elements 300 and 310. Thus, the lifting-up movement of the platform assembly stops at the entry level position. The spring mechanism of the link bridge 800 swings open the link bridge so that a wheelchair can enter the plate 110 of the platform assembly via the link bridge 800, as shown in Figure 3.

[0046] In order to lower the platform assembly to ground level, the pressure inside the hydraulic cylinders 201 of the power units 200 and 210 is reduced so that the platform assembly 100 is moved down from the entry level position to the ground level position caused by the force of gravity due to the weight of the wheelchair. During the movement of the platform assembly 100 to the ground level the respective plunger 202 of the power units 200 and 210 is pulled out of the housing of the power units 200 and 210 and the force-transmitting elements 300 and 310 are moved away from the crossbar 430.

[0047] The lifting arms 10, 20, 30 and 40 respectively perform a rotational movement around their respective hinge element 11, 21, 31 and 41 until the plate 110 of the platform assembly 100 touches the ground, as shown in Figure 4. Before reaching the ground position, the structured profile 530 which rotates by the rotational movement of the connecting rod 50 activates the sensor 630 which may be configured as a micro-switch. When the sensor 630 is activated, for example at a position of the plate 110 of the platform assembly 100 being positioned about 5 cm above ground level, the power unit 210 is controlled such that the roll stop means 600 is lowered so that a person sitting in a wheelchair lift on the platform assembly can leave the platform assembly.

[0048] The use of a tensile force to control the movement, especially the lifting-up movement, of the platform assembly allows the mechanics, in particular the force-

transmitting elements 300 and 310, to be produced with low dimensions. The force-transmitting elements 300 and 310 may be embodied as a draw bar with a low height, for example a height of 24 mm at the highest location. The low construction height of the underfloor wheelchair lift 1 enables the wheelchair lift to be mounted to the bottom side of the vehicle without modifying any components of the vehicle and guarantees sufficient clearance between the cassette chassis and the ground.

List of Reference Signs

[0049]

1	wheelchair lift	15
10,..., 40	lifting arm	
50	connecting rod	
100	platform assembly	
200, 210	power unit	
300, 310	force-transmitting element	20
400	frame	
510, 520, 530	structured profile	
610, 620, 630	sensor	
700	roll stop means	
800	link bridge	25
900	motor	
1000	cassette	

Claims

1. A wheelchair lift for mounting to a bottom side of a vehicle, comprising:

- a platform assembly (100) being configured to support a wheelchair and to be moved between an entry level position, a stowed position and a ground position, wherein the entry level position is above the stowed position and above the ground position, and wherein the stowed position is between the entry level position and the ground position,
- a power unit (200) to provide a tensile force to move the platform assembly (100) from said one of the stowed and ground position to the entry level position,
- at least one first and second lifting arm (10, 20) respectively coupled to the platform assembly (100) to lift the platform assembly (100),
- a force-transmitting element (300) being coupled to the at least one first and second lifting arm (10, 20) to transmit the tensile force provided by the power unit (200) to the at least one first and second lifting arm (10, 20) to move the platform assembly (100) from said one of the stowed and ground position to the entry level position.

2. The wheelchair lift as claimed in claim 1, comprising:

- a frame (400) to which the power unit (200) and the at least one first and second lifting arm (10, 20) are moveably mounted,
- wherein the at least one first and second lifting arm (10, 20) respectively comprise a first end section (E10a, E20a),
- wherein the at least one first and second lifting arm (10, 20) respectively comprise a first hinge element (11, 21) and a second hinge element (12, 22),
- wherein the respective first hinge element (11, 21) of the at least one first and second lifting arm (10, 20) is disposed at the respective first end section (E10a, E20a) of the at least one first and second lifting arm (10, 20) and the frame (400) to rotationally couple the at least one first and second lifting arm (10, 20) to the frame (400),
- wherein the respective second hinge element (12, 22) of the at least one first and second lifting arm (10, 20) is disposed at the respective first end section (E10a, E20a) of the at least one first and second lifting arm (10, 20) and the force-transmitting element (300) to rotationally couple the at least one first and second lifting arm (10, 20) to the force-transmitting element (300).

