(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 245 995 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
22.11.2017 Bulletin 2017/47

(51) Int Cl.:
A61G 5/10 *(2006.01)* ***A61G 5/14*** *(2006.01)*

(21) Application number: **17171393.6**

(22) Date of filing: **16.05.2017**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(30) Priority: **18.05.2016 IT UB20163558**

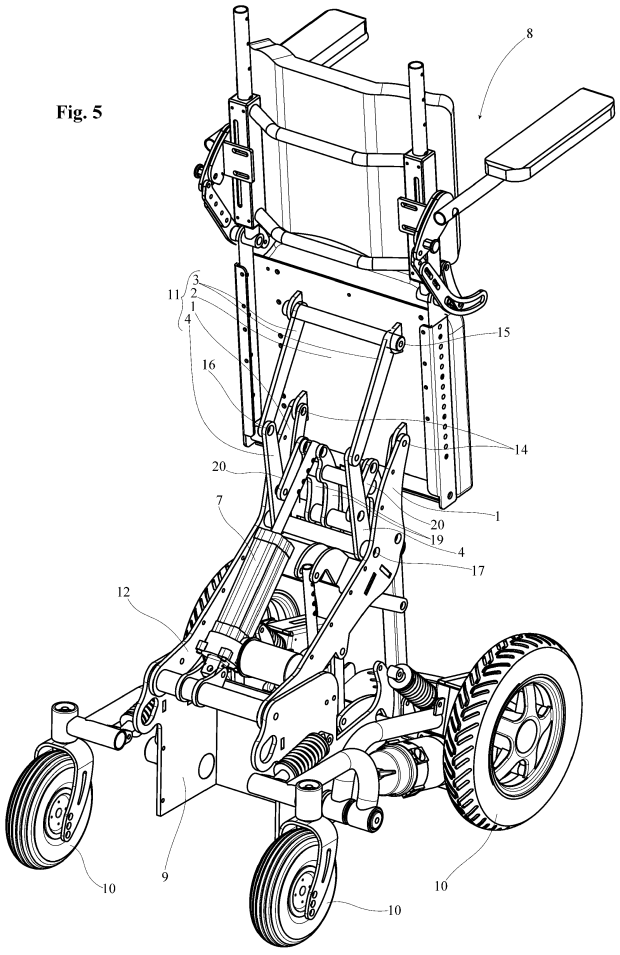
(71) Applicant: **Vassilli s.r.l.**
35020 Saonara (PD) (IT)

(72) Inventor: **Berto, Vassilli**
35020 Saonara (IT)

(54) **WHEELCHAIR WITH A COMPACT SEAT TRAVEL SYSTEM**

(57) The object of the inventions concerns a compact excursion system for moving the seat or its verticalisation underneath the seat, which employs an quadrilateral linkage system.

Fig. 5



EP 3 245 995 A1

Description

Summary

[0001] The object of the invention concerns a compact travel system for the movement of the seat or its verticalisation.

Prior art

[0002] Also in the field of aids for the disabled, wheelchairs are subject to continuous revisions and refinements to bring their bulk, weight and performance to ever greater levels.

[0003] All without sacrificing features and reliability.

[0004] It is now known that the highest quality wheelchairs are those that allow the user to move in total autonomy and that can vary the height of the seat, and which can also be brought to an upright position and even be tilted.

[0005] Today, such types of wheelchairs are rather cumbersome and heavy. For this reason, manufacturers are trying to provide customised wheelchairs based on the size of the user, for example for children and adults. This, however, forces users to buy two wheelchairs of the same type over time, depending on their growth. In fact, if the height travel of the wheelchair for an adult requires very long actuators, and very long levers and special devices against tipping over, everything is much simpler for wheelchairs for children.

[0006] What the object of the invention proposes is a new type of wheelchair, with all possible configuration modes, which is compact, which is extremely stable even with the seat raised and in an vertical position, without any play or possible loose connections in particular due to the positioning of the actuators at their limit positions, which carry out an alignment of the application point of the stress between the fulcrum and the resistant point.

[0007] In fact, it would also be very easy with undersized actuators to reach large angle travels or elevated movements, for example by applying the point of application of the force of an actuator to a lever near its fulcrum, but the result would be precarious, subject to being loose and not so resistant to heavy loads, and therefore creating in the user a sense of uncertainty that the position can be maintained securely and firmly.

[0008] In fact, it is crucial that one actuator not only operates and moves the various parts of the wheelchair, but that it also can keep the position reached stable and safe. In the eventuality that said actuator acts on lever or kinematic mechanisms, its point of application on a lever must create between the actuator itself and the lever on which it acts a minimum angle of 45 -30 degrees, thereby being able to efficiently compensate for and resist not only the normal component, but also the tangent of the external stresses. Finally, bearing in mind the size of wheelchairs, which are becoming increasingly more compact, also the relative actuators need to be very small.

[0009] Obviously, also due to the high costs, very expensive special, dual-action or telescopic actuators, which are much more delicate and difficult to maintain than simple pneumatic or electrical actuators, are not economically viable

Objects of the invention

[0010] The object of the present invention is therefore to overcome one or more drawbacks of the prior art.

[0011] An essential object of the present invention is to make available a wheelchair with a compact travel system for verticalisation.

[0012] An important object of the present invention is to make available a wheelchair with a compact travel system that is resistant to stress over time and that is inexpensive.

[0013] A different object of the present invention is to make available a wheelchair with a compact travel system employing actuators that can easily be found on the market.

[0014] Another object of the present invention is to make available a wheelchair with a compact travel system whose structural configuration provides a high degree of stability.

[0015] All of the aforesaid purposes and others that will best be described in the description are obtained from a wheelchair with a compact seat travel system as set out in the characterising part of the attached claims.

Explanation of the invention

[0016] In particular, this concerns a wheelchair with a compact travel system employing a quadrilateral linkage system positioned between a base and a seat, which is raised by a first lifting actuator hinged to the base and deformed by a second displacement actuator with a point of application outside the quadrilateral by means of an actuation lever hinged on a first side of the quadrilateral and acting through a tie rod on the side adjacent to the first side.

[0017] Specifically said quadrilateral linkage consists of a first side, to which the second and fourth sides are hinged spaced out, said first side extends from the part opposite the hinging to the second side, and beyond the hinging to the fourth side, towards the base to which it is hinged. A first lifting actuator acts on said first side to raise the quadrilateral.

[0018] The first and third sides are hinged spaced apart on the second side. To said second side is joined directly or by the interposition of a frame, the seat of the wheelchair.

[0019] The second and fourth sides are hinged on the third side in a spaced apart manner.

[0020] The third and the first side are hinged on the fourth side in a spaced apart manner. In an intermediate position between the two hinges acts a first end of the

tie rod, joined at the second opposite end to the actuating lever.

Advantageous features of the invention

[0021] Advantageously, the hinging of the extension of the first side with the base is in the rear of the wheelchair, so that the raising of the quadrilateral linkage by means of the lifting actuator takes place towards the centre of gravity of the quadrilateral making the front of the seat retract, increasing stability both during the raising of the seat and during the verticalisation of the wheelchair. Advantageously, the hinging of the displacement actuator on the base is carried out either on the same axis as the hinging of the extension of the first side with the base or directly on the highest and most retracted part of the base, promoting a stabilising effect for lowering of the masses and obtaining an angle of application between the stem and the actuation lever of not less than 30° and preferably not less than 45°, thus maintaining a good reaction to the peak load on the actuator stem.

