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Description

Wheelchair

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The invention relates to a wheelchair, comprising a frame on which wheels are rotatably arranged and a seat which can be moved relatively to the frame.

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A wheelchair of this kind is known from **EP 1 133 968 A2**. Here the seat of the wheelchair is arranged on a lifting element by which it can moved up and down to a desired height. By this equipment the usage of the wheelchair is facilitated.

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In **WO 92/04002** a wheelchair is disclosed which comes up with a seat which also can be adjusted in its height. To do this a handwheel has to be turned until the desired height is reached.

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Also, **WO 2004/098479 A1** shows a wheelchair which has means for moving the seat in vertical direction. For this purpose the seat is borne by an element which can run up and down on a vertical column which is fixed on a base frame of the wheelchair.

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DE 198 21 021 A1 shows a frame for a wheelchair which has two scissors elements which are hinged together. By those element the whole upper part of the wheelchair including the seat can be moved up and down.

A wheelchair with the possibility to lift the seat to a desired height is also known from US 5,112,076. With this arrangement the transfer of an occupant can be facilitated.

5 It is also known to equip a wheelchair with an apparatus by which the seat of the wheelchair can be moved in the longitudinal direction. US 5,058,221 shows such a solution. The seat of the wheelchair is supplied with a linear bearing arrangement being part of a movable transport device to move it into longitudinal direction without variation of the height of the seat. With this arrangement the transfer of a
10 patient between the wheelchair and a bed, toilet, etc. using the movable transport device can be facilitated.

While the usage of a wheelchair is improved by employing the above mentioned solutions there is the desire to further enlarge the possibilities of handling of a
15 occupant using the wheelchair.

Therefore, it is an o b j e c t of the invention to further improve the possibilities for using a wheelchair of the above mentioned art for facilitating the handling for an user of the wheelchair. Especially, the move to another location should be made
20 easier for the occupant of the wheelchair.

The s o l u t i o n of this object according to the invention is characterized in that moving means are arranged for simultaneously moving the seat relatively to the frame in a vertical direction and in a longitudinal direction.

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Preferably, the moving means comprise at least one joining rod articulated joined with the frame with its one end and articulated joined with the seat with its other end. Specifically, at least two joining rods are arranged spaced apart in longitudinal direction. To improve the stability of the seat four joining rods can be employed

which are arranged symmetrically to a symmetry plane of the wheelchair which is vertical and contains the longitudinal direction.

The moving means can comprise an actuator connecting the frame with the seat.
5 Alternatively, the actuator can connect at least one of the joining rods with the seat. As a further alternative, the actuator can connect at least one of the joining rods with the frame.

By this arrangement the seat of the wheelchair can be moved simultaneously in
10 vertical and longitudinal direction. The advantage of this design is that the seat of the wheelchair can be brought in a suitable position so that the occupant of the wheelchair can position himself into a position where he can easily leave or enter the wheelchair.

15 The actuator is preferably a linear actuator; it can be of the telescope type. The actuator can be equipped with an electrical motor with a drive unit for changing the effective length of the actuator. The drive unit comprises preferably a ball screw.

To make sure that the wheelchair does not tilt when the seat together with the
20 occupant of the wheelchair is brought into the foremost position the wheelchair can be equipped with a support element which is arranged at the frame, which can be moved in longitudinal direction. The support element can have at least one support wheel rotatably arranged on one of its ends. Furthermore, the at least one support wheel can be arranged on one end of an arm which is articulated arranged at the end
25 of the support element.

The support element is usefull only when the seat of the wheelchair is moved into the longitudinal direction relatively to the frame. Therefore, coupling means can be provided which move the at least one support wheel in the longitudinal direction
30 when the seat is moved in this direction, too. Also, coupling means can be provided

which swivel the arm so that the at least one support wheel approaches the ground when the the seat is moved in the longitudinal direction. The coupling means can comprise a cable or the like which is guided by rollers / pulleys. Furthermore, coupling means can be provided which draw the at least one support wheel back
5 against the longitudinal direction when the seat is moved back against this direction, i. e. when the seat is brought back to the normal using position. Also, coupling means can be provided which swivel the arm back so that the support wheel removes from the ground when the seat is moved back against the longitudinal direction. Also in this case, the coupling means can comprise a cable which is
10 guided by rollers.

To optimize the stabilisation of the wheelchair when the seat is in the foremost position two support wheels can be employed which are arranged symmetrical to a symmetry plane of the wheelchair which is vertical and contains the longitudinal
15 direction.

With the arrangement according to the invention the wheelchair has improved using properties so that the occupant of the wheelchair can easier change his position from the wheelchair to another location or seat.

20 The drawing shows an embodiment of the invention. The figures depict:

fig. 1 a perspective view of a wheelchair,

25 fig. 2 the side view of a part of the frame of the wheelchair in normal using position of the seat,

fig. 3 the side view of a part of the wheelchair in the foremost position of the seat (support element not shown),

fig. 4a the side view of the chairwheel in normal using position of the seat,

fig. 4b the view as fig. 4a during the movement of the seat in longitudinal direction,

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fig. 4c the view as fig. 4a after termination of the movement of the seat with the seat in the foremost position,

fig. 5 a perspective view of the support element of the wheelchair,

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fig. 6 the side view of the support element with coupling means for the extension of the support element,

fig. 7 the side view of the support element with coupling means for the retraction of the support element,

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fig. 8a a schematically side view of the seat and the support element in normal using position of the seat,

fig. 8b the view of fig. 8a during movement of the seat in longitudinal direction,

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fig. 8c the view of fig. 8b during movement of the seat in longitudinal direction near the foremost position of the seat and

fig. 8d the view of fig. 8c after termination of the movement of the seat in longitudinal direction in the foremost position of the seat.

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In figures 1 till 3 a wheelchair 1 is shown which has a frame 2 which carries large wheels 3 and 4 and small wheels 5 und 6. While the axis of wheels 3 and 4 is fixed to the frame 2 the axis of wheels 5 und 6 can swivel to steer the wheelchair 1.