3. The wheelchair lift as claimed in claim 2,

- wherein the platform assembly (100) has a first side (S100a) from which the platform assembly is accessible by the wheelchair in the entry level position and a second side (S100b) from which the platform assembly (100) is accessible by the wheelchair in the ground position,
- wherein the at least one first and second lifting arm (10) is rotationally coupled to the platform assembly (100) at a first location (L1) of the platform assembly (100), wherein the at least one second lifting arm (20) is rotationally coupled to the platform assembly (100) at a second location (L2) of the platform assembly (100), wherein the first location (L1) of the platform assembly (100) is arranged closer to the first side (S100a) of the platform assembly (100) than the second location (L2) of the platform assembly (100), and wherein the second location (L2) of the platform assembly (100) is arranged closer to the second side (S100b) of the platform assembly (100) than the first location (L1) of the platform assembly (100),
- wherein the at least one first and second lifting arm (10, 20) respectively comprise a second end section (E10b, E20b),
- wherein the at least one first and second lifting arm (10, 20) respectively comprise a third hinge element (13, 23),

- wherein the third hinge element (13) of the at least one first lifting arm (10) is disposed at the second end section (E10b) of the at least one first lifting arm (10) and the first location (L1) of the platform assembly (100) to rotationally couple the at least one first lifting arm (10) to the platform assembly (100),

- wherein the third hinge element (23) of the at least one second lifting arm (20) is disposed at the second end section (E20b) of the at least one second lifting arm (20) and the second location (L2) of the platform assembly (100) to rotationally couple the at least one second lifting arm (20) to the platform assembly (100).

4. The wheelchair lift as claimed in claim 3, comprising:

at least a third and a fourth lifting arm (30, 40) to lift the platform assembly (100), wherein the at least one third lifting arm (30) is rotationally coupled to the platform assembly (100) at a third location (L3) of the platform assembly (100), wherein the at least one fourth lifting arm (40) is rotationally coupled to the platform assembly (100) at a fourth location (L4) of the platform assembly (100), wherein the third location (L3) of the platform assembly (100) is arranged closer to the first side (S100a) of the platform assembly (100) than the fourth location (L4) of the platform assembly (100) and arranged opposite to the first location (L1) of the platform assembly (100), and wherein the fourth location (L4) of the platform assembly (100) is arranged closer to the second side (S100b) of the platform assembly (100) than the third location (L3) of the platform assembly (100) and arranged opposite to the second location (L2) of the platform assembly (100).

5. The wheelchair lift as claimed in claim 4, wherein at least one of the at least one third and fourth lifting arm (30, 40) is coupled to at least one of the at least one first and second lifting arm (10, 20) so that the movement of the at least one third and fourth lifting arm (30, 40) is performed simultaneously to the movement of the at least one first and second lifting arm (10, 20).

6. The wheelchair lift as claimed in claims 4 or 5, comprising:

another force-transmitting element (310), wherein the at least one third and fourth lifting arm (30, 40) are moveably coupled to the other force-transmitting element (310) to couple the movement of the at least one fourth lifting arm (40) to the movement of the at least one third lifting arm (30).

7. The wheelchair lift as claimed in claim 6, comprising:

- another power unit (210),
 - wherein the power unit (200) provides a first amount of the tensile force and the other power unit (210) provides a second amount of the tensile force,
 - wherein the force-transmitting element (300) is mechanically coupled to the power unit (200) so that the power unit (200) exerts the first amount of the tensile force to the force-transmitting element (300),
 - wherein the other force-transmitting element (310) is mechanically coupled to the other power unit (210) so that the other power unit (210) exerts the second amount of the tensile force to the other force-transmitting element (310).

