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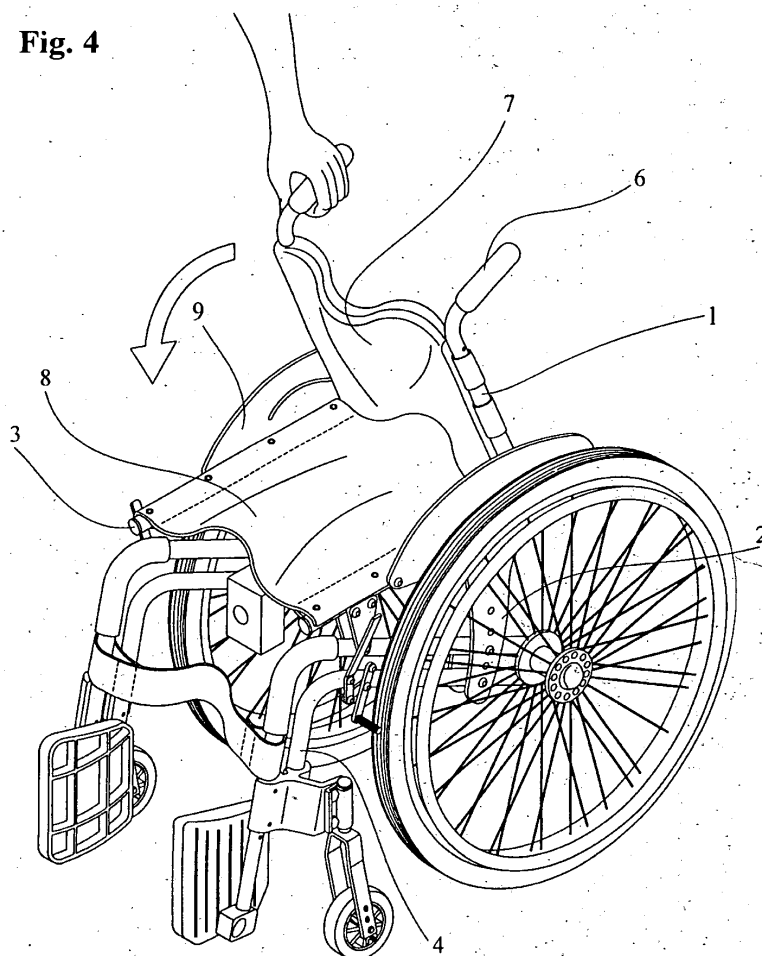
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(54) **Foldable wheelchair**

(57) It is a folding wheelchair for disabled persons characterized in that the folding and the opening can occur by only one hand acting on the top of a post of the backrest let it collapse moving it against the seat and let it raise taking it to the vertical position. The post of the backrest is so structured in order to

achieve a lever with unequal arms which transmits the force by kinematic mechanisms which let the owned angular position change by turning elements of the kinematic pantographic system which connects one to the other the bearing structures of the sides of the wheelchair (Fig. 4).

Fig. 4



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Description

[0001] The present invention concerns the wheelchairs for disabled persons, and in particular its opening and closing kinematic mechanisms.

[0002] To this purpose, the wheelchairs which can be collapsed for easy transport and storage have been in existence for a very long time.

[0003] The collapsing always concerns the approaching of the tubular structures which make up the two lateral walls. The way by which this collapsing can be performed is reached by different methods. One way is for example that of lifting the two lateral pipes which keep the seat sheet and to move them closer at the same time. Another way is that of disengaging locking mechanisms and to move the two armrests closer. In all cases, these operations must be executed not with one only hand buth with both hands, which grip two parts (generally symetrically opposed) of the wheelchair and perform the closing of this latter.

[0004] Sometimes, to limit the storing space even further, the backrest is detached. In case this would be hinged, and you need to lower it down against the seat, you must remove the safety bolt before, with a hand, and then fold it onwards with the other hand.

[0005] Said operations, as it can be noticed, always require to be carried out with both hands, either for closing the wheelchair or to detach or fold the backrest. In fact, it would be practically impossible to carry out the said operations with one only hand.

[0006] It is worth considering here that, in case of disabled persons, the condition of having one only hand available which can operate, occurs rather frequently. So, if we think of a disabled person who wants to load his wheelchair into his car by himself, and who needs therefore to close it before, all this would prove to be very difficult.

[0007] This invention is intended therefore to solve the above-mentioned inconveniences, by giving a solution to the closing of the wheelchair for disabled persons, which can be made even by one only hand and in practical conditions. The object of this patent is characterized by what is described under claim 1.

[0008] In fact, if you kinematically connect the backrest to the closing kinematic mechanisms of the wheelchair with the only operation, to be performed with one only hand, of lowering down the backrest against the seat, you will obtain that the two lateral sides of the wheelchair get each other closer until nearly meeting each other, so performing the closing of the wheelchair.

[0009] Likewise, by the only operation, to be made with one only hand, of raising the backrest which is leaning against the seat, up to taking it back to its normal upright position, you will obtain that the two lateral parts of the wheelchair drawn closer to each other, are moved away, so reaching the complete opening of the wheelchair.

[0010] It is extremely advantageous that said opera-

tions can be carried out by using one only hand, in particular by the disabled user who must operate the closing and the re-opening of the wheelchair, especially when he/she needs to load it or unload it from the car.

[0011] The achievement of this patent is obtained by connecting the bearings structures of the sides of the wheeclahir with a system of kinematic mechanisms to achieve a movement of pantographic type, and by connecting each column of the backrest having function of a lever with unequal arms, by means of a special kinematic connection, to the above-mentioned system of kinematic mechanisms, with movement of pantographic type.

[0012] The system of kinematic mechanisms which connects and moves the two bearing structures of the sides of the wheelchair is made up by two pairs of rods, like each other, at a proper distance one from the other, each pair of rods being parallel to the other, and by a central element, being parallel to the bearing structures of the sides, located next to the geometrical symmetry axis of said bearing structures. This central connection is equipped on each of its ends with metal gusset plates, to which each of the ends of the equal rods of the above-mentioned couples are hinged.

[0013] Therefore, each rod ensues to be hinged by one end to one of the bearing structures of the sides and by the other end it ensues to be hinged with one of the vanes of the gusset plate secured to the central element.

[0014] The distances of the hinge points along the structure of each side and of the hinge points on each vane of the opposed gusset plates, integral with the central element, are of the same extent.

[0015] The set of the two bearing structures and of the central element with the four hinged rods make up two quadrilaterals, having their opposed sides arranged parallel to each other.

[0016] The largest width of the quadrilaterals is reached when the rods are nearly in perpendicular position to the other two sides. This is the largest width the wheelchair can reach.

[0017] When you let the central element move and, consequently, let the rods rotate while inclining them, the area of the two quadrilaterals is reduced and, at the same time, the structural elements of the sides get closer to the centre towards the thin central element until leaning against it. This is the smaller width condition reached by the wheelchair, that is, of closed wheelchair.