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The wheelchair 1 has a seat 7 for carrying the occupant of the wheelchair. The seat 7 is movable relatively to the frame 2 in vertical direction V and in longitudinal direction L simultaneously. For this moving means 8, 9, 10 are supplied having two
5 joining rods 8 and two joining rods 9 which are articulated with their ends on the frame 2 and on the seat 7 respectively. The two joining rods 8 and the two joining rods 9 are arranged symmetrically to a symmetric plane which is oriented vertically and which includes the longitudinal direction L.

10 In figures 4a, 4b and 4c three subsequent positions of the seat 7 relatively to the frame 2 are shown. Due to the design of the moving means 8, 9, 10 and especially of the joining rods 8 and 9 the seat 7 describes a curve relatively to the frame 2 by which it is brought from the normal position (shown in figure 4a) via a intermediate position (shown in figure 4b) into a foremost position (shown in figure 4c). As can
15 be seen in figure 4 the foremost position of the seat comes up with a lower height as the normal position which makes it easier for the occupant of the wheelchair to leave or enter the wheelchair. Also, it can be seen that the seat 7 can be brought into a foremost position so that the normal elements of the wheelchair (like armrests etc.) do not disturb the occupant when leaving or entering the wheelchair.

20 The position of the seat 7 relatively to the frame 2 is adjusted due to the desires of the occupant of the wheelchair by an actuator 10 which is connecting the seat 7 with the frame 2 (see figure 2). An alternative solution comes up with the actuator 10 connecting the frame 2 with the end of the joining rods 8 adjacent to their linkage at
25 the seat (see figure 3).

The actuator 10 is equipped with an electrical motor with a drive unit 11 as can be seen in figure 2. The drive unit has a ball screw drive in this case so that the effective length of the actuator 10 can easily be adjusted.

To avoid tilting of the wheelchair 1 when the seat 7 approaches its foremost position a support element 12 is engaged which is shown in figure 5. Basically, the support element 12 is fixed with one end (right end in figure 5) at the frame 2 of the wheelchair 1. The other end (left end in figure 5) can be driven into longitudinal direction L in a telescopic way when the seat 7 is also moved into this direction. At this end an arm 14 is pivotable connected at the support element 12. At the end of the arm 14 a rod 22 is fixed which bears two support wheels 13 at both ends.

Figures 6 and 7 depict coupling means 15 and 20 by which the length of the support element 12 can be extended (figure 6) or retracted (figure 7). For both coupling movements rollers 18 and 19 are fixed at separate telescopic parts of the support element 12 and cables 17 and 21 are guided in the depicted manner.

When moving the seat 7 into the longitudinal direction L the cable 17 shown in figure 6 is drawn in the direction of arrow 23, e. g. by being connected by means of not shown further rollers / pulleys with the seat 7. Due to the traction of the cable 17 the left end of support element 12 is moved to the left in figure 6, so that the wheelchair is supported by the supporting means 12.

When the seat 7 is brought back into its normal position the cable 21 in figure 7 is drawn into the direction of the arrow 24. Therefore, the left end of support element 12 is drawn back into the not-supporting position.

This movement of the seat 7 and the supporting element 12 is again shown in figures 8a till 8d.

In normal position of the seat 7 as being depicted in figure 8a the supporting element 12 is in a non-supporting position. The arm 13 is pivoted as shown so that the supporting wheels 13 have no contact to the ground 16 and do not hinder the normal drive of the wheelchair 1.

Figure 8b shows the movement of the seat 7 into longitudinal direction. Due to the arrangement as shown in figure 6 the left end of the support element 12 is moved into the longitudinal direction L. The arm 14 is pivoted automatically by not shown cable elements.

Before the seat 7 reaches its foremost position – see figure 8c – the arm 14 has reached its supporting position, i. e. the supporting wheels 13 contact the ground 16.

When reaching the final position as shown in figure 8d the support element 12 and its left end respectively is arranged under the seat 7 so that the wheelchair 1 is supported and tilting is prevented.

By the illustrated design the seat 7 of the wheelchair 1 makes a forward movement (into longitudinal direction L) out of the wheelchair and is adjustable in height. This makes it easier to slide from the wheelchair seat to another seat. The system can move the seat forward and backwards when it is operated. During this movement the seat 7 will move in a curve and therefore the seat will be on different heights. When the seat is moved it will first go up. When the seat is in front of the wheelchair it is optional to be moved downwards to the desired height. The height variation of the seat is approximately 30 cm (10 cm upwards and 20 cm downwards).

As explained above, the support element 12 has to extend when the seat 7 is being moved in longitudinal direction L. This can be done to link the supporting element 12 via mentioned cables and rollers / pulleys to the frame. One cable 17 has to extend the support element 12 when the seat 7 moves forward and the other cable 21 has to retract it again when the seat 7 moves backward. This can be done to connect the cables 17, 21 to the right positions on the support element 12 and to the link-system and place pulleys (rollers) on strategic places. Because there will

always be a difference in the length of the two paths (cable 17 and cable 21) there has to be made a buffer into one of the cables. The cable which retracts the slider 12 needs the most power to be able to retract the supporting wheels 13 and therefore can not be weakened with a buffer. The cable for extending will be equipped with a tension spring to be able to buffer minor path differences.

It is very easy to add the described system to existing wheelchairs to enable them to come up with the illustrated feature. When the transfer system is added to a wheelchair only the existing seat has to be removed and the system can be attached to the bars (frame) of the wheelchair.