[0022] Advantageously, the displacement of the quadrilateral linkage is carried out with an actuator, which while maintaining a peak load in the actuation lever, allows the variation of the inclination of the position from -45°, tilting stage, to 90°, verticalised phase for a total travel of 135°

[0023] Advantageously, said total travel is achieved with an actuator whose stem has a maximum travel of 20 cm and preferably of 15 cm.

Brief description of the drawings

[0024] The technical features of the invention, according to the aforesaid aims, can clearly be seen in the content of the claims below, and its advantages will become more readily apparent in the detailed description that follows, made with reference to the accompanying drawings, which illustrate a preferred embodiment, which is purely exemplary and not limiting, in which:

Fig. 1 shows a perspective view of an electronic wheelchair that adopts a quadrilateral linkage seat travel system that is the object of the invention.

Fig. 2 shows what is set out in fig. 1 from a plan view of a vertical section that makes it easy to see the deformable quadrilateral between the base and the seat.

Fig. 3 shows a perspective view of the wheelchair in fig. 1 with the seat raised.

Fig. 4 shows what is set out in fig. 3 according to a plan view of a vertical section showing in detail the components of the deformable quadrilateral and its hinging.

Fig. 5 shows a perspective view of the wheelchair in fig. 1 in a vertical configuration.

Fig. 6 shows what is shown in fig. 5 according to a plan view of a vertical section that highlights the seat retraction with respect to the front wheels.

Fig. 7 shows a perspective view of the wheelchair of fig. 1 tilting backward for the complete extension of the lifting actuator of the quadrilateral.

Fig. 8 shows what is set out in fig. 7 according to a plan view of a vertical section highlighting the backward retraction of the entire seat.

Fig. 9 shows a perspective view of the wheelchair of fig. 1 tilting forward for the complete extension of the displacement actuator of the quadrilateral, where it is possible to check in detail the various components of the quadrilateral linkage system.

Fig. 10 shows what is set out in fig. 9 according to a plan view of a vertical section that highlights the inclination of the seat forwards without any appreciable displacement of the masses outside the perimeter of stability.

Detailed description of an example of a preferred embodiment

[0025] The object of the present invention refers particularly to a type of electric or electronic verticalising wheelchair 8 or with the seat 5 whose height can vary to obtain a wheelchair with a raised seat 21. This type of wheelchair generally allows tilting, hence the inclination of the seat, the variation in height and the verticalisation by means of several actuators and with complicated, expensive and bulky systems. The travel system that is the object of the invention for the operating modes described above is simple, economical and compact.

[0026] Other advantages of the travel system of the invention lie in the fact that it acts by stabilising the configuration under critical stability conditions, i.e. with the seat 5 raised and in the verticalised mode 8.

[0027] The wheelchair of the invention shown in the drawings is an electronic wheelchair with multiple configurations with a tilting position 22, with a seat 5 that can have various heights or raised 21 and the capacity to assume a vertical configuration 8.

[0028] Referring specifically to the travel system, hinged on a base 9 supported by the wheels 10 there is an overhanging extension of the quadrilateral linkage 11.

[0029] In particular, said extension 12 is hinged at the back of the base 9 of the wheelchair so that during the raising for rotating around the hinging fulcrum 13, the quadrilateral linkage 11 is made to draw back with respect to the front verticalisation side, thereby acquiring stability.

[0030] Said first side 1 of the quadrilateral linkage 11 is hinged to the second side 2 and the fourth side 4 respectively at the fulcrums 14 and 17 at the ends.

[0031] Equally, for the other sides 2, 3 and 4 hinged to the ends of the contiguous sides, respectively 1 and 3, 2 and 4, 3 and 1, with fulcrums in 14 and 15, 15 and 16, 16 and 17 respectively. Effectively, the second side 2 can be identified with a frame supporting the seat 5 or with the seat 5 itself.

[0032] The elevating or lifting actuator 6 is hinged on

the base 9 with its end 18, while the opposite end acts on side 1 or its extension 12.

[0033] The displacement actuator 7 of the quadrilateral 11 is also hinged to the base 6, or on the same hinging axis 13 of the extension 12 of side 1, in any event always at the rear and higher part of the base 6 in such a way as to maintain a sufficient peak angle with respect to the actuation lever 19 on which it acts. In fact, said second actuator 7 does not directly act on the deformable quadrilateral 11 but on a first end of a lever, said actuation lever 19, which is hinged to the opposite end on side 1. In an intermediate position between the two ends of the actuation lever 19, a tie rod 20 is hinged connected to the fourth side 4.

[0034] The action of the displacement actuator 7 therefore, with its stem applied to the end of the actuation lever 19 and the drive operated by the tie rod 20, moves and deforms the quadrilateral linkage 11 as needed for moving the seat 5 or for the verticalisation of the wheelchair.

[0035] For illustrative purposes we see that after the single movement of the elevation actuator 6, the seat 5 of the wheelchair tilts backward by about 45°.

[0036] With the joint movement of the elevating actuator 6 and the displacement actuator 7 there is an upward movement relative to the bottom of the seat 5, a further movement can allow the wheelchair to reach the vertical configuration 8.

[0037] We can see, during the movement of the lifting actuator 6, that in any situation the seat 5 draws back with respect to the front wheels 10, bringing the centre of gravity of the whole, the user and wheelchair, towards a more central position inside the stability perimeter.

[0038] This benefit is especially significant with a substantial raising of the seat 5, but it becomes very advantageous during verticalisation 8, since this wheelchair does not have to adopt bulky stabilisers overhanging on the outside in front of the front wheels.

[0039] In fact, even in fully verticalised mode 8, of both the user and the wheelchair, there is a centre of gravity that always falls within the stability perimeter.

[0040] As can also be seen in the drawings, the configuration of the various adjacent parts up against each other when the wheelchair is lowered, allows you to appreciate the compactness of the assembly and to evaluate the enormous benefit of adopting an actuator 7 for the displacement of the quadrilateral 11 that, with a travel of 15 cm, obtains an travel of 135°, an ideal situation for the verticalisation of a person with a height even up to 200 cm.

Claims

1. Wheelchair with a compact seat travel system that employs an articulated quadrilateral (11) consisting of a base (9) and a seat (5), **characterised by** the fact that it is elevated by a first lifting actuator (6) hinged to the base (9) and displaced by a second displacement actuator (7), with the point of application outside the quadrilateral (11), using an actuating lever (19) hinged on a first side (1) of the quadrilateral (11) and acting by means of a tie rod (20) on the side adjacent (4) to the first side (1).

2. Wheelchair with a compact seat travel system according to claim 1 **characterised by** the fact that said quadrilateral (11) comprises a first side (1), to which are hinged in a spaced apart manner the second (2) and the fourth side (4), said first side (1) extends with an extension (12) extending from the side opposite to the hinging (14) with the second side (2), and beyond the hinging (17) with the fourth side (4), towards the base (9) to which is hinged (13); acting on said first side (1) a first lifting actuator (6) for the lifting of the quadrilateral (11).