8. The wheelchair lift as claimed in claims 6 or 7,

- wherein the other power unit (210) and the at least one third and fourth lifting arm (30, 40) are moveably mounted to the frame (400),
 - wherein the at least one third and fourth lifting arm (30, 40) respectively comprise a first end portion (E30a, E40a),
 - wherein the at least one third and fourth lifting arm (30, 40) respectively comprise a first hinge element (31, 41) and a second hinge element (32, 42),
 - wherein the respective first hinge element (31, 41) of the at least one third and fourth lifting arm (30, 40) is disposed at the respective first end section (E30a, E40a) of the at least one third and fourth lifting arm (30, 40) and the frame (400) to rotationally couple the at least one third and fourth lifting arm (30, 40) to the frame (400),
 - wherein the respective second hinge element (32, 42) of the at least one third and fourth lifting arm (30, 40) is disposed at the respective first end section (E30a, E40a) of the at least one third and fourth lifting arm (30, 40) and the other force-transmitting element (310) to rotationally couple the at least one third and fourth lifting arm (30, 40) to the other force-transmitting element (310).

9. The wheelchair lift as claimed in claim 8,

- wherein the at least one third and fourth lifting arm (30, 40) respectively comprise a second end section (E30b, E40b),
 - wherein the at least one third and fourth lifting arm (30, 40) respectively comprise a third hinge element (33, 43),
 - wherein the third hinge element (33) of the at least one third lifting arm (30) is disposed at the second end section (E30b) of the at least one

third lifting arm (30) and the third location (L3) of the platform assembly (100) to rotationally couple the at least one third lifting arm (30) to the platform assembly (100),

- wherein the third hinge element (43) of the at least one fourth lifting arm (40) is disposed at the second end section (E40b) of the at least one fourth lifting arm (40) and the fourth location (L4) of the platform assembly (100) to rotationally couple the at least one fourth lifting arm (40) to the platform assembly (100).

10. The wheelchair lift as claimed in any of the claims 4 to 9, comprising:

a connecting rod (50) to connect the at least one first lifting arm (30) to the third lifting arm (40), wherein a first end (E50a) of the connecting rod (50) is fixed to the at least one first lifting arm (10) and a second end (E50b) of the connecting rod (50) is fixed to the at least one third lifting arm (30) so that the outer surface (S50) of the connecting rod (50) rotates around the longitudinal axis of the connecting rod (50) by the movement of the at least one first and third lifting arm (30, 40).

11. The wheelchair lift as claimed in claim 10, comprising:

a cassette (1000) to house the power unit (200) and the other power unit (210) and the at least one first and second and third and fourth lifting arm (10, 20, 30, 40) and the force-transmitting element (300) and the other force-transmitting element (310) and the connecting rod (50).

12. The wheelchair lift as claimed in claims 10 or 11, comprising:

- at least one sensor (610, 620, 630) to detect a position of the platform assembly (100), wherein the at least one sensor (610, 620, 630) is mounted to the frame (400)

- wherein the connecting rod (50) comprises at least one structured profile (510, 520, 530) being arranged on the outer surface (S50) of the connecting rod (50) so that the at least one structured profile (510, 520, 530) rotates around the longitudinal axis of the connecting rod (50) and moves in relation to the at least one sensor (610, 620, 630) during the movement of the at least one first and third lifting arm (10, 30),

- wherein the at least one sensor (610, 620, 630) is configured to detect the position of the platform assembly (100) in dependence on the position of the at least one structured profile in relation to the at least one sensor (610, 620, 630).

