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(54) **Foldable wheelchair with x-shaped cross bracing frame assembly**

(57) The frame assembly of the foldable wheelchair comprises a cross-bracing frame assembly (4) coupling the side frames (3, 3') together for movement transversely between a spaced apart deployed position and a proximate folded position. A pair of link elements (14, 14') is provided, each linking one of the side frames (3, 3') to a section of a strut (13, 13') of the cross-bracing frame assembly. Each of said link elements is at one of its ends pivotally mounted to said strut and to its other end pivotally mounted to one of said side frames, around an axis of pivoting which is parallel and displaced below the longitudinal axis of the upper frame tube (8, 8') of said side frame (3, 3').

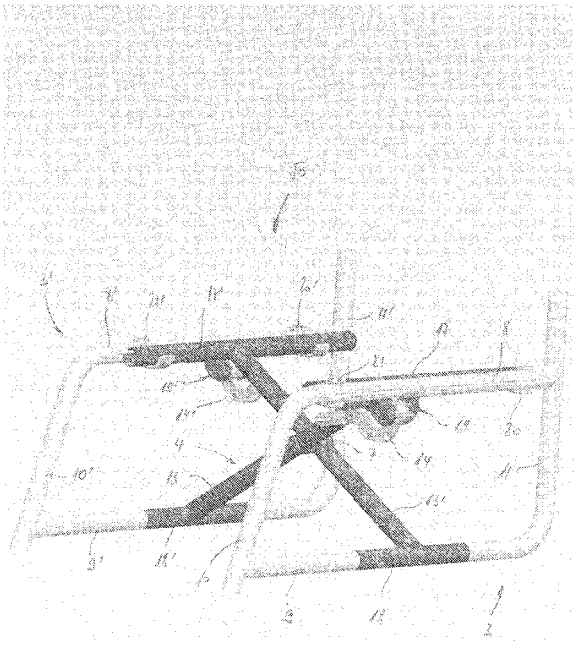

Fig. 2

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Description

Technical Field

[0001] The present invention relates in general to foldable wheelchairs, and more particularly, to wheelchairs which have X-shaped cross-bracing frame assemblies that fold or scissor to allow the side frames of the wheelchairs to be moved between a spaced apart deployed position for use and a folded position for storage or transport.

Prior Art and the Problem Underlying the Invention

[0002] Foldable wheelchairs with cross-wise arranged struts are disclosed in US 4,989,890 and US 6,050,582. In wheelchairs of this type, cross-struts are pivotally attached, with their bottom ends, to lower side frame tubes, which are disposed horizontally and which extend along the rear to front direction of the wheelchair. At their upper end, the cross-struts carry a seat profile. Attachment of each strut to an upper tube of the left and right side frame, respectively, which is equally disposed horizontally along the rear to front direction of the wheelchair, is provided by means of a link element, also referred to as link plate or simply link. Each left and right link element is pivotally attached to the corresponding upper tube of the side frame and also to the corresponding strut, so that folding of the wheelchair is allowed for by the pivoting connections of the cross-struts to the tubes of the left and right side frames of the wheelchair.

[0003] In both the folded and unfolded state, the side frames of the foldable wheelchairs form two planes that are ideally situated parallel with respect to each other. However, during the folding process the side frames have the tendency not to stay in parallel but assume a V-shape, with the upper side frames staying apart from each other. This can also be referred to as a splaying or tilting of the side frames during folding, due to the geometry of the articulation provided by the link element together with the cross-struts, comprising as many as 7 pivoting axis. The link element experiences forces in its longitudinal axis during folding, and thus resisting to the side frames getting together in parallel. Actually, during folding, the distance between the two pivoting attachments of an individual link element, one to the upper side frame tube and the other to a cross-strut, is transitionally reduced during the folding and unfolding process.

[0004] On the other hand, the upholstery on the backrest may oppose to the backrest tubes assuming a V-shape, which means in the end that more force has to be applied to unfold the wheelchair. In wheelchairs with bigger seat width and, as a consequence, longer cross-struts, the force to be overcome increases and may become too hard for some people to overcome.

[0005] This problem is discussed in DE 20112335, where a link element comprising an elastic section is suggested, so that, upon folding, the elastic section at least partly compensates for the reduction of the distance between the pivoting attachments of the link element. However, the compensation provided by an elastic section of the link element is limited and goes hand in hand with a decrease of the overall stability and/or rigidity of the attachment provided by the link element.