3. Wheelchair with a compact seat travel system according to claim 1 **characterised by** the fact that said articulated quadrilateral (11) comprises a second side (2), to which are hinged in a spaced apart manner the first (1) and the third side (3); to said second side (2) is connected directly, or by the interposition of a frame, the seat (5) of the wheelchair.

4. Wheelchair with a compact seat travel system according to claim 1 or 3, **characterised by** the fact that said second side (2) and the seat (5) are coinciding.

5. Wheelchair with a compact seat travel system according to claim 1 by the fact that said articulated quadrilateral (11) comprises a third side (3) to which are hinged in a spaced apart manner the second (2) and the fourth side (4).

6. Wheelchair with a compact seat travel system according to claim 1 **characterised by** the fact that said articulated quadrilateral (11) comprises a fourth side (4) to which are hinged in a spaced apart manner the third (3) and the first side (1); in an intermediate position between the two hinges (16, 17), with the third side (3) and the first side (1), operates a first end of the tie rod (20) joined, at the opposite second end, to the actuating lever (19).

7. Wheelchair with a compact seat travel system according to claim 1 **characterised by** the fact that the hinging (13) of the extension (12) of the first side (1) with the base (9) is in the rear part of the wheelchair, so that the raising of the quadrilateral (11) by means of the lifting actuator (6) takes place by having the quadrilateral (11) move towards the centre of gravity of the wheelchair and pulling back the front part of the seat (5), increasing stability both during the raising of the seat (21) as well as during the verticalisation (8) of the wheelchair.

8. Wheelchair with a compact seat travel system according to claim 1 **characterised by** the fact that the hinging of the displacement actuator (7) on the base (9) is made either on the same hinging axis (13) of the extension (12) of the first side (1) with the base (9) or directly on the highest and most rearward part of the base (9), favouring a stabilising effect for lowering the height of the mass and obtaining an angle of application of action between the rod and the actuating lever (19) not less than 30° and preferably not less than 45°, thereby maintaining on the actuator stem (7) an effective peak load reaction.

9. Wheelchair with a compact seat travel system according to claim 1 **characterised by** the fact that the displacement of the quadrilateral (11), is implemented using a displacement actuator (7), which, while maintaining a peak load in the actuating lever (19), allows a variation in the inclination of the seat (5) by -45°, in the tilting phase (22), at 90°, in the verticalisation phase (8), for a total travel of 135°

10. Wheelchair with a compact seat travel system according to the previous claim **characterised by** the fact that the aforesaid total travel is obtained with a displacement actuator (7) whose rod has a maximum travel of 20 cm and preferably 15 cm.