5 **List of References**

	1	wheelchair
10	2	frame
	3	wheel
	4	wheel
	5	wheel
	6	wheel
15	7	seat
	8, 9, 10	moving means
	8	joining rod
	9	joining rod
	10	actuator
20	11	electrical motor with drive unit
	12	support element
	13	support wheel
	14	arm
	15	coupling means
25	16	ground
	17	cable
	18	roller
	19	roller
	20	coupling means
30	21	cable

22 rod
23 arrow
24 arrow

5

V vertical direction
L longitudinal direction

10

Claims

Wheelchair

1. Wheelchair (1), comprising:
 - a frame (2) on which wheels (3, 4, 5, 6) are rotatably arranged and
 - a seat (7) which can be moved relatively to the frame (2),**characterized in that**
moving means (8, 9, 10) are arranged for simultaneously moving the seat (7) relatively to the frame (2) in a vertical direction (V) and in a longitudinal direction (L).
2. Wheelchair according to claim 1, characterized in that the moving means (8, 9, 10) comprise at least one joining rod (8, 9) articulated joined with the frame (2) with its one end and articulated joined with the seat (7) with its other end.
3. Wheelchair according to claim 2, characterized in that at least two joining rods (8, 9) are arranged spaced apart in longitudinal direction (L).
4. Wheelchair according to claim 3, characterized by four joining rods (8, 9) which are arranged symmetrically to a symmetry plane of the wheelchair (1) which is vertical (V) and contains the longitudinal direction (L).

5. Wheelchair according to one of claims 1 till 4, characterized in that the moving means (8, 9, 10) comprise an actuator (10) connecting the frame (2) with the seat (7).
6. Wheelchair according to one of claims 1 till 4, characterized in that the moving means (8, 9, 10) comprise an actuator (10) connecting at least one of the joining rods (8, 9) with the seat (7).
7. Wheelchair according to one of claims 1 till 4, characterized in that the moving means (8, 9, 10) comprise an actuator (10) connecting at least one of the joining rods (8, 9) with the frame (2).
8. Wheelchair according to one of claims 5 till 7, characterized in that the actuator (10) is a linear actuator.
9. Wheelchair according to claim 8, characterized in that the actuator (10) is of the telescope type.
10. Wheelchair according to claim 8 or 9, characterized in that the actuator (10) has an electrical motor with a drive unit (11) for changing the effective length of the actuator (10).
11. Wheelchair according to claim 10, characterized in that the drive unit (11) comprises a ball screw.
12. Wheelchair according to one of claims 1 till 11, characterized in that a support element (12) is arranged at the frame (2), which can be moved in longitudinal direction (L) for preventing tilting of the wheelchair (1) when the seat (7) is in its foremost position in longitudinal direction (L).

13. Wheelchair according to claim 12, characterized in that the support element (12) has at least one support wheel (13) rotatably arranged on one of its ends.
14. Wheelchair according to claim 13, characterized in that the at least one support wheel (13) is arranged on one end of an arm (14) which is articulated arranged at the end of the support element (12).
15. Wheelchair according to claim 13 or 14, characterized in that coupling means (15) are provided which move the at least one support wheel (13) in the longitudinal direction (L) when the seat (7) is moved in this direction (L).
16. Wheelchair according to claim 14 and 15, characterized in that coupling means are provided which swivel the arm (14) so that the at least one support wheel (13) approaches the ground (16) when the the seat (7) is moved in the longitudinal direction (L).
17. Wheelchair according to claim 15 or 16, characterized in that the coupling means comprise a cable (17) which is guided by rollers (18, 19).
18. Wheelchair according to one of claims 12 till 13, characterized in that coupling means (20) are provided which draw the at least one support wheel (13) back against the longitudinal direction (L) when the seat (7) is moved back against this direction (L).
19. Wheelchair according to claim 14 and 18, characterized in that coupling means are provided which swivel the arm (14) back so that the support wheel (13) removes from the ground (16) when the seat (7) is moved back against the longitudinal direction (L).
20. Wheelchair according to claim 18 or 19, characterized in that the coupling means comprise a cable (21) which is guided by rollers (18, 19).

21. Wheelchair according to one of claims 13 till 20, characterized by two support wheels (13) which are arranged symmetrical to a symmetry plane of the wheelchair (1) which is vertical (V) and contains the longitudinal direction (L).