[0018] To define the translation limit of the central element when the maximum opening of the wheelchair is reached, beyond which the wheelchair would re-start closing, in this specific case under consideration, a sliding bushing, whose sliding is adjusted through two specific rods, appears to be mounted on the central element. Each rod appears to be hinged on one end to one of the two wings integral with the bushing and on the other end hinged to the bearing structure of the opposed side.

[0019] The result of modifying the area of the above-

described articulated quadrilaterals (therefore, by modifying the width of the wheelchair), besides being obtained by directly operating on the central element, which is moved thereby, it can also be obtained by operating any of the four hinged rods, so modifying the angle conformation.

[0020] In the specific case of the here described patent, in fact, the pushing or pulling action is applied on the rods when one of the two stanchions of the backrest is upsetted or raised from the seat. As previously said, the stanchions are so hinged as to form a lever with unequal arms. The kinematic chain, which starts from the end of the lower arm, gives motion to one of the above-mentioned rods. In the specific case, since the direction of the transmission of the force coming from the stanchion of the backrest, according to whether it is upsetted or raised, needs to be reversed, a special reversing element is fitted in the kinematic chain.

[0021] The Tables of drawings enclosed hereto, can better clarify what above stated.

[0022] Fig. 1 shows a normal wheelchair viewed from side with rings for manual movement, with a dummy on it. The kinematic mechanisms for the closing are not shown.

[0023] Fig. 2 shows the same wheelchair of Fig. 1 viewed from side with the backrest collapsed on the seat. Being a side view, it does not show the reduction of space occupied obtained through the closing condition.

[0024] Fig. 3 is an axonometric view of the wheelchair as per Fig. 1.

[0025] The presence of the backrest sheet and, in particular, of the seat sheet prevent to see the kinematic mechanisms which carry out its closing with the backrest collapsing. It can be noticed a hand which takes the handgrip, as initial stage of the backrest collapsing.

[0026] Fig. 4 shows the wheelchair as per Fig. 2 in an intermediate closing stage, connected with the backrest collapsing.

[0027] Fig. 5 shows the wheelchair as per Fig. 3 in its final closing stage with the completion of the backrest collapsing.

[0028] Fig. 6 shows schematically the bearing structure of a wheelchair side, supporting the section iron for the seat sheet and the post for the backrest sheet. It can be noticed that the backrest post appears to be hinged in an intermediate position so as to originate lower down the shortest arm of a lever. There are shown the two areas crossed by the axis for the hinging of the rods which are part of the kinematic mechanisms system for the closing of the wheelchair. Next to said areas, placed underneath, there are schematically shown the corresponding sections.

[0029] Fig. 7 shows schematically the bearing structure for a wheelchair side which supports the section bar for the seat sheet and the corresponding post for the backrest sheet. It can be noticed that the backrest post appears to be hinged in an intermediate position, so as to

originate lower down the shortest arm of a lever. There are shown the elements of the kinematic chain which, operated from the lower end of the post, transmit the motion to one of the rods of the kinematic mechanisms which control the opening (or closing) of the wheelchair. In this drawing, the post is in upright position compared to seat and the wheelchair is in open position.

[0030] Fig. 8 schematically shows viewed from the top the elements of the bearing structures of the sides spaced out each other having the wheelchair in opened position and the system of kinematic mechanisms of pantographic type which couple them. There are shown the four identical rods with almost normal arrangement in respect to the elements belonging to the sides and hinged with one end to the said elements and with the other end hinged to the sides of the two end gussets integral with the thin central element parallel to the sides. There is shown also the sleeve wrapped slidably on the central element equipped with vanes symmetrical to the axis. This sleeve is connected to each one of the two elements of the bearing structure of the sides by two rods each one of them having one end hinged to an element of the side and the other end is hinged on one of the two vanes of the sleeve. The function of the sleeve limits the translation of the central element when the opening of the wheelchair has reached its maximum opening. There can be noticed, indicated on bold type the end elements of the kinematic chain which connect the lower ends of the posts of the backrest.

[0031] Fig. 9 shows schematically what already shown in fig. 7 with the difference that the post of the backrest is collapsed on the structural section of the seat. In this position the wheelchair is closed. The rods of the kinematic chain which transmit the movement from the lower end of the backrest post to one of the rods of the kinematic mechanism invert their function depending if they perform the folding or opening of the wheelchair taking alternatively the function of tie rods or the function of rafters.

[0032] Fig. 10 shows in a schematic way what already shown in fig. 8 with the difference that the structural elements of the sides of the wheelchair are now close up each other and the plates and the central element which compose the pantographic kinematism of the system appears closed up on the central part. In this situation the wheelchair appears folded.

[0033] Fig. 11 with the continuous and hatched lines summarizes the figures 7 and 9 already considered previously giving the possibility of comparison.

[0034] Fig. 12 with the continuous and hatched lines summarizes the figures 8 and 10 already considered previously giving the possibility of comparison.

[0035] Numeral 1 shows the posts of the backrest; numeral 2 a bracket which connects the section bar 3 of the seat with the bearing structure 4 of the side; numeral 5 the dummy; numeral 6 the handgrips of the posts 1; numeral 7 the fabric backrest; numeral 8 the fabric seat;

numeral 9 the armrests; numeral 10 the hinging of the post 1 with the brackets 2; numeral 11. the junction point placed on the lower end of the post 1 of the first element 12 of the kinematic chain 13 and 17 which transmits the force to the plate 18; numeral 19 the plates which together with the plates 18, with the structural elements 4 of the sides and of the central element 22 compose the panthographic system for the folding and opening of the wheelchair; numeral 20 the hinging axis of the ends of the plates 18 on the structural bearing elements of the sides 4; numeral 21 the hinging axis of the ends of the plates 19 on the structural bearing elements of the sides 4; numeral 24 the hinging axis of the ends of the plates 19 on the sides of the gusset 23 integral with the central element 22; numeral 25 the hinging axis of the ends of the plates 18 to the sides of the gusset 26 integral to the central element 22; numeral 27 the sleeve which wraps the central element 22 equipped with vanes 28; numeral 30 the rods which connects the sleeve 27 with the structural bearing elements of the sides 4, these rods 30 having one of the ends which is hinged on these structural bearing elements of the sides 4 next to the hinging axis 31 and the other end that is hinged on the vanes 28 of the sleeve 27 next to the hinging axles 32. Any other solution, even in an improved way, which uses the teachings claimed, does not fall outside the patent.