13. The wheelchair lift as claimed in any of the claims 7 to 12, comprising:

- a roll stop means (700) being moveably disposed at the second side (S100b) of the platform assembly (100),

- wherein the roll stop means (700) is configured to be moved in dependence on the detecting of the position of the platform assembly (100) by the at least one sensor (610, 620, 630),

- wherein the wheelchair lift (1) is configured to move the platform assembly (100) in the cassette (1000) in dependence on the detecting of the position of the platform assembly (100) by the at least one sensor (610, 620, 630),

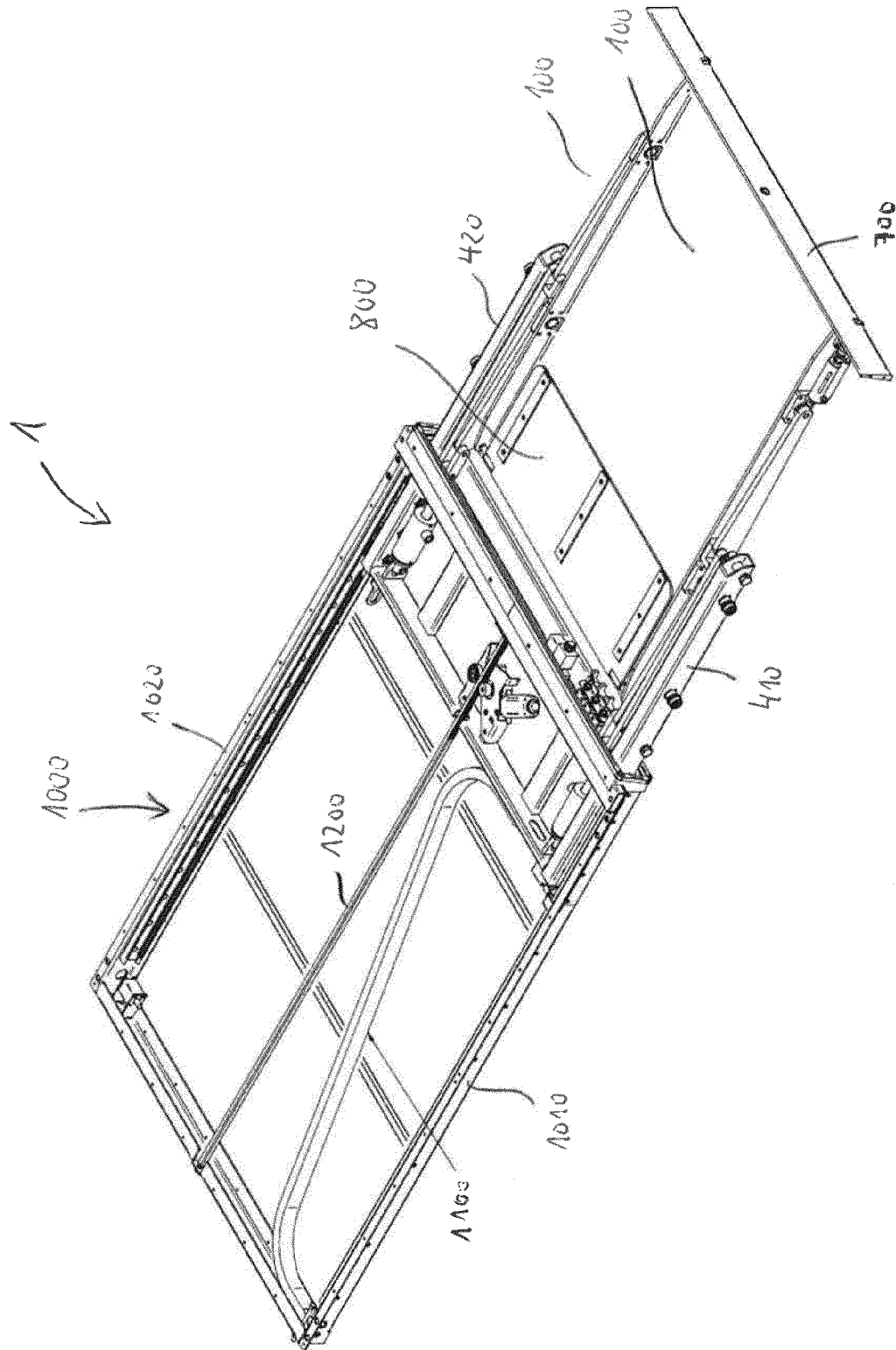
- wherein the power unit (200) and the other power unit (210) are configured to be activated to provide or stop providing the tensile force in dependence on the detecting of the position of the platform assembly (100) by the at least one sensor (610, 620, 630).