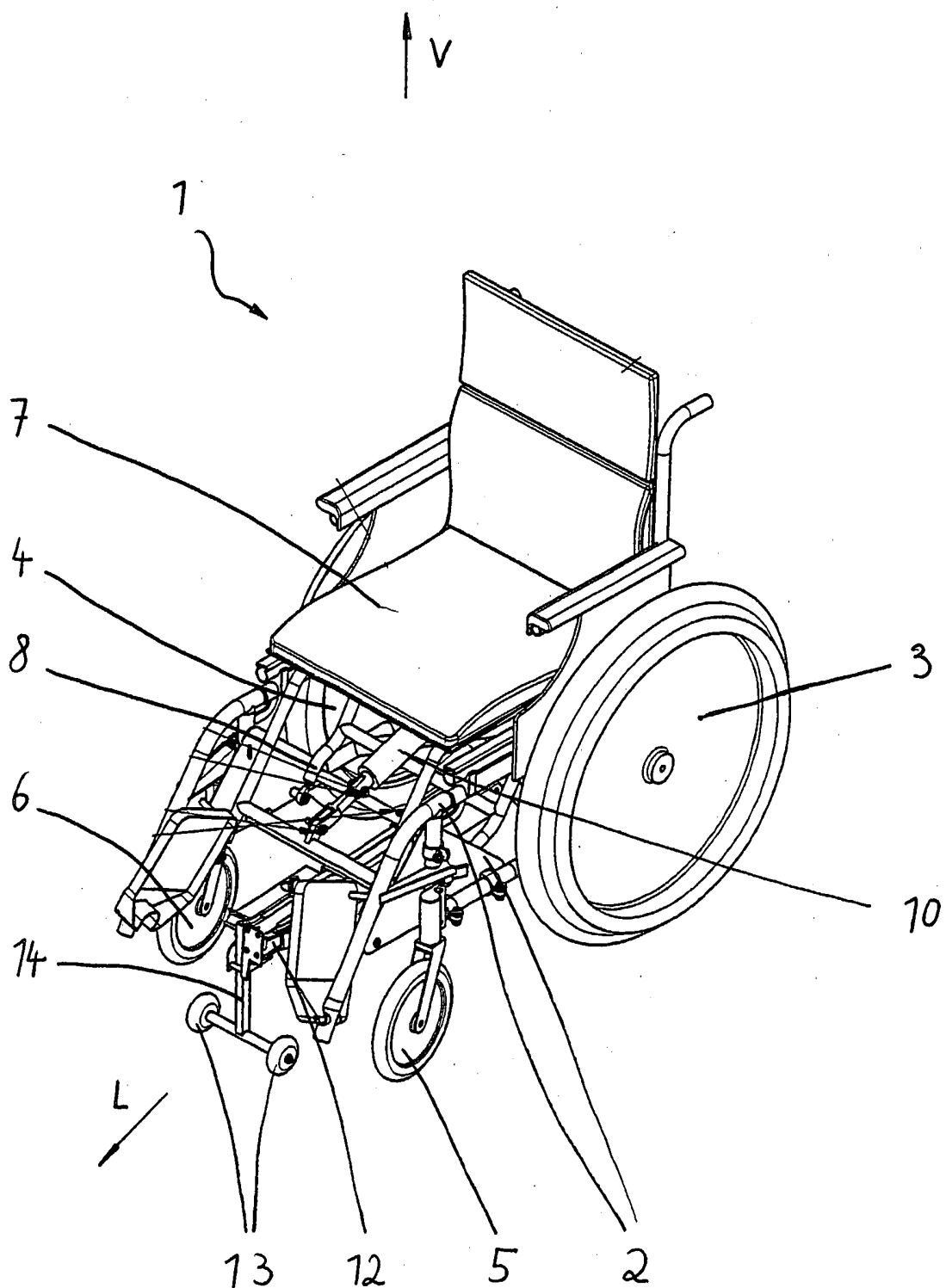
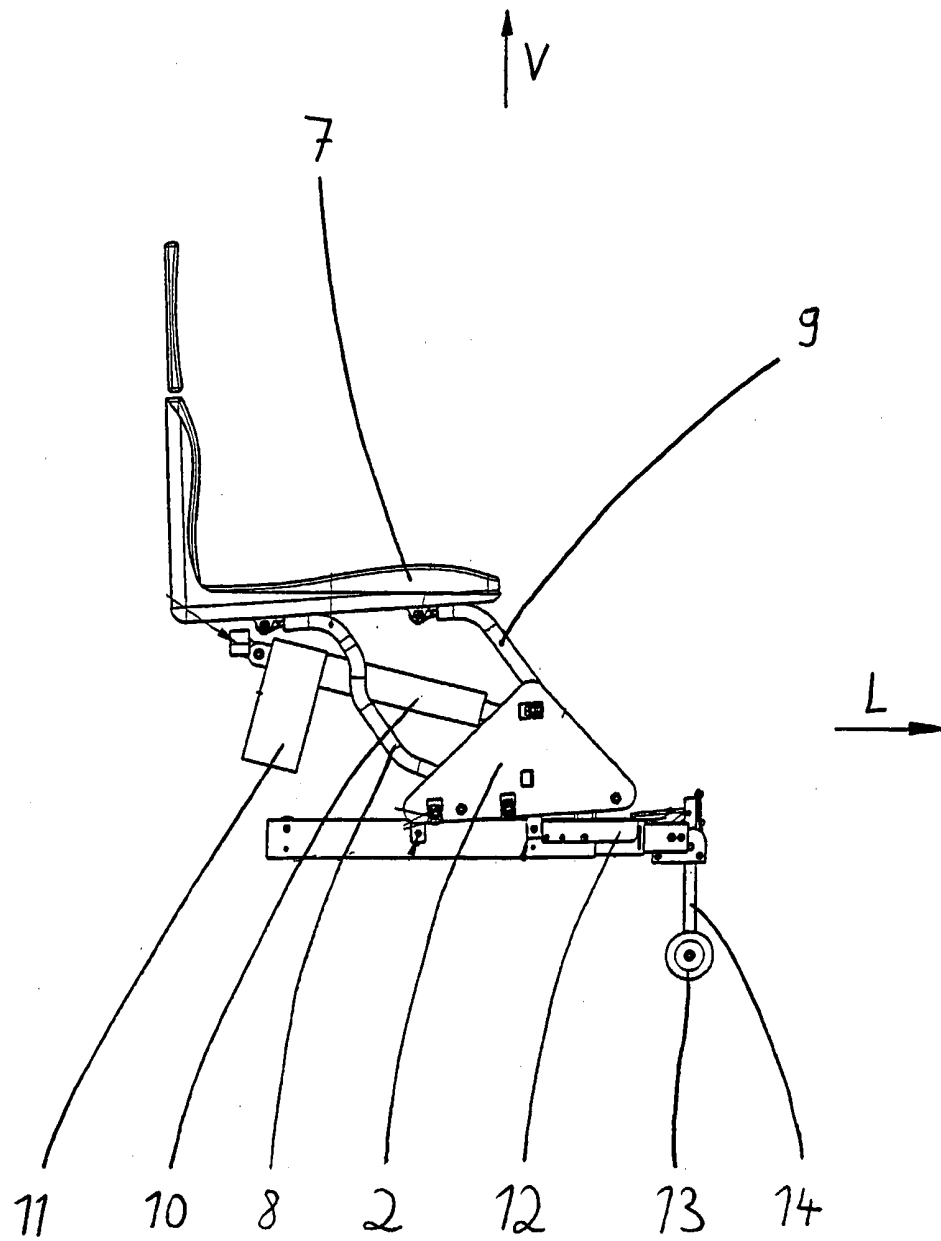