Fig. 1

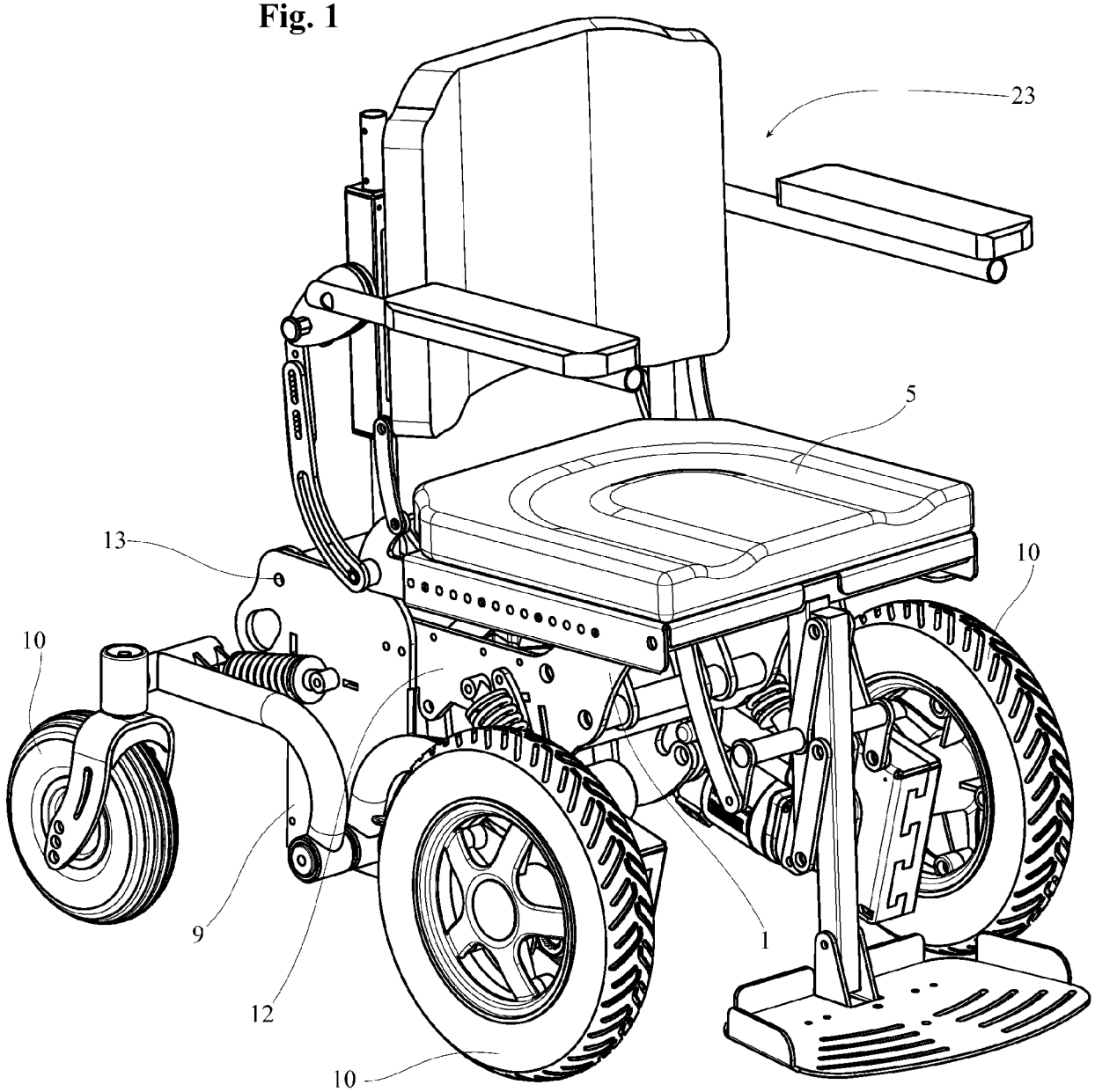


Fig. 2

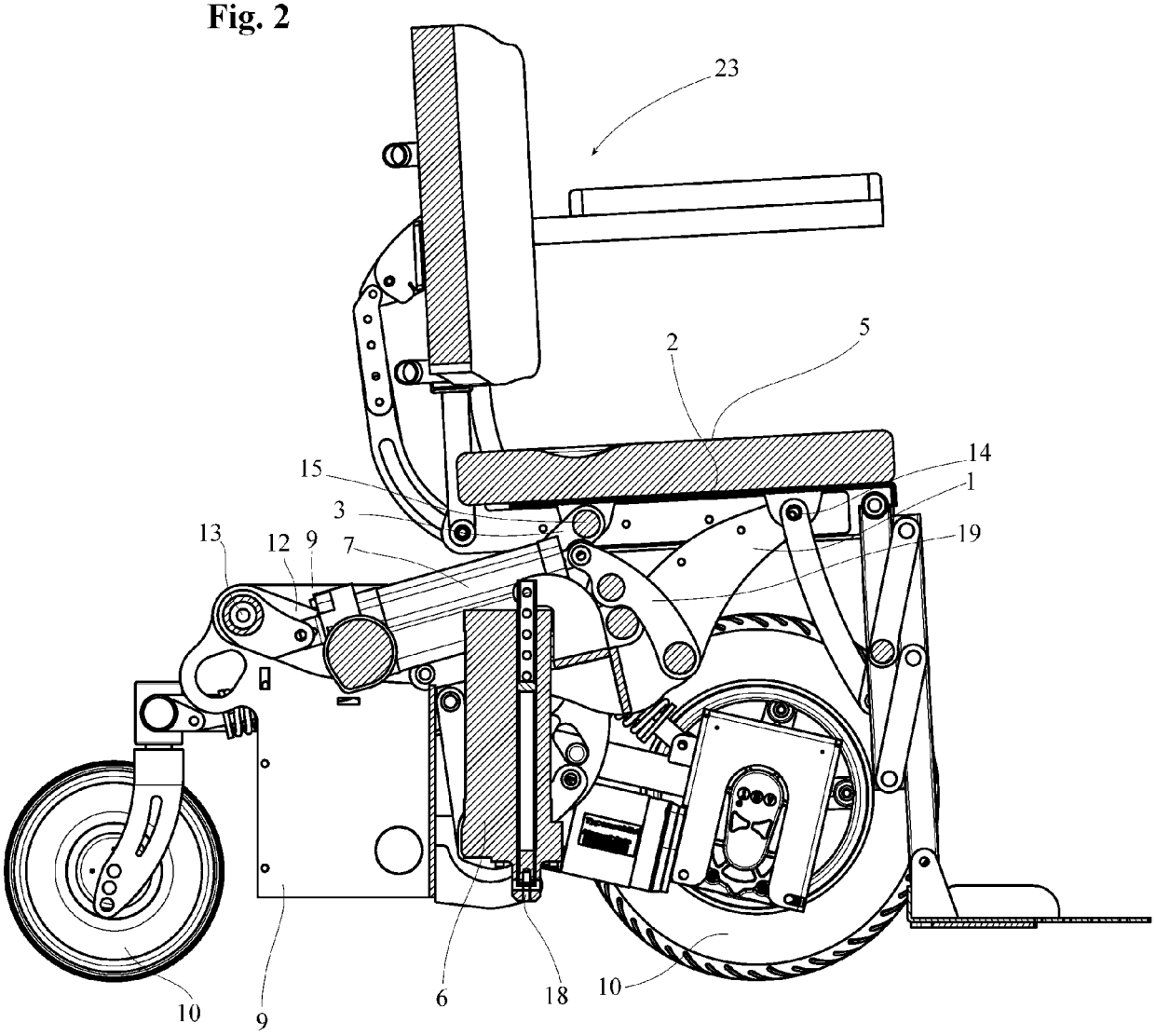


Fig. 3

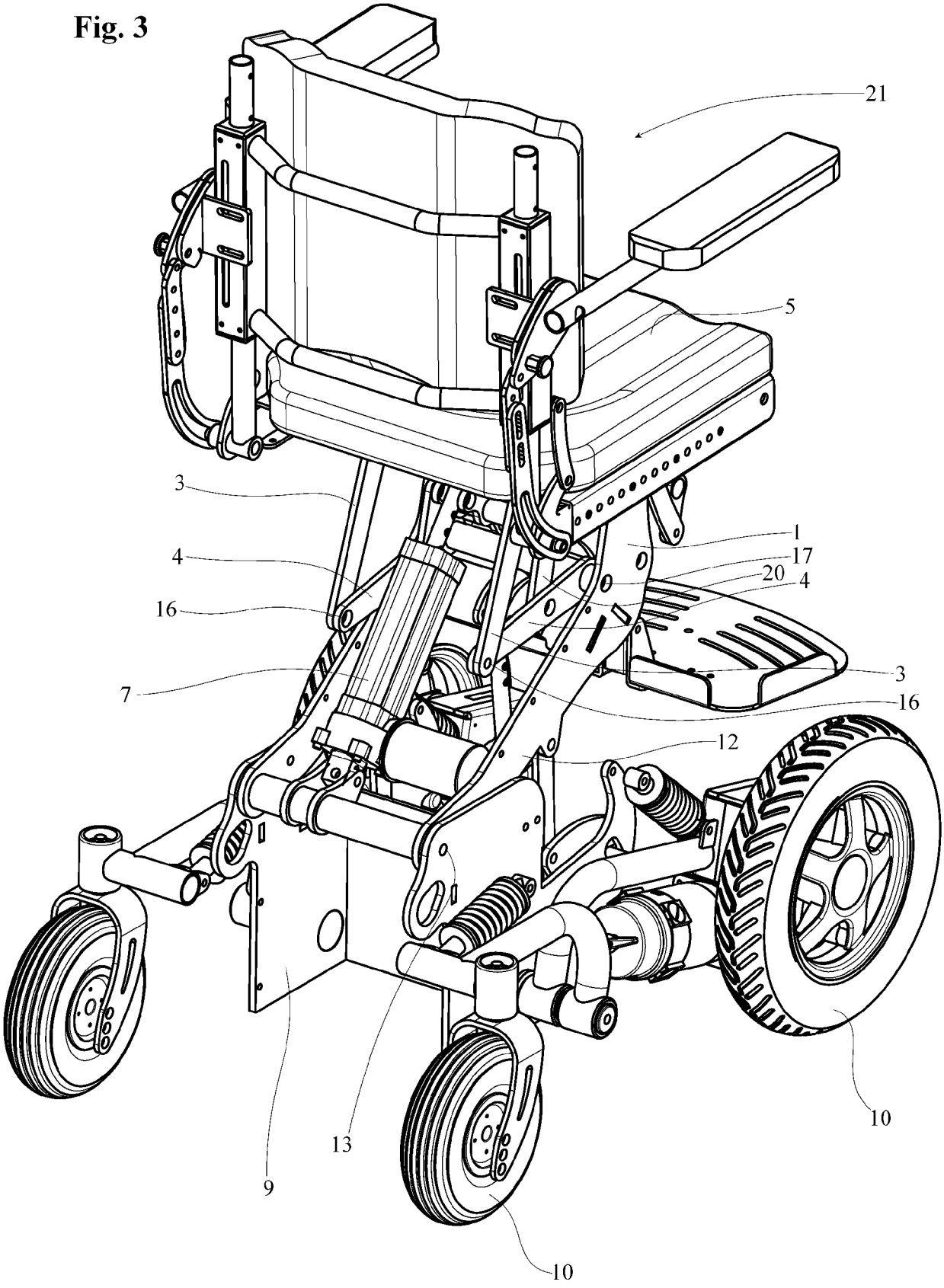


Fig. 4

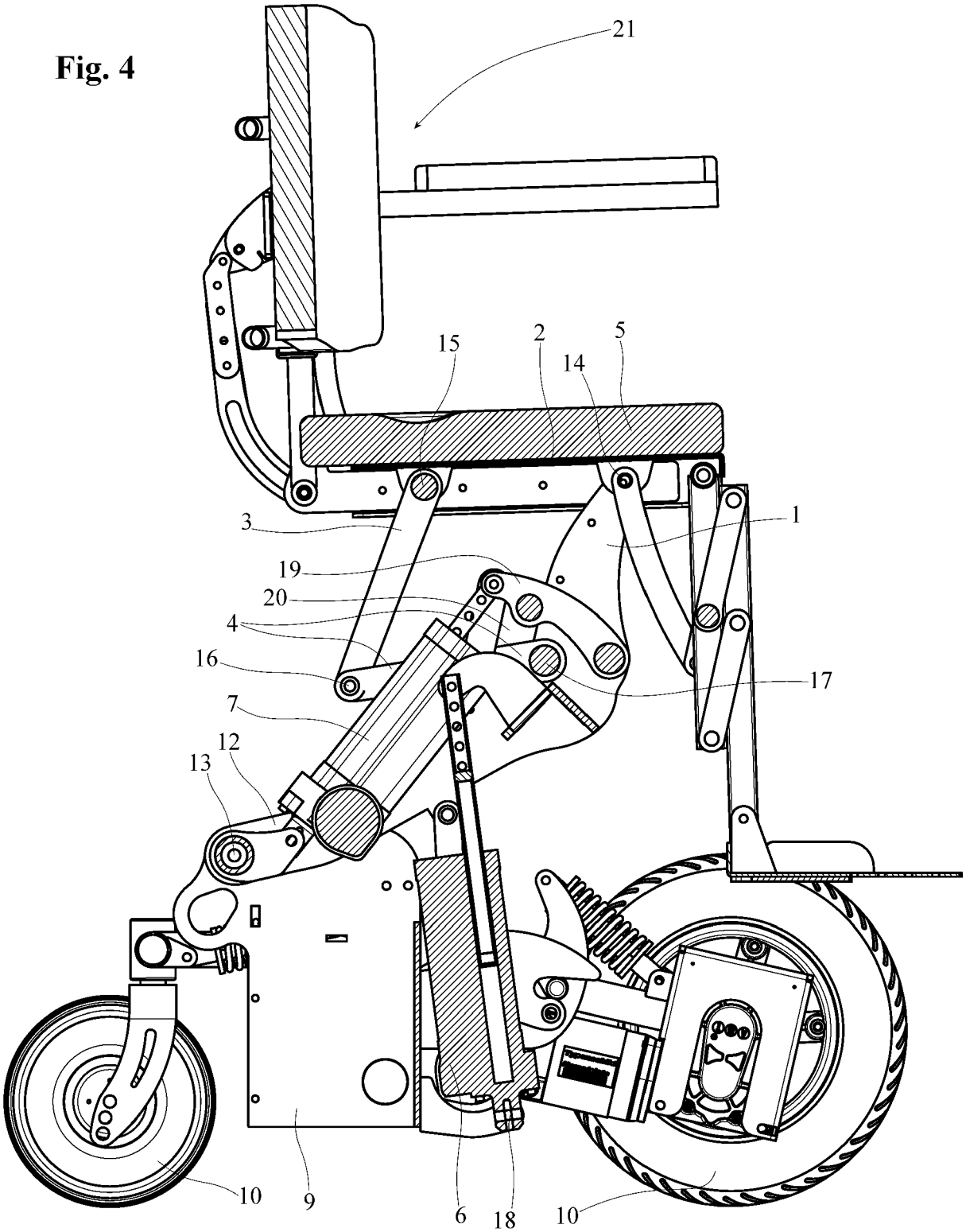


Fig. 5

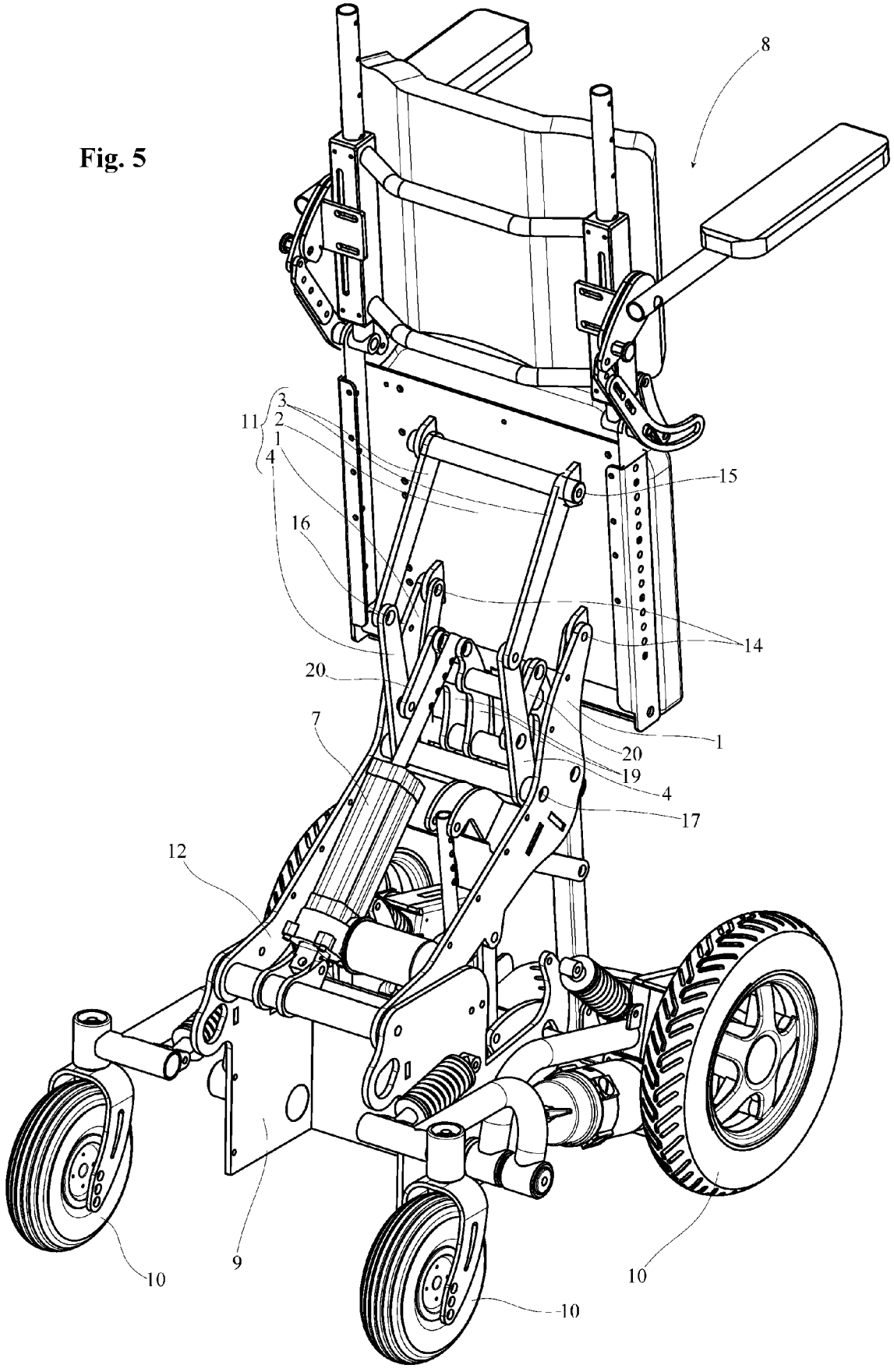


Fig. 6

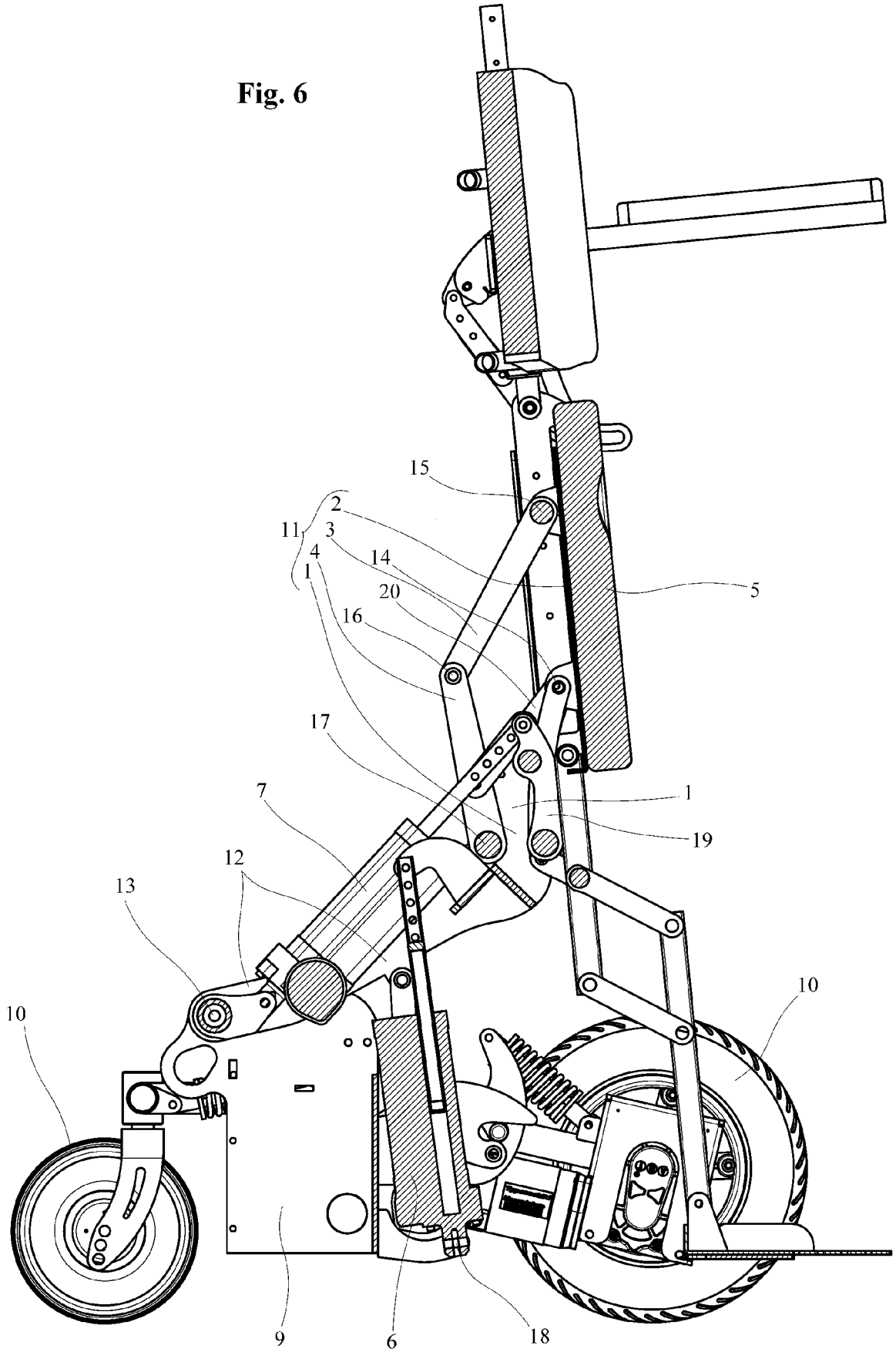


Fig. 7

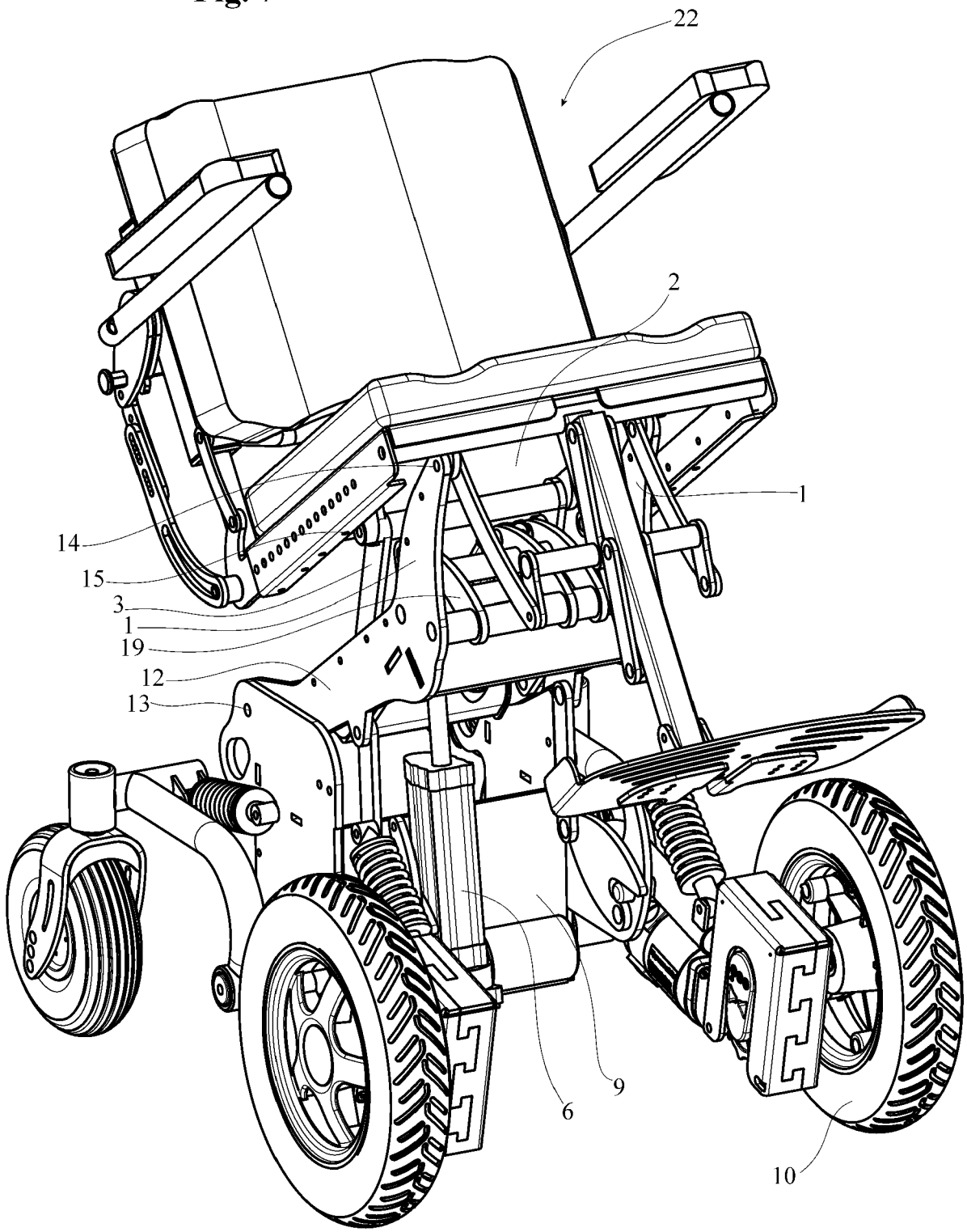