Claims

1. Folding wheelchair for disabled persons **characterized in that** with only one movement of the backrest (1) the wheelchair folds, in particular by collapsing the backrest (1) against the seat (3) the side parts (4) of the wheelchair approach until almost meeting each other obtaining the folding of the wheelchair; and viceversa by uprising the backrest (1) which is pushed against the seat (3) the parts (4) of the wheelchair which are approached each other, space out, so obtaining the complete opening of the wheelchair.
2. Folding wheelchair for disabled persons according to claim 1 **characterized in that** the force for moving the kinematic system (18,19,22,4) which operates the bearing structures (4) of the sides to approach (or take away) from each other to obtain the folding (the opening) of the wheelchair comes from the force (6) applied by the operator to the posts (1) of the wheelchair to rotate them placing them against the seat (3) (letting them raise in vertical position).
3. Folding wheelchair for disabled persons according to claim 1 **characterized by** that the posts (1) of the backrest are hinged to the bearing structure (2) of the sides (4) in an intermediate position (10) in order to achieve a lever by arms definitely unequal; it follows from that at the ends (11) of the lower arm (10,11) a wide amplification of the force exerted by the operator on the handgrips (6) which are on the top of the posts (1).
4. Folding wheelchair for disabled persons according to claim 1 **characterized in that** the folding or opening operation is made by only one hand which exerts the force on the top (6) of a post (1) of the backrest lowering it close to the seat (3) or uprising it in the vertical position.
5. Folding wheelchair for disabled persons according to claim 1 **characterized in that** the rotation of a stanchion (1) towards the seat (3) or in elevation from the seat (3) lets the other post (1) make the same rotation being both posts connected to elements (18) (plates) correspondents of the articulated contiguous parallelograms composing the kinematic panthographic system (18,19,22,4) which connects the bearing structures (4) of the sides of the wheelchair, therefore these elements (18) (plates) making the same angular variations.
6. Folding wheelchair for disabled persons according to claim 1 **characterized in that** the opening and folding of the wheelchair is determined by the angular configuration taken by the moving of the stanchions (1) of the backrest to the elements (18,19) (plates) hinged (20,21,24,26) through their ends to the other elements (4,22) capable of movements only parallel to themselves which in their wholeness compose two articulated contiguous parallelograms belonging to the kinematic panthographic system (18,19,22,4) applied to the wheelchair.
7. Folding wheelchair for disabled persons according to claim 1 **characterized in that** on the thin central element (22) common to the two articulated contiguous parallelograms composing the kinematic panthographic system (18,19,22,4) which connects the bearing structures (4) of the sides of the wheelchair a sliding sleeve (27) is fitted on this central element (22), this sleeve being connected with its rods (30) having one of the ends (31) hinged on the bearing structures (4) of the sides and the other end (32) hinged on the vanes (28) integral with the sleeve (27) for the purpose to define the maximum angular value allowed to the turning elements (18) (plates) of the kinematic panthographic system (18,19,22,4).
8. Folding wheelchair for disabled persons according to claim 1 **characterized in that** the end (11) of the arm (10,11) of lower lever of each post (1) of the backrest is kinematically connected (12,13,17) directly to the turning elements (18) (plates) of the kinematic panthographic system (18,19,22,4).

Fig. 1

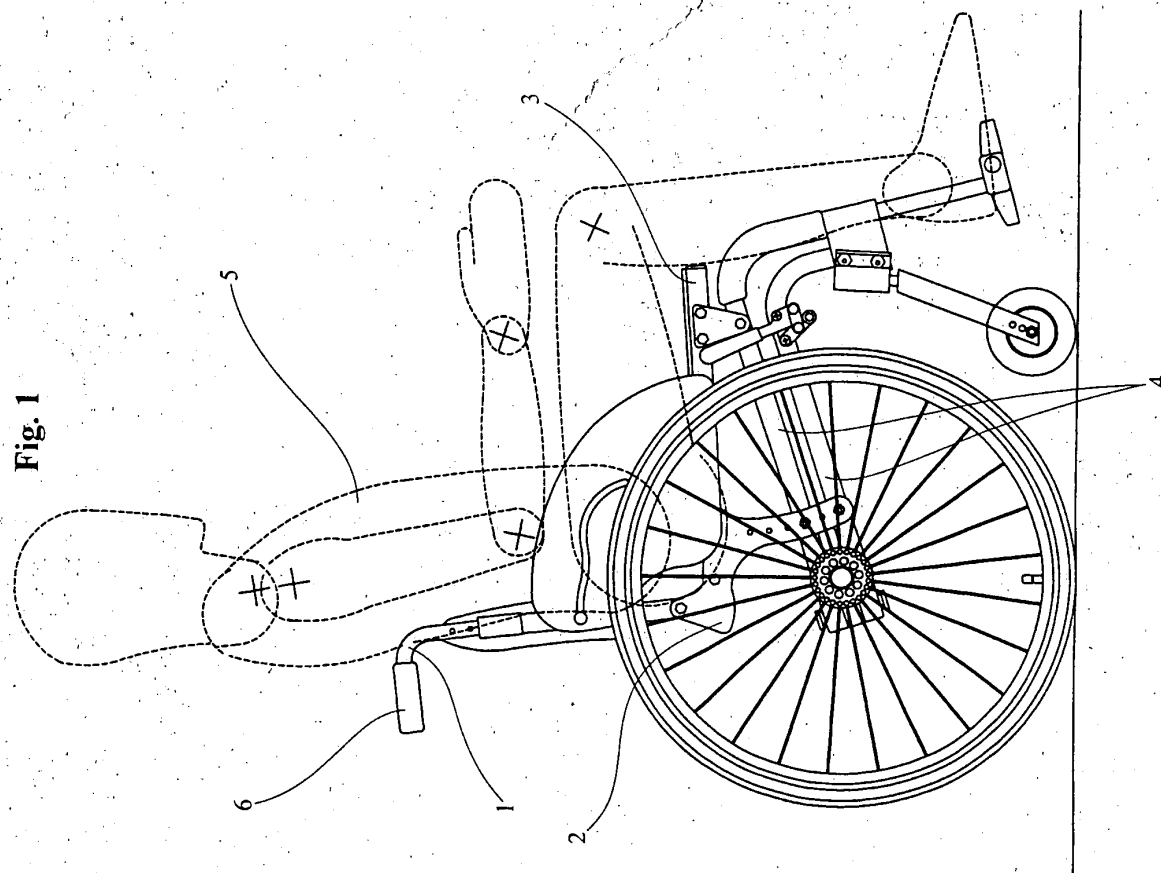
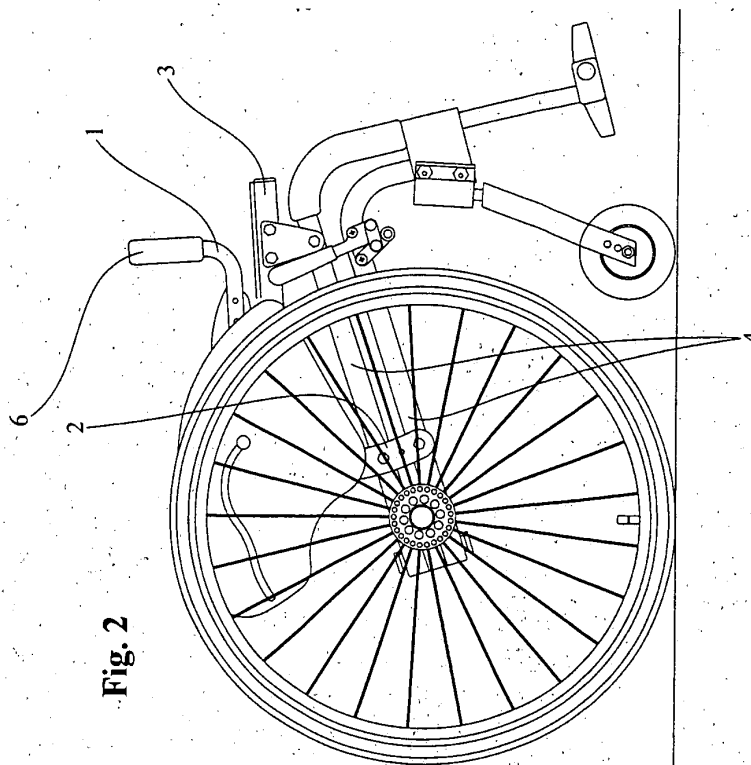