Fig. 1

Fig. 2

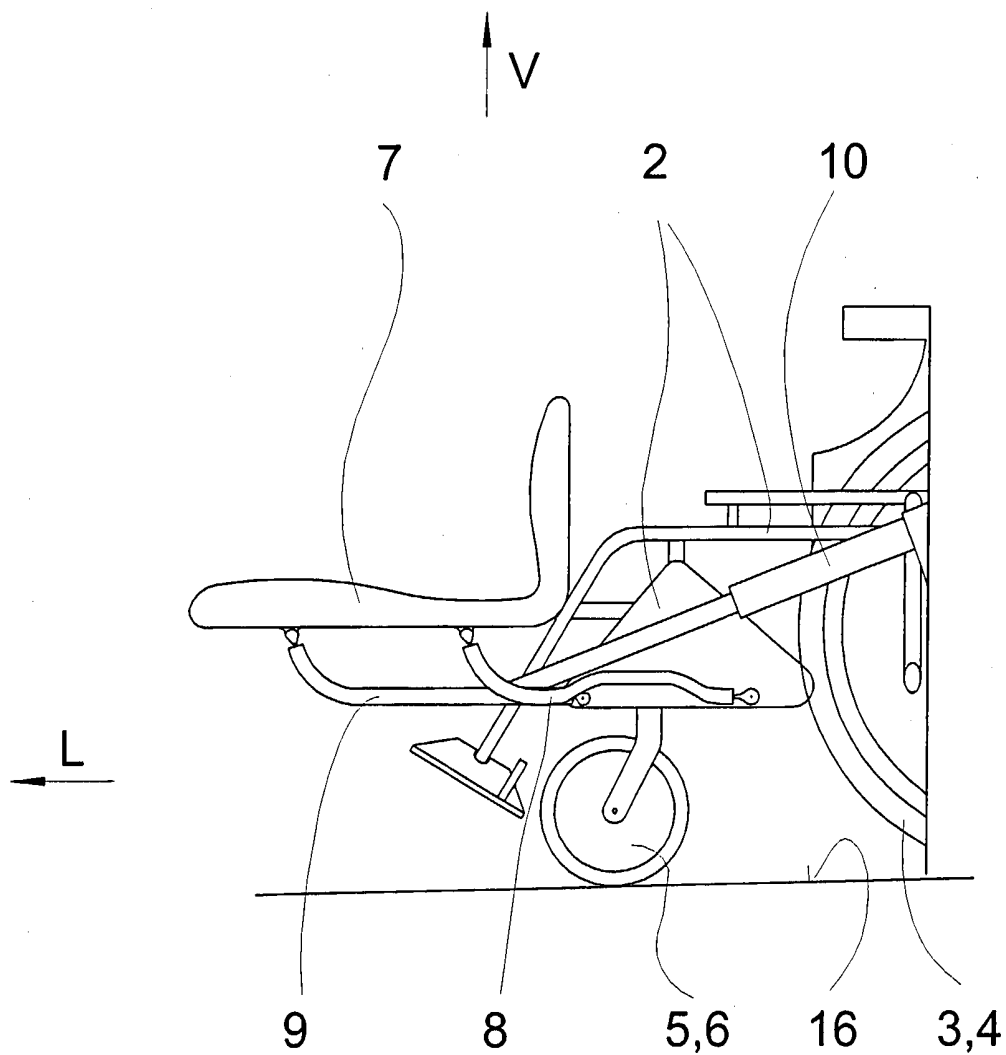


Fig. 3