14. The wheelchair lift as claimed in any of the claims 8 to 13,

wherein the power unit (200) and the other power unit (210) respectively comprise a pressure cylinder (201) to provide the tensile force to the force-transmitting element (300) and the other force-transmitting element (310).

15. The wheelchair lift as claimed in any of the claims 7 to 14,

wherein the force-transmitting element (300) and the other force-transmitting element (310) are respectively configured as one of a bar and a chain.



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FIG 2

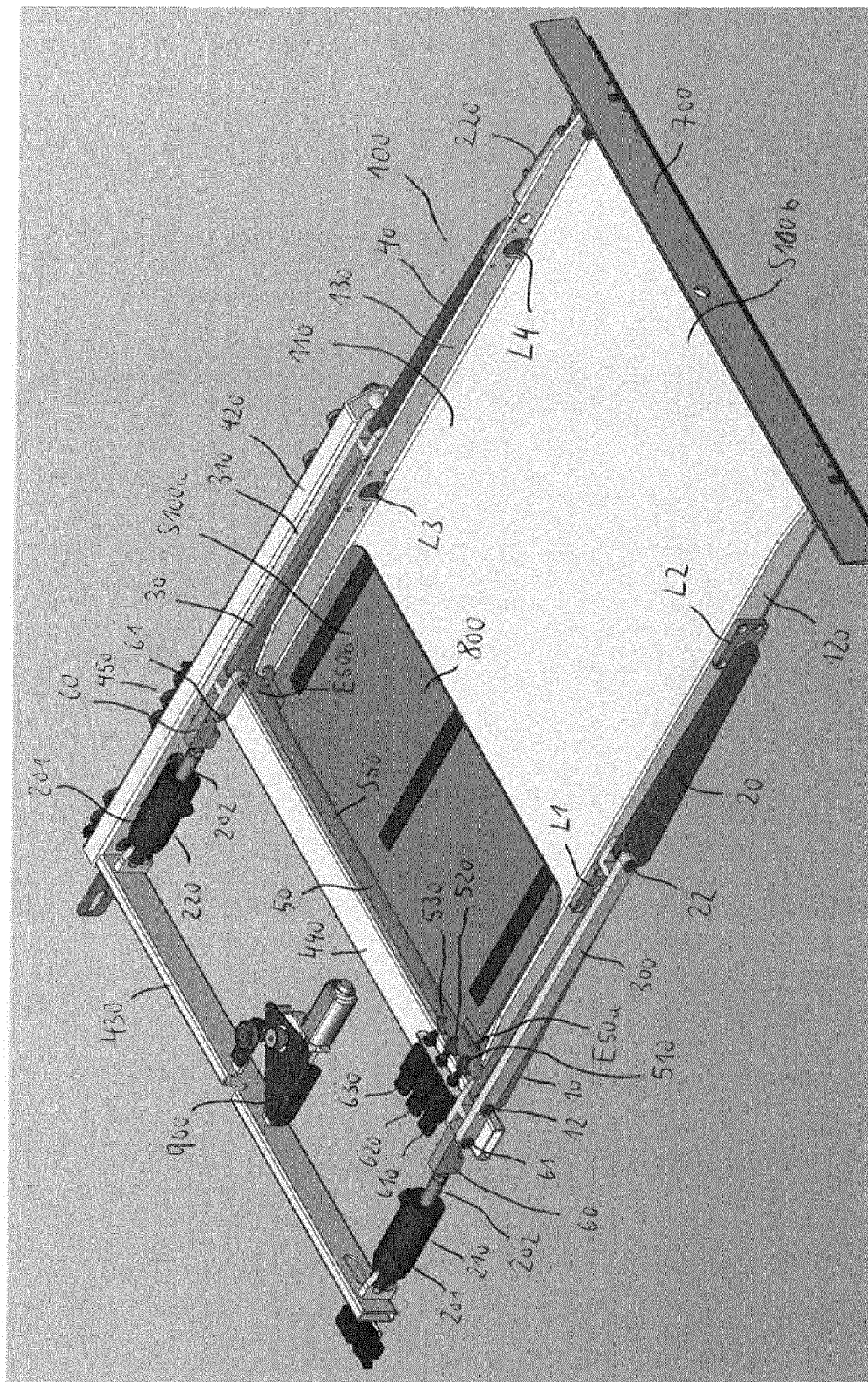


FIG 3

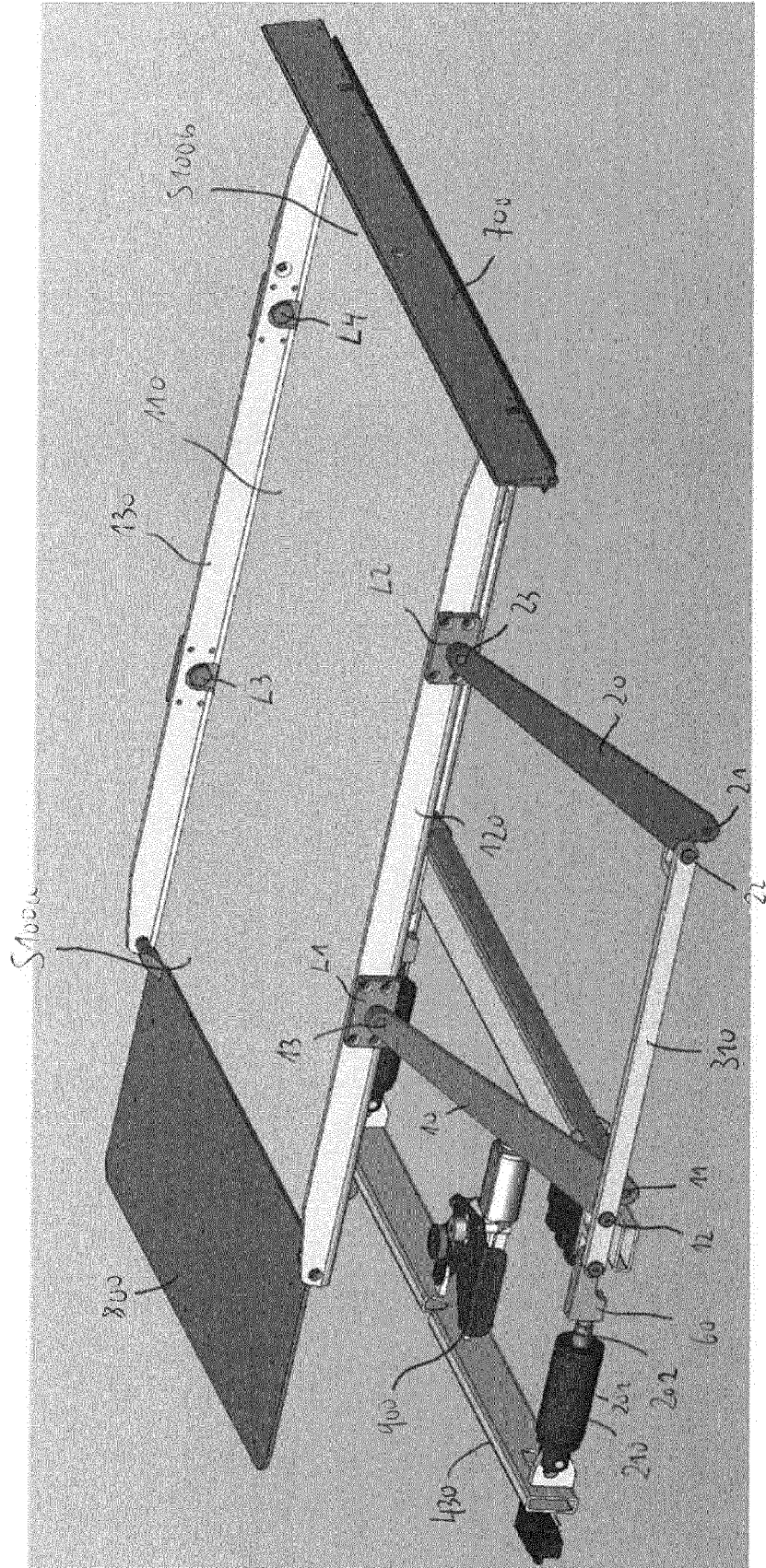


FIG 4

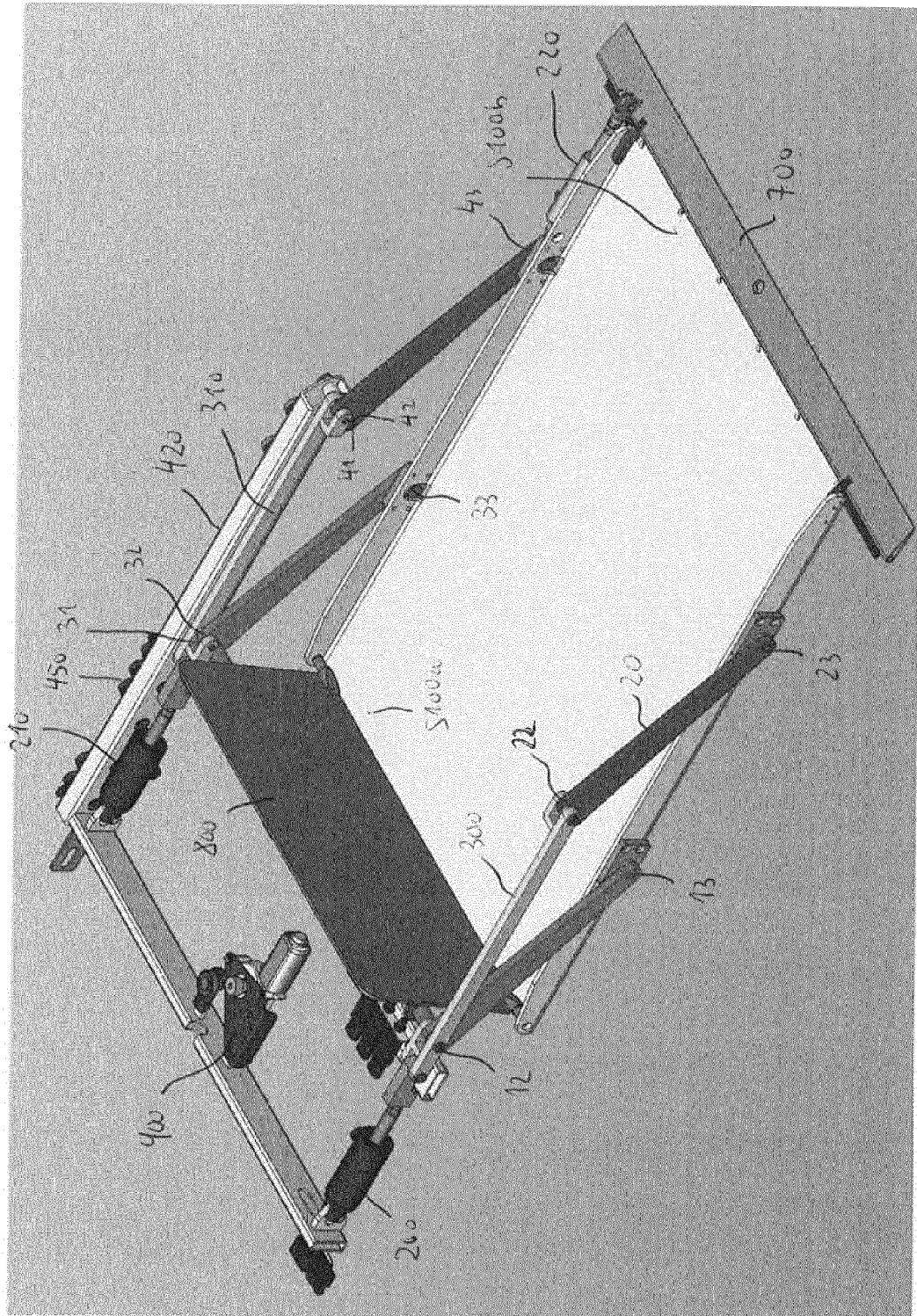
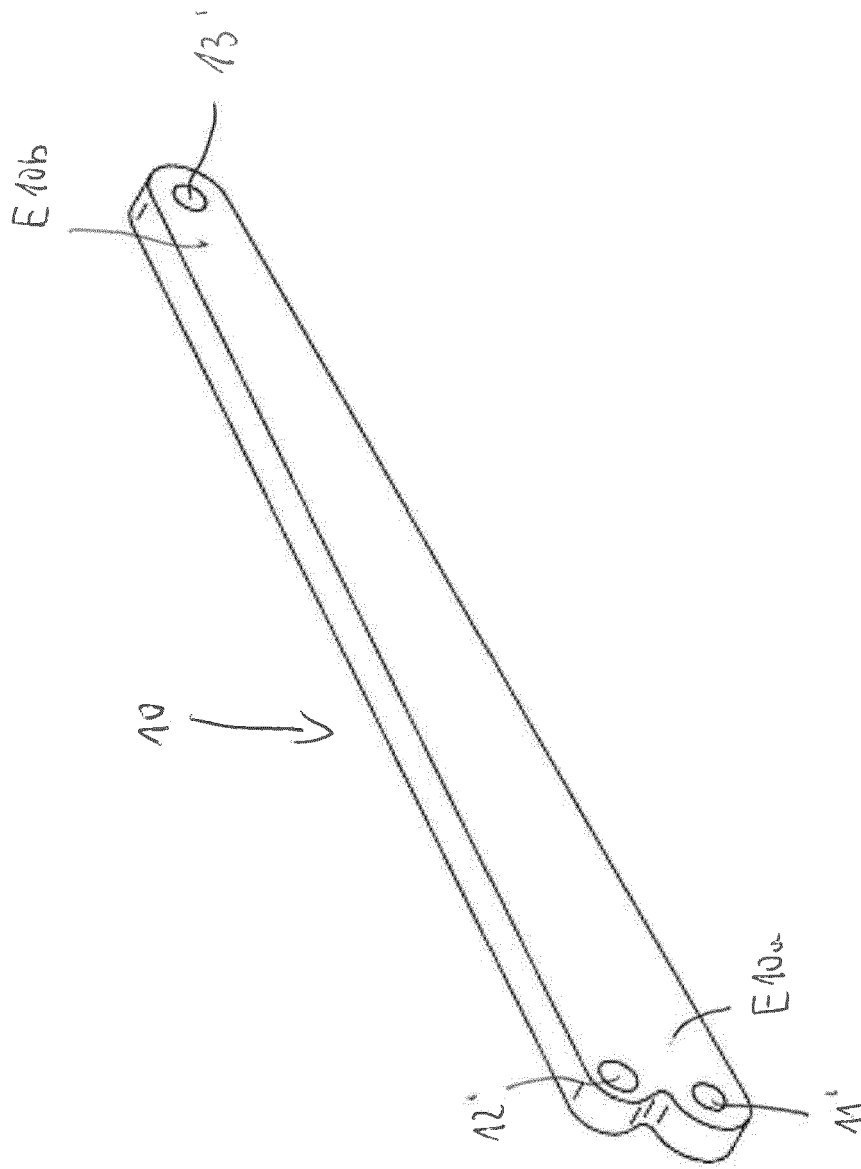


FIG 5





EUROPEAN SEARCH REPORT

Application Number
EP 15 17 2916

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			TECHNICAL FIELDS SEARCHED (IPC)
			A61G
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 25 November 2015	Examiner Edlauer, Martin
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