Fig. 2



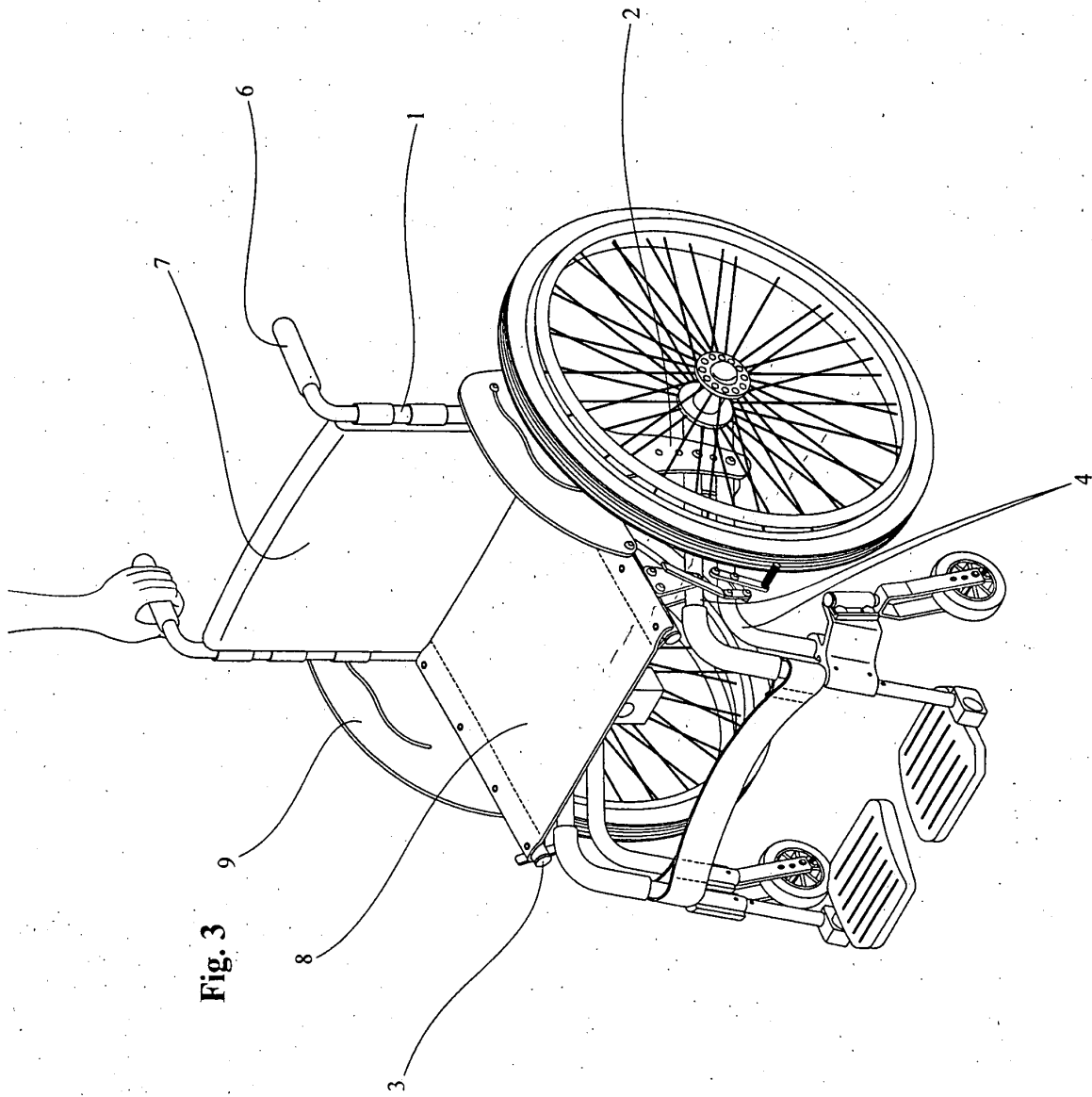


Fig. 3

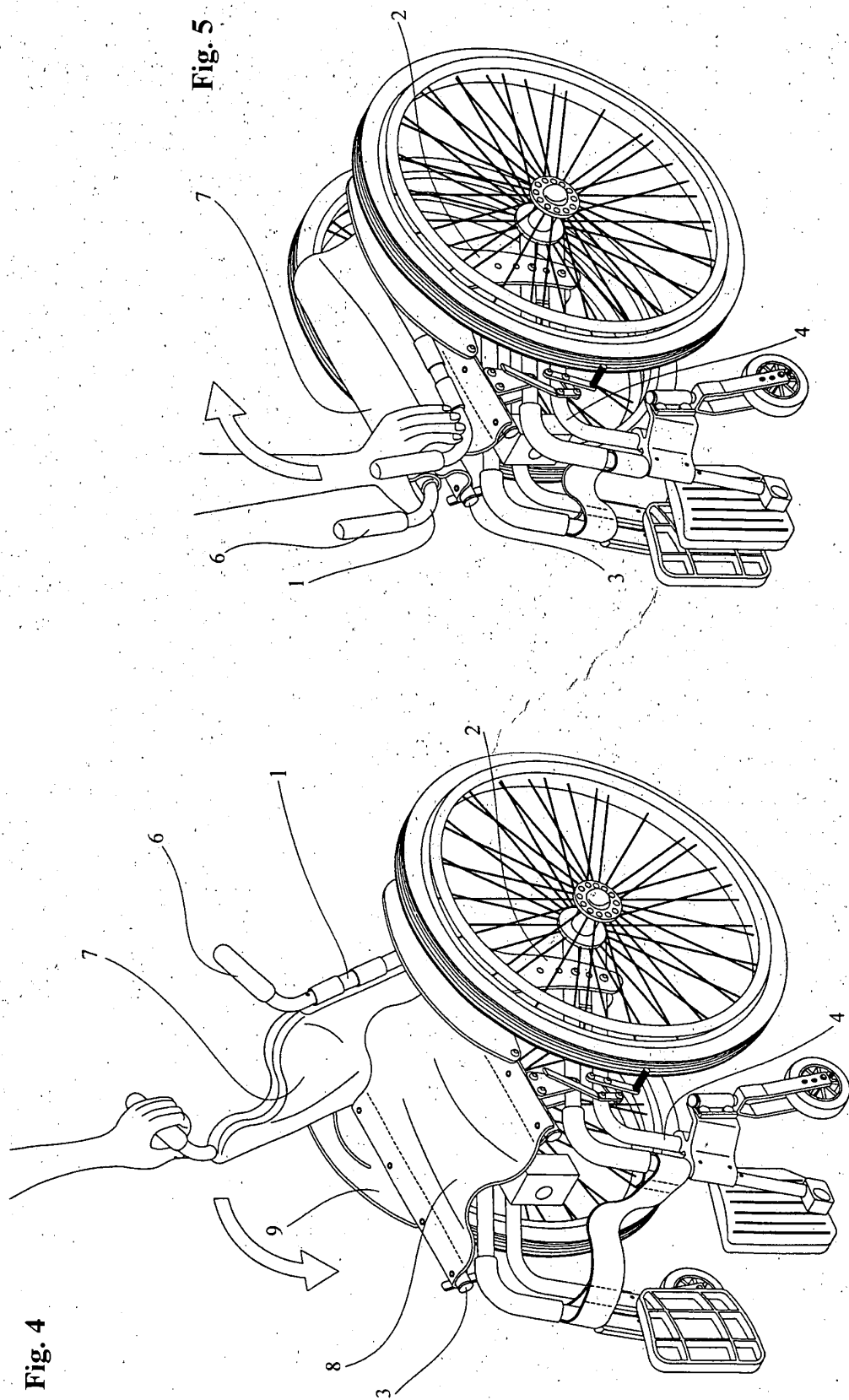