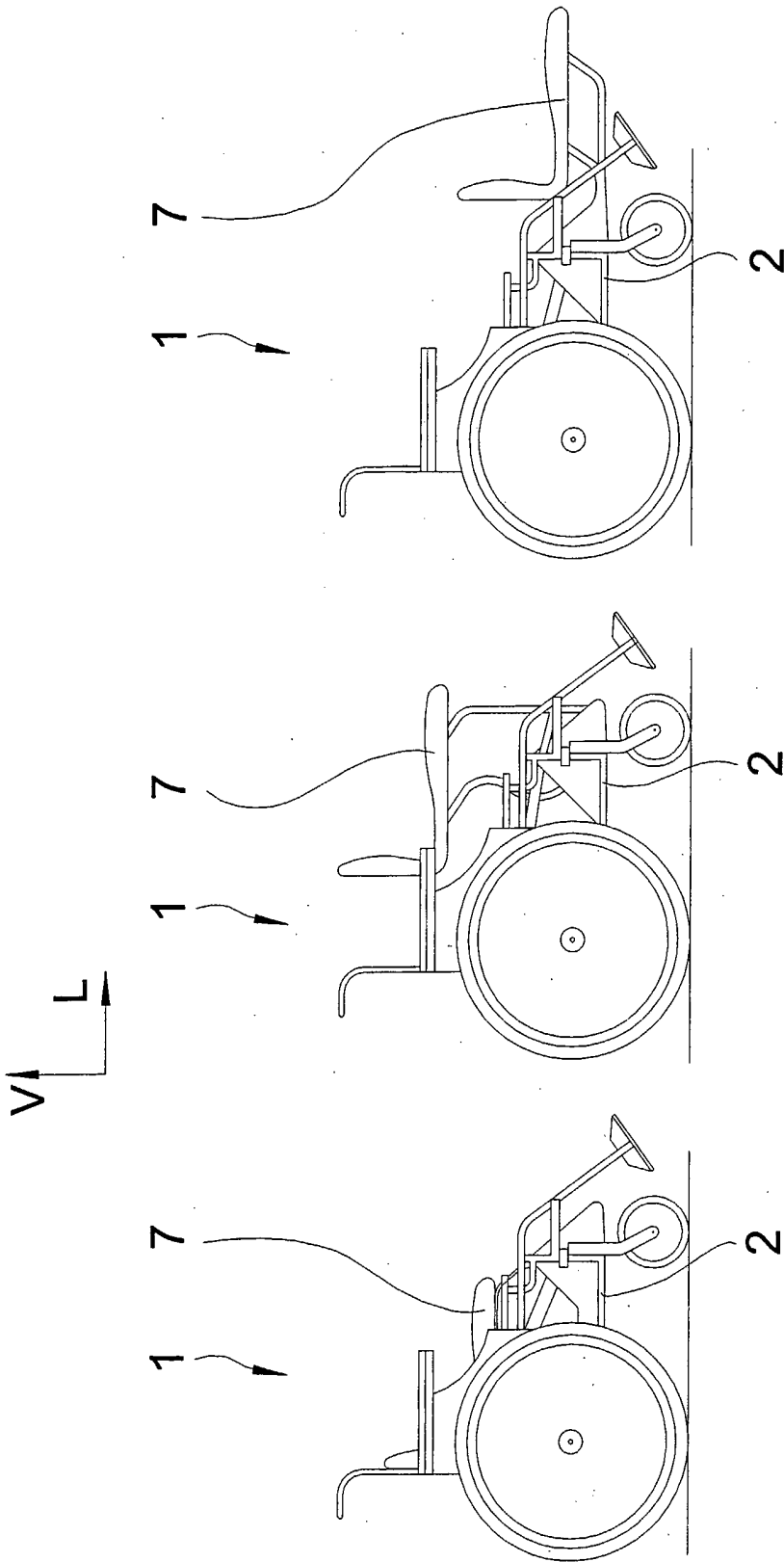


Fig. 4c

Fig. 4b

Fig. 4a

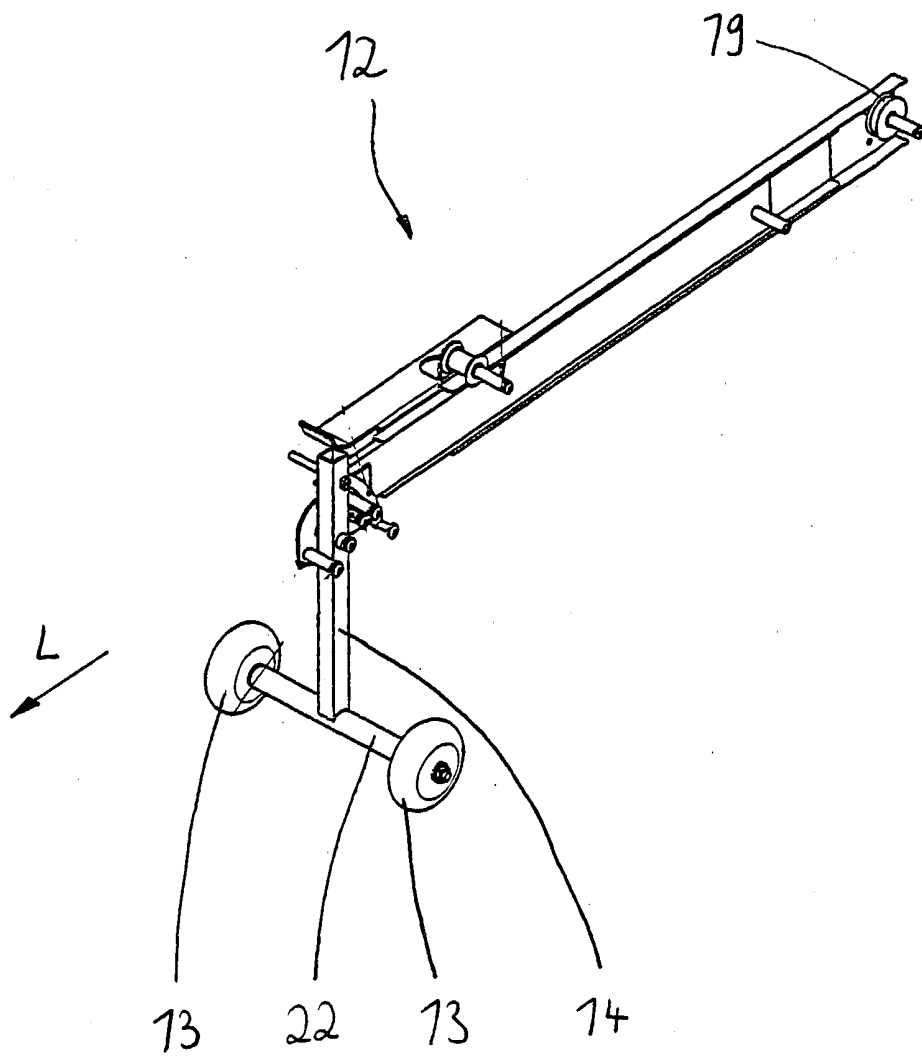