Fig. 8

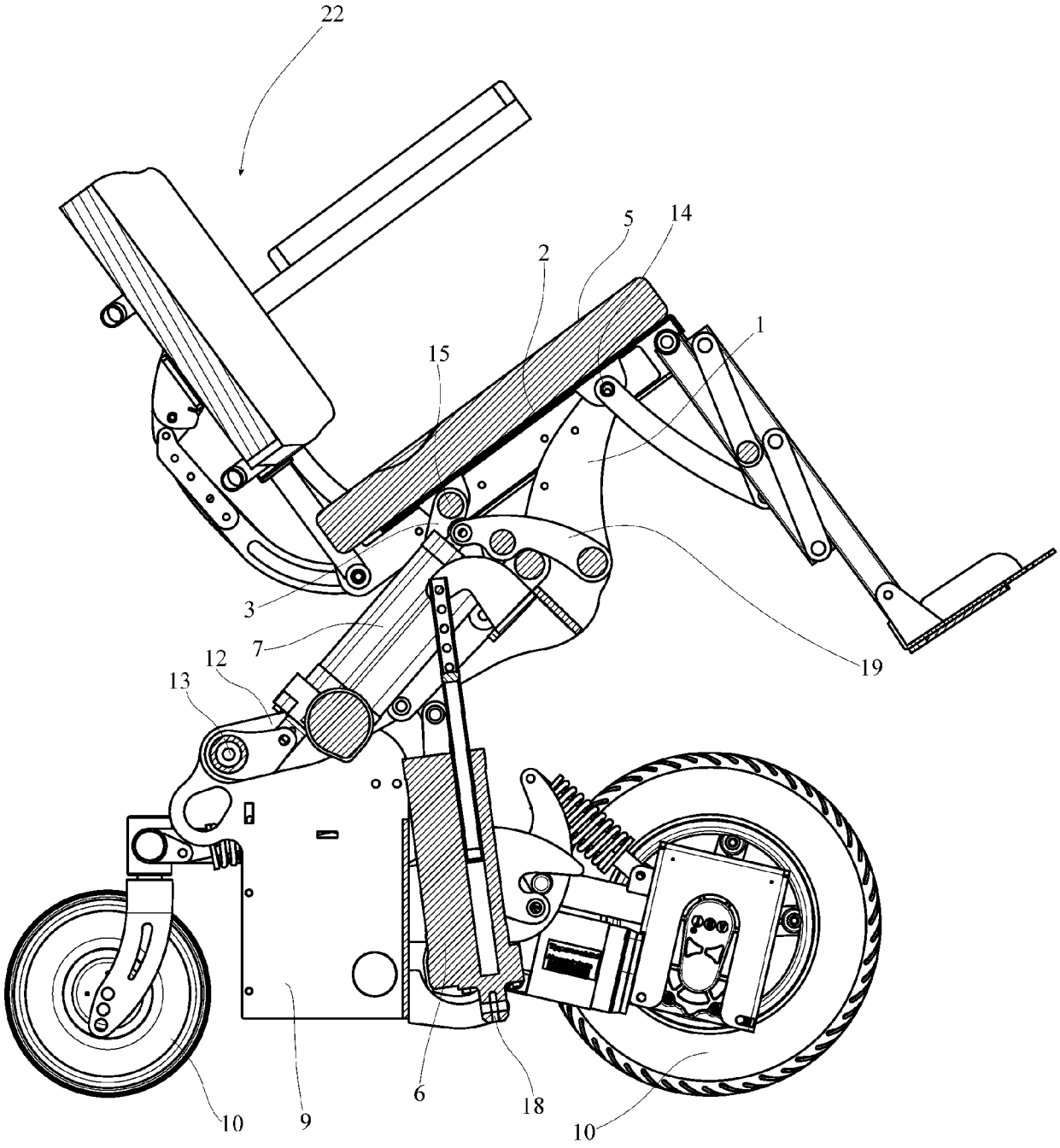


Fig. 9

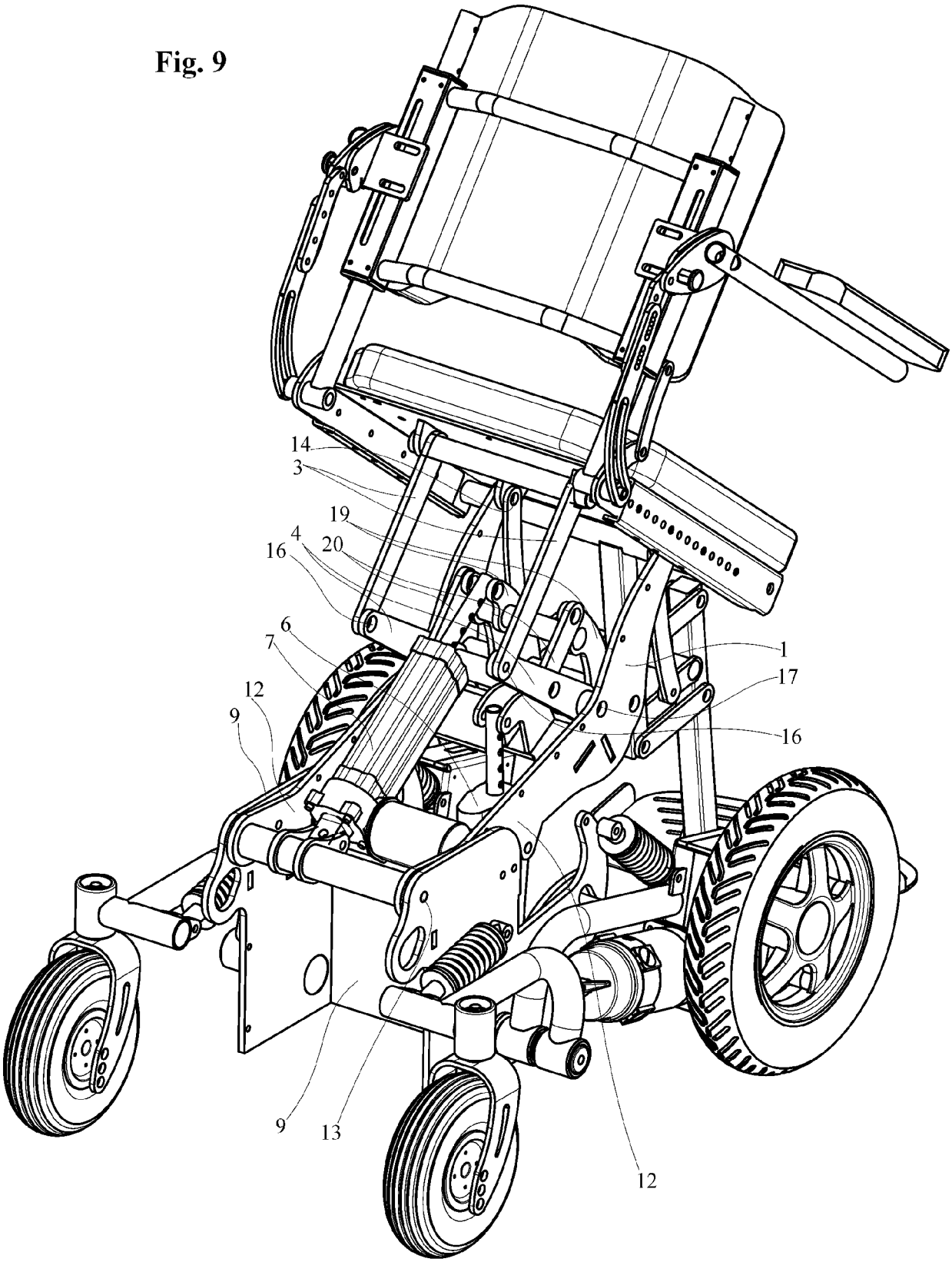
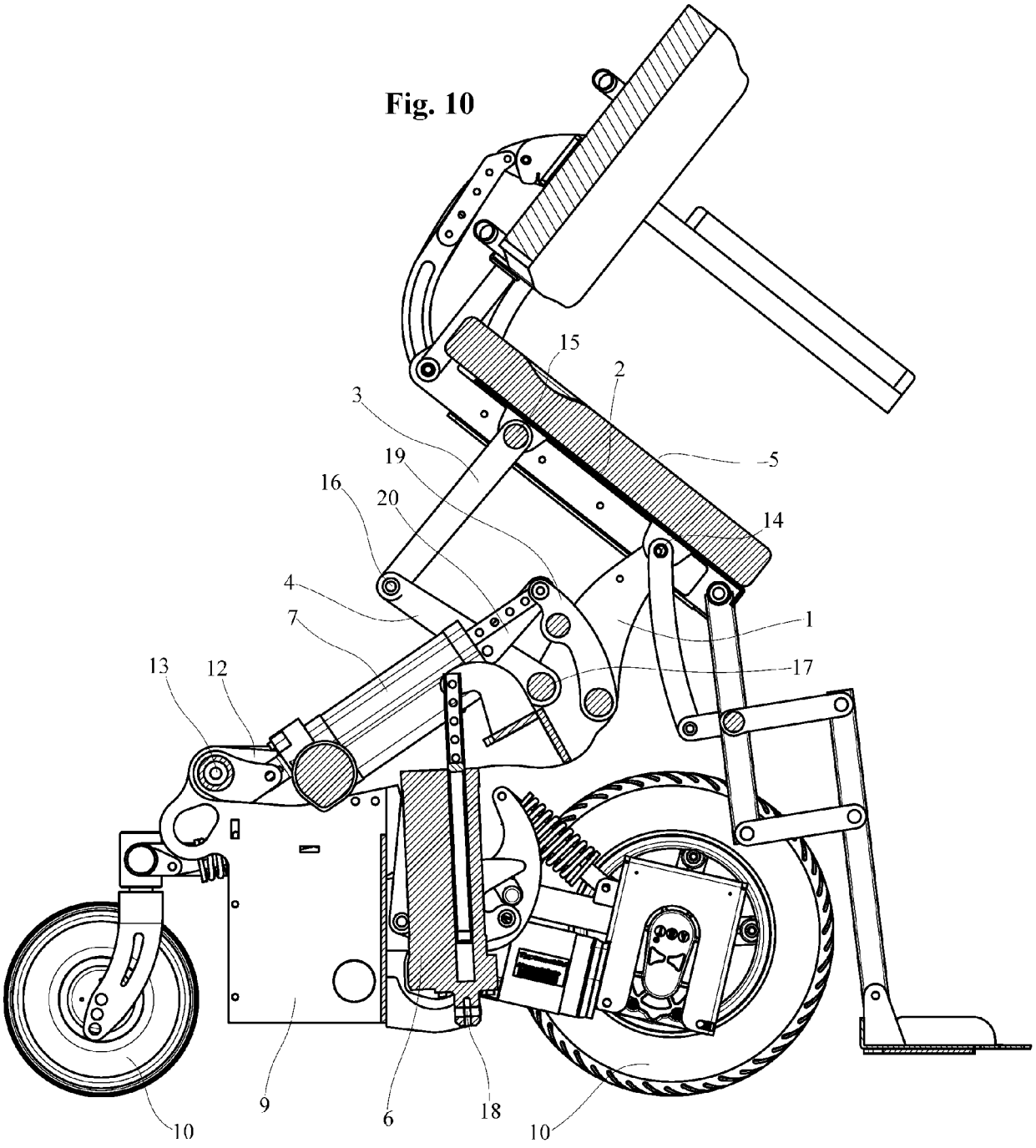


Fig. 10



Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 17 17 1393

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 1 864 637 A1 (LIFESTAND VIVRE DEBOUT [FR]) 12 December 2007 (2007-12-12) * figures 1-9 * -----	1-10	INV. A61G5/10 A61G5/14
X	WO 2007/113395 A1 (LIFESTAND VIVRE DEBOUT [FR]; PORCHERON FRANCOIS [FR]) 11 October 2007 (2007-10-11) * figures 1-10 * -----	1-10	
X	EP 1 764 070 A2 (LIFESTAND VIVRE DEBOUT [FR]) 21 March 2007 (2007-03-21) * figures 1-4 * -----	1-10	

TECHNICAL FIELDS SEARCHED (IPC)

A61G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	27 September 2017	Gkama, Alexandra

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 17 17 1393

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

27-09-2017

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1864637 A1	12-12-2007	AT 494874 T	15-01-2011
		CN 101103946 A	16-01-2008
		EP 1864637 A1	12-12-2007
		FR 2901997 A1	14-12-2007
		US 2007296177 A1	27-12-2007
WO 2007113395 A1	11-10-2007	AT 555765 T	15-05-2012
		CN 101460133 A	17-06-2009
		EP 2004124 A1	24-12-2008
		US 2009218784 A1	03-09-2009
		WO 2007113395 A1	11-10-2007
EP 1764070 A2	21-03-2007	EP 1764070 A2	21-03-2007
		FR 2890855 A1	23-03-2007
		US 2007063480 A1	22-03-2007

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82