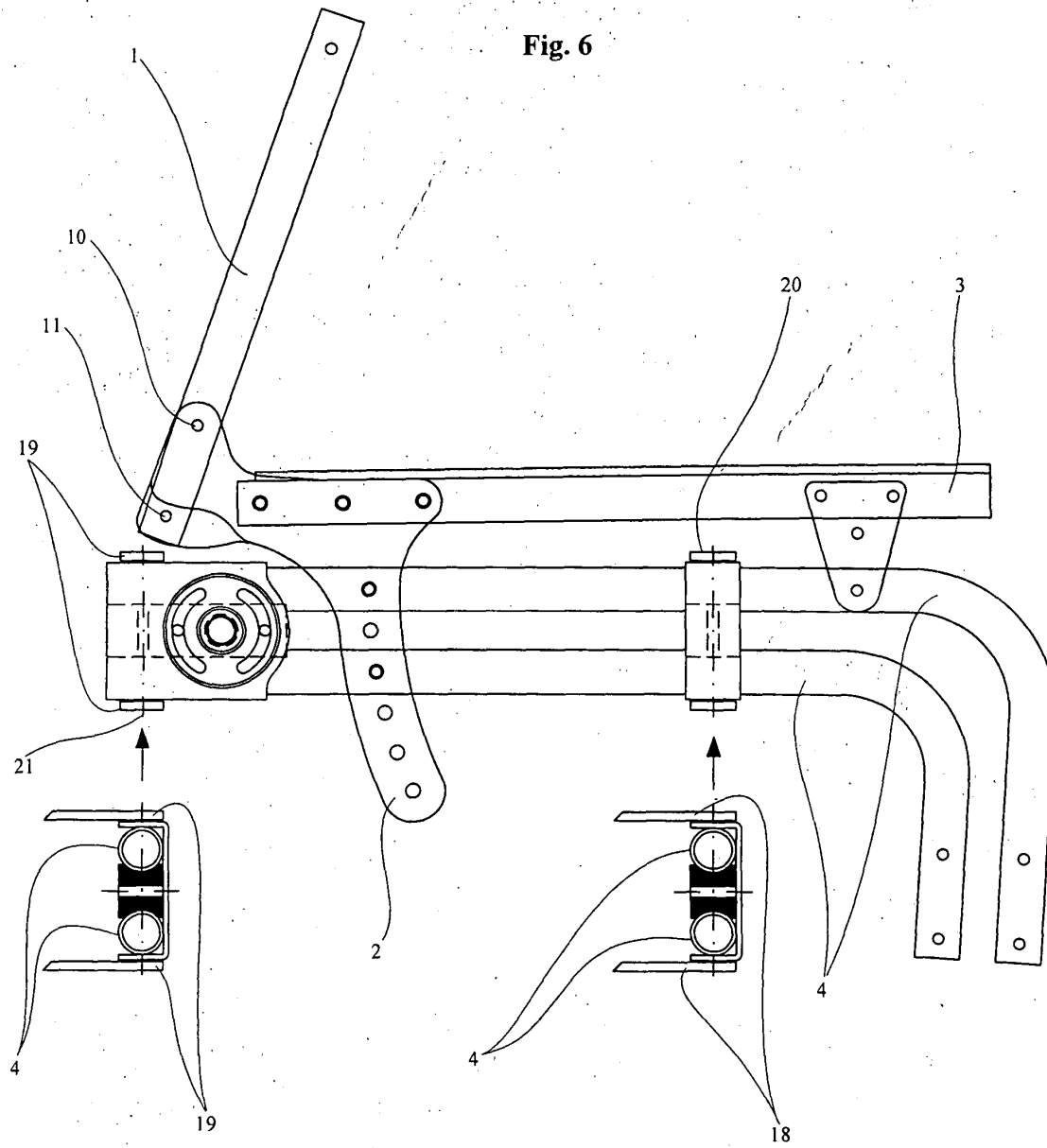
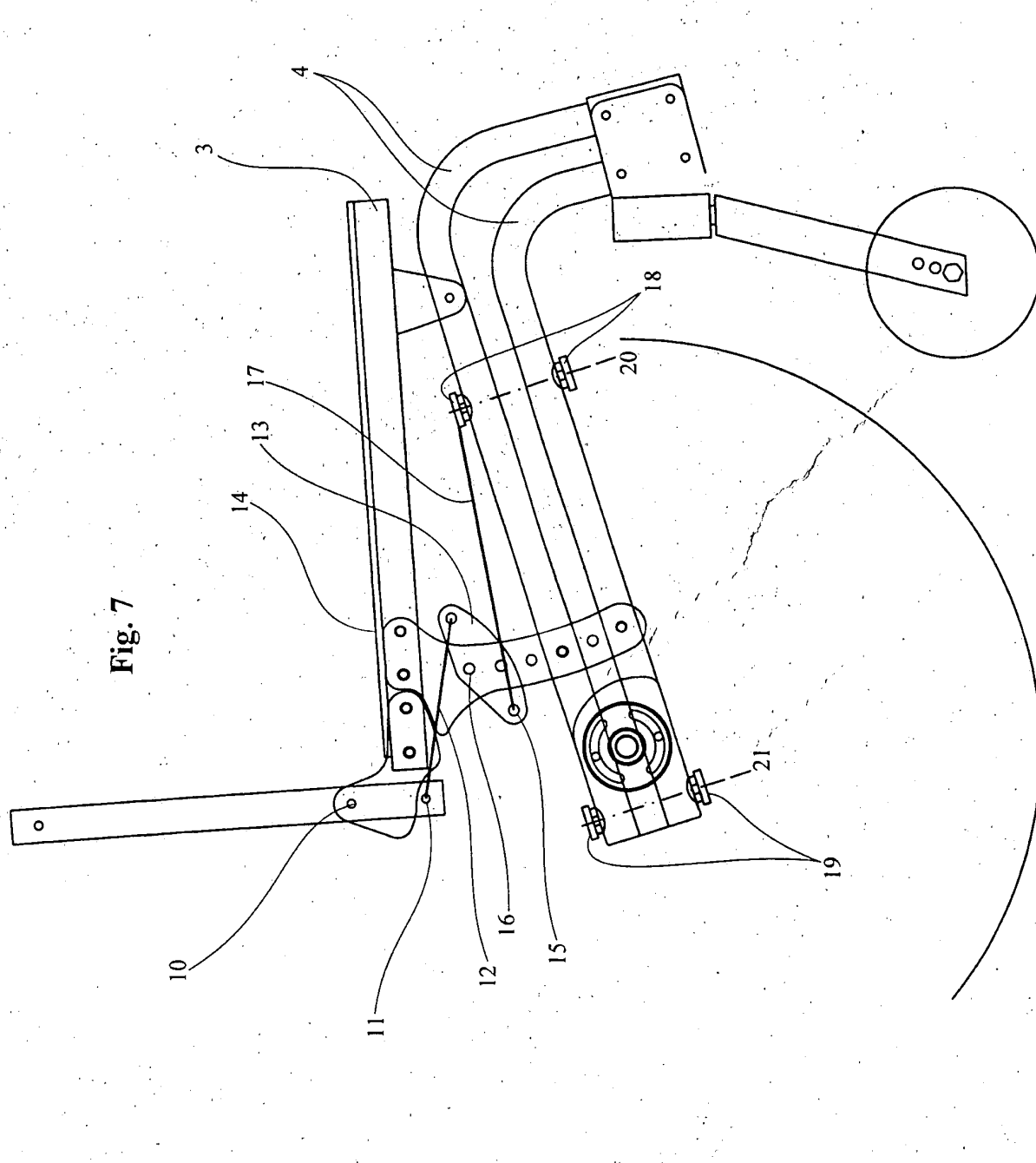