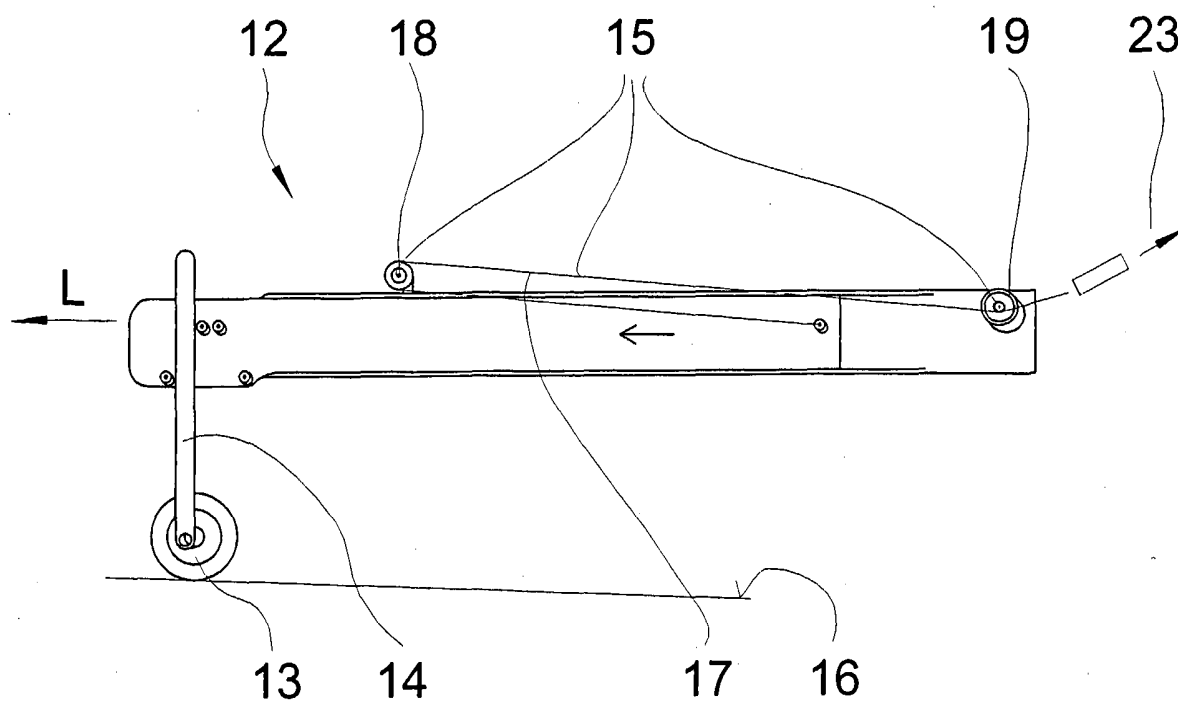
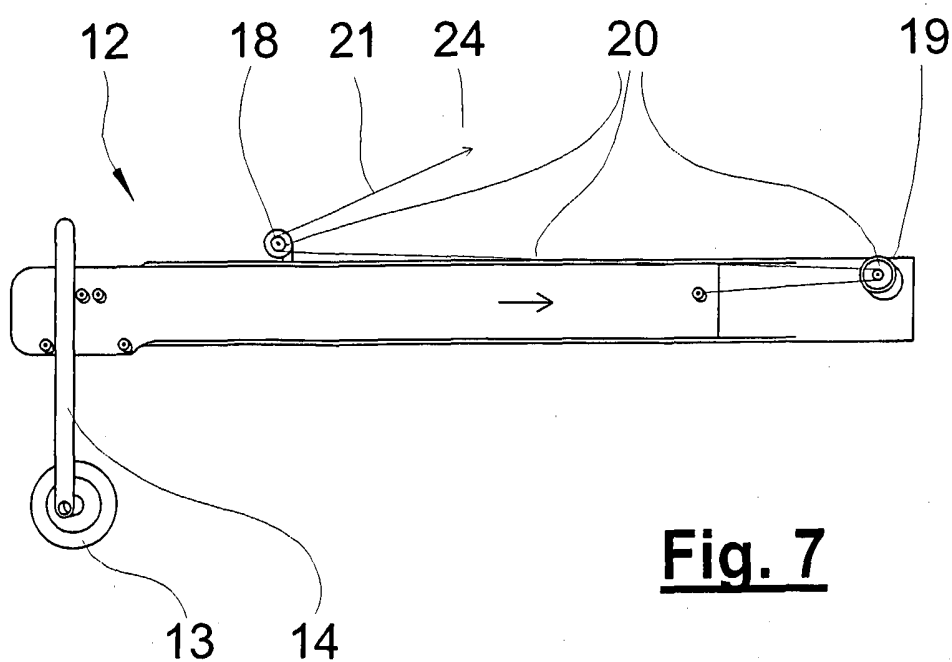