Fig. 6





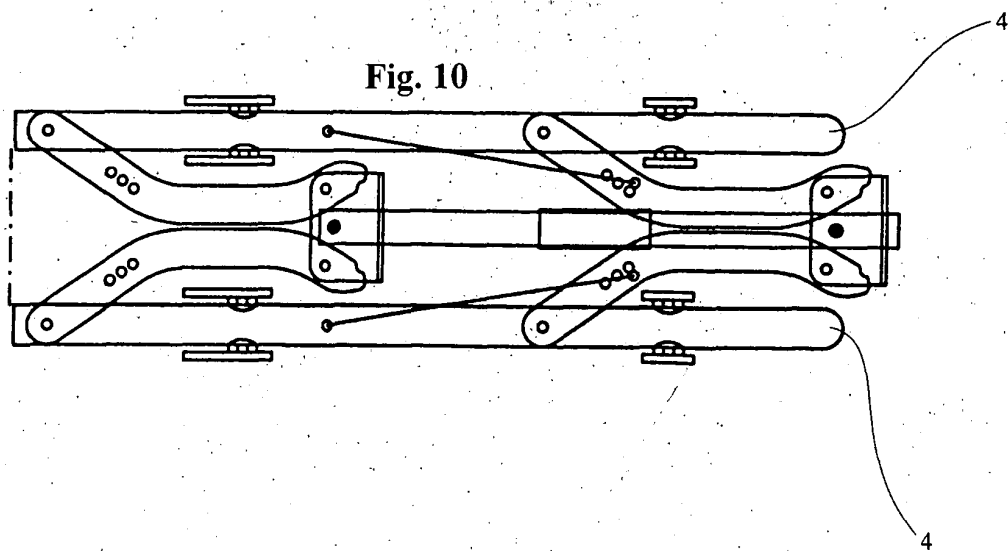
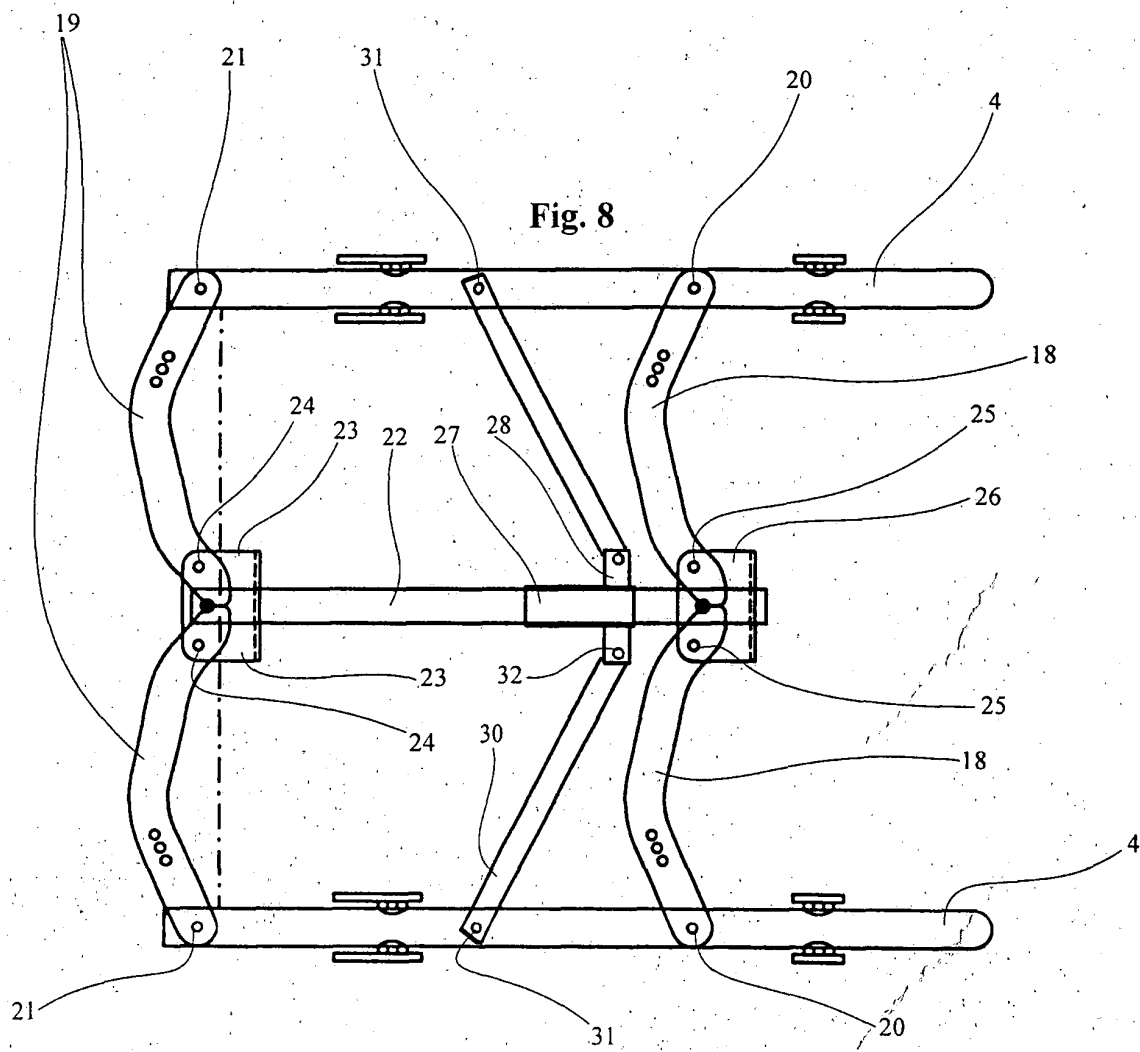