Fig. 5

**Fig. 6****Fig. 7**

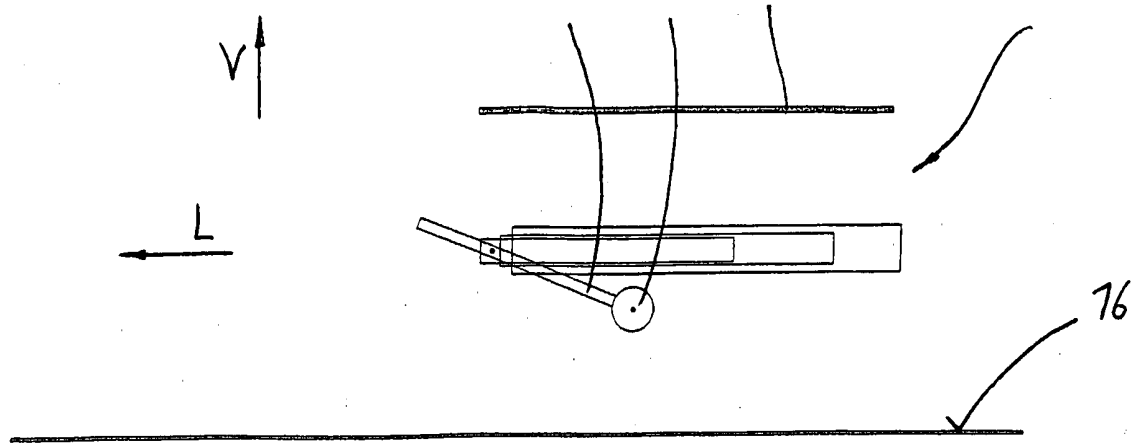


Fig. 8a

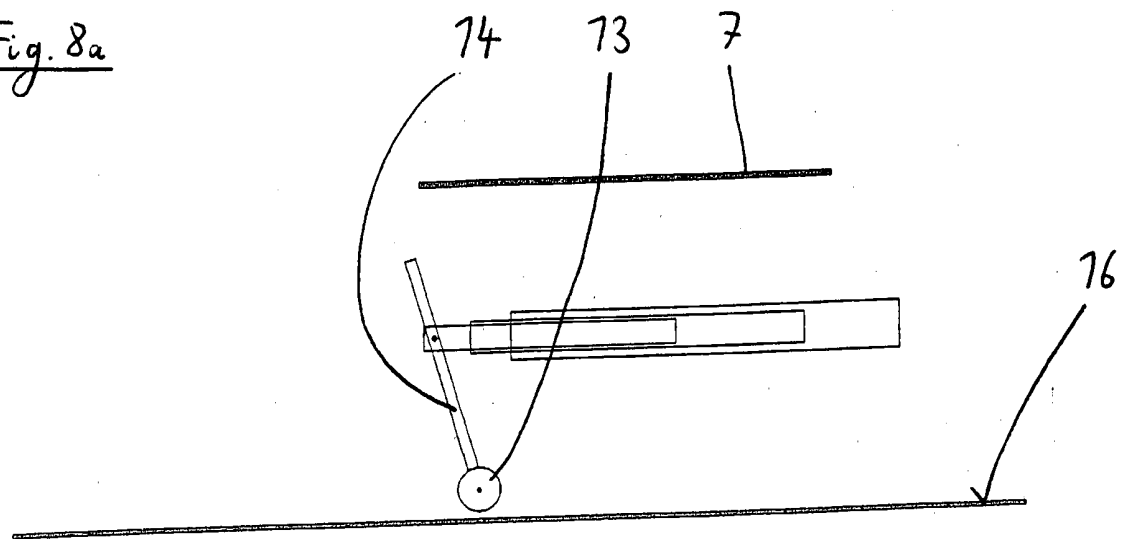


Fig. 8b

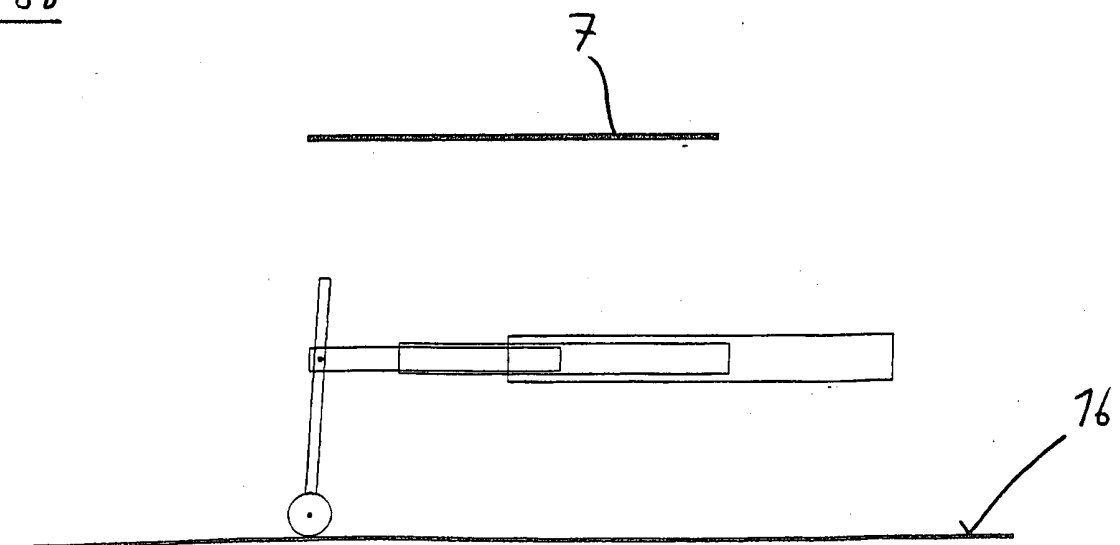


Fig. 8c

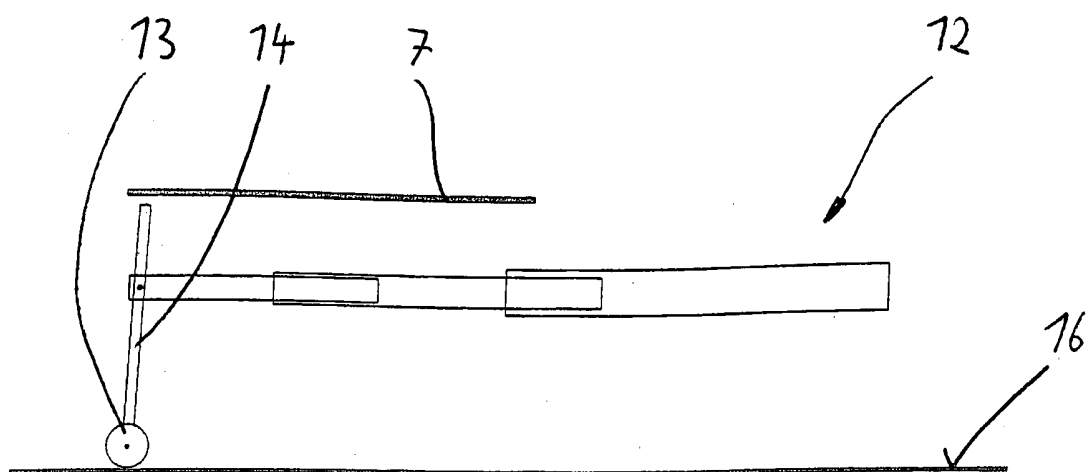


Fig. 8d

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP2005/004276

A. CLASSIFICATION OF SUBJECT MATTER
A61G5/10

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

B. FIELDS SEARCHEDMinimum documentation searched (classification system followed by classification symbols)
A61G

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

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

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 201 377 A (WILSON ET AL) 13 April 1993 (1993-04-13) the whole document	1-21
X	GB 2 026 398 A (HEMS C) 6 February 1980 (1980-02-06) the whole document	1-11
A		12-21
X	WO 2004/060737 A (RIOLS, SYLVAIN) 22 July 2004 (2004-07-22) the whole document	1-11
A		12-21
X	US 4 614 246 A (MASSE ET AL) 30 September 1986 (1986-09-30) the whole document	1-11
A		12-21
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☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

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8 document member of the same patent family

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP2005/004276

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

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