Fig. 9

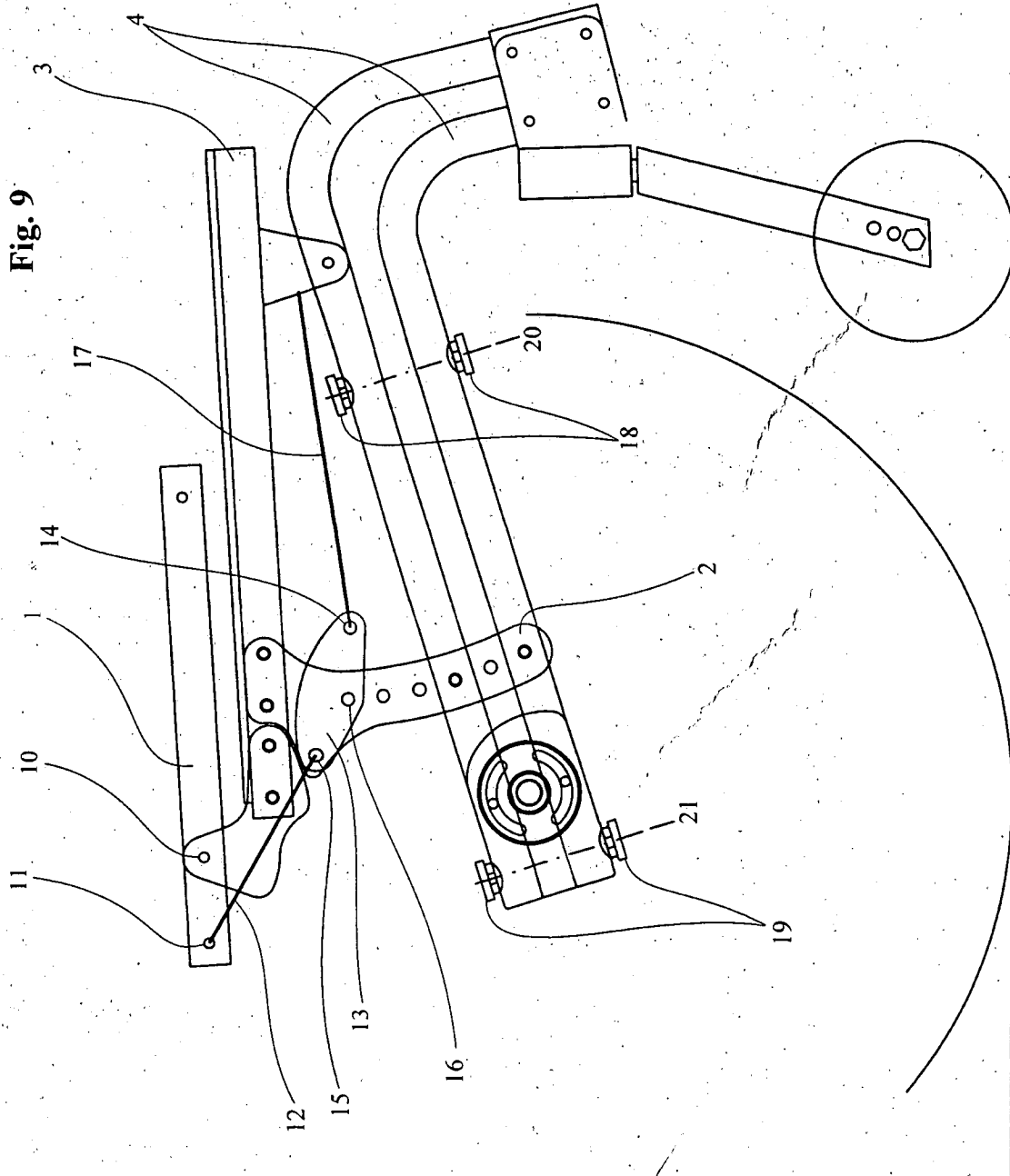


Fig. 11

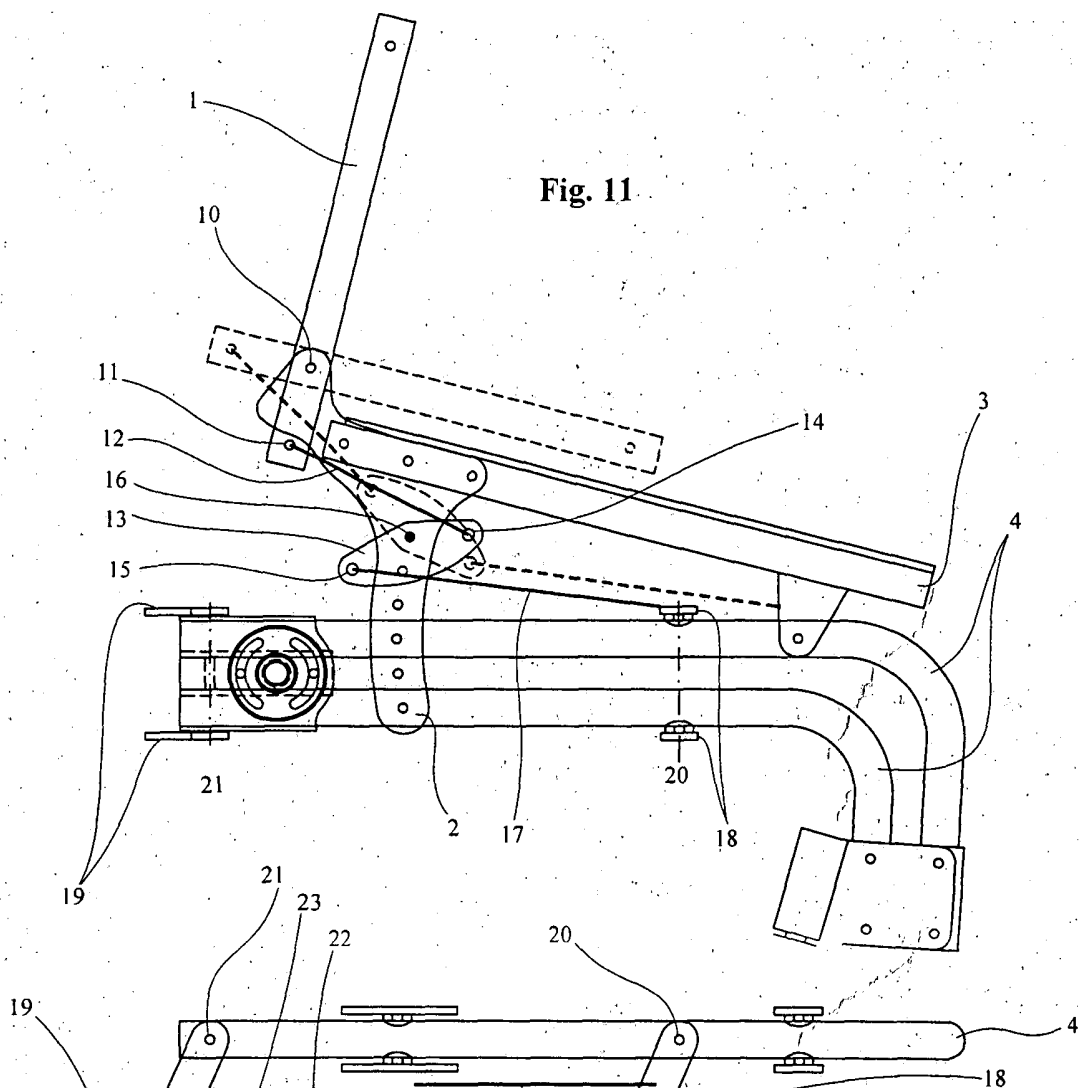
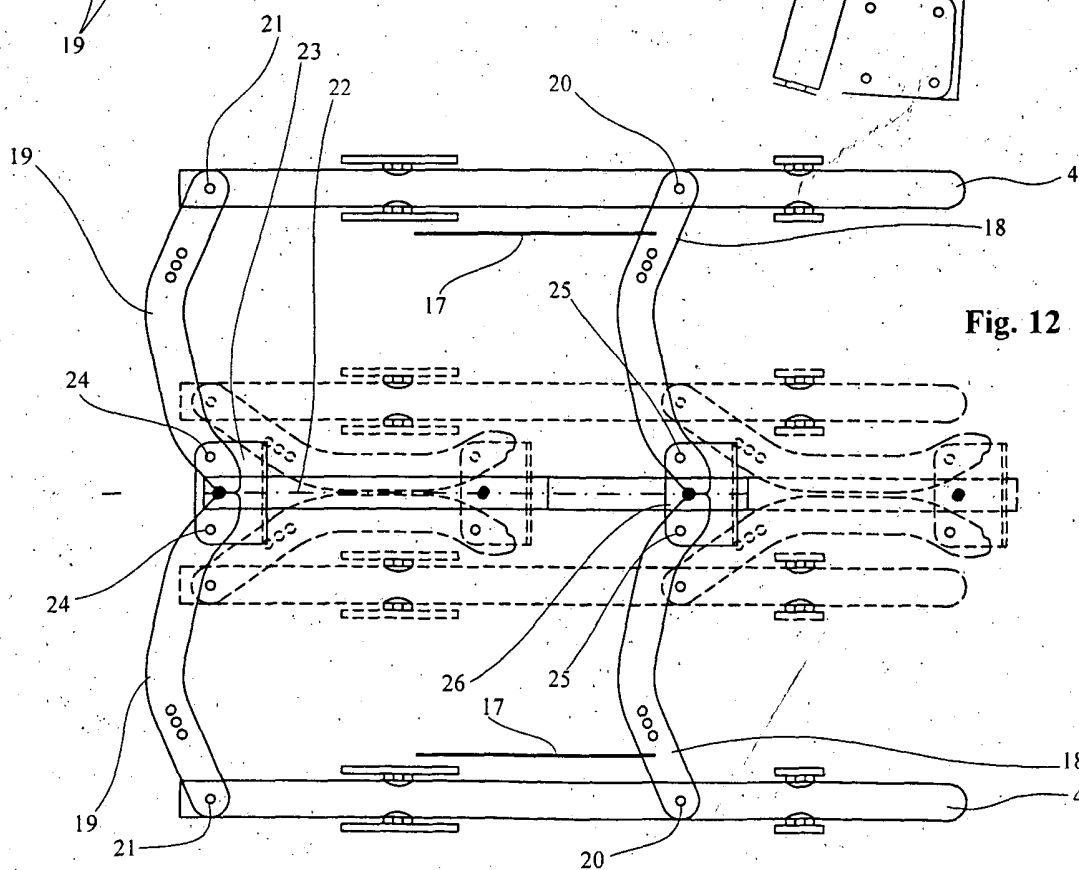


Fig. 12





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EUROPEAN SEARCH REPORT

Application Number
EP 03 00 5074

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 6 173 986 B1 (SICHER JACK) 16 January 2001 (2001-01-16)	1-6,8	A61G5/08
Y	* column 5, line 15 - line 57; claim 4; figures 4-6 *	7	
Y	--- WO 02 056816 A (SUNRISE MEDICAL HHG INC) 25 July 2002 (2002-07-25) * page 20, line 6 - line 26; figures 21,22 *	7	
X	--- DE 100 40 902 A (MOLL THISSEN JOSEF) 22 March 2001 (2001-03-22) * column 1, line 58 - line 66; claim 1; figures *	1-4	
A	--- DE 196 53 324 A (BOHNER MATTHIAS ;LIPPERT STEFAN (DE); SAETTELE JOERG (DE); SAETTEL) 12 March 1998 (1998-03-12) * column 6, line 24 - column 7, line 24; figures *	1-8	
A	--- US 5 593 173 A (WILLIAMSON DANIEL E) 14 January 1997 (1997-01-14) * column 7, line 19 - line 39 * * column 7, line 64 - column 8, line 18; figures 2A-2C *	1-8	TECHNICAL FIELDS SEARCHED (Int.Cl.7)
A	--- US 4 712 830 A (CHARBROL JEAN-JACQUES ET AL) 15 December 1987 (1987-12-15) * column 2, line 44 - line 65; figures * -----	7	A61G
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 15 August 2003	Examiner Cametz, C
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 03 00 5074

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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15-08-2003

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 6173986	B1	16-01-2001	NONE	
WO 02056816	A	25-07-2002	US 2002093156 A1	18-07-2002
			WO 02056815 A1	25-07-2002
			WO 02056816 A1	25-07-2002
			US 6572133 B1	03-06-2003
DE 10040902	A	22-03-2001	DE 10040902 A1	22-03-2001
DE 19653324	A	12-03-1998	DE 19653324 A1	12-03-1998
US 5593173	A	14-01-1997	CA 2204761 A1	17-05-1996
			EP 0790913 A1	27-08-1997
			JP 10509608 T	22-09-1998
			WO 9614232 A1	17-05-1996
US 4712830	A	15-12-1987	FR 2581299 A1	07-11-1986
			AT 56613 T	15-10-1990
			DE 3674241 D1	25-10-1990
			EP 0201423 A1	12-11-1986
			JP 62057522 A	13-03-1987