[0006] The problem is further treated in US 2006/0145456, which proposes a link assembly having a variable length in the direction extending transversely between the side frames. According to an embodiment, a spring is used to provide a variable length which compensates for the reduction of the distance during folding. Again, the use of a flexible element such as a spring decreases the overall stability and/or rigidity of the attachment provided by the link element.

[0007] It is an objective of the present invention to solve the problem depicted above. In particular, it is an objective to facilitate folding of a foldable wheelchair comprising an "X"-type cross-bracing frame assembly. Furthermore, it is an objective to reduce the extent of the splaying of the side-frames during folding of the wheelchair.

[0008] It is a further objective of the invention to provide a foldable wheelchair having an improved overall stability and /or rigidity if compared to the above prior art wheelchairs. Accordingly, it is an objective to provide a rigid link element that warrants high overall rigidity of the chair, when driving, preventing loose attachments of various components of the wheelchair.

[0009] It is yet another objective to provide a foldable wheelchair which can be folded and unfolded in a substantially effortless way.

Summary of Invention

[0010] Remarkably, the present inventors found a way of diminishing the extent of splaying of the side frames during folding, while warranting the rigidity of the overall frame assembly of the wheelchair. According to the invention, a link element pivotally connecting an upper frame tube to an upper section of a cross-strut of a cross-strut assembly of the foldable wheelchair was mounted at a supporting structure at a side frame of the wheelchair. Interestingly, by displacing the axis of pivoting of the link element at said supporting structure, the extent of splaying can be modified and in particular reduced.

[0011] The present invention provides a foldable wheelchair, a foldable wheelchair frame assembly, and a link assembly as defined in the appended claims.

Brief Description of the Figures

[0012] In the figures,

[0013] **Figure 1** is a front view of a foldable wheelchair according to the present invention.

[0014] **Figure 2** is a perspective view of a foldable wheelchair frame assembly of the present invention in an unfolded position.

[0015] **Figure 3** is a perspective view of the foldable

wheelchair frame assembly of Figure 2 in a folded position.

[0016] **Figure 4** is a lateral view of the foldable wheelchair frame assembly of Figure 2 in an unfolded position.

[0017] **Figure 5** is a perspective exploded view of a first embodiment of a link assembly of the present invention.

[0018] **Figure 6** is a front view of a link element used in the link assembly shown in Figure 5.

[0019] **Figure 7** is a left side front view of the assembled link assembly of Figure 5.

[0020] **Figure 8** is a top view of the assembled link assembly of Figure 5.

[0021] **Figure 9** is a perspective exploded view of a second embodiment of a link assembly according to the present invention.

[0022] **Figure 10** is a perspective exploded view of a third embodiment of a link assembly according to the present invention.

Detailed Description of the Preferred Embodiments

[0023] The wheelchair of the present invention is now illustrated by way of example with reference to the appended drawing figures. Due to the largely mirror-symmetrical constitution of the wheelchair, with many elements appearing pair wise, in the following the left side of the wheelchair are mainly referred to, with corresponding elements on the right side generally having the same reference number in the figures, indicated with the sign '.

[0024] **Figure 1** shows a foldable wheelchair according to the present invention, in a position which is about midway between the folded and the unfolded position. Situations and directions of axis of elements of the wheelchair are determined by the perspective of a user seated in the wheelchair. Accordingly, the left side of the wheelchair corresponds on the right side of Figure 1 and vice versa. The situations or directions "up" or "top", "down" or "bottom", "rear" or "back" and "front" follow the same rule. Figure 1 is a front view of an embodiment of the wheelchair of the present invention.

[0025] The wheelchair of Figure 1 comprises left and right side wheels 2, 2', turnably mounted on left and right side frames 3, 3' of the wheelchair. The side-frames comprise upper frame tubes 8, 8' and lower frame tubes 9, 9', which are basically horizontally and parallely arranged in a rear-to-front orientation on each side of the wheelchair. Each left and right side frame further comprises rear and front side frame tubes 11, 11'; 10, 10', which are basically vertically arranged in a bottom-to-top orientation.

[0026] Preferably, in the unfolded or completely folded state of the wheelchair, the rear and front side frame tubes 10, 11 are basically oriented in parallel to each other, while, during the folding process, due to the geometry of the cross-struts assembly discussed further below, a splaying occurs, as can be seen in Figure 1. It is a goal of the present invention to reduce the extent of this splaying thus approaching a substantially parallel orientation of the entire side frames during the folding and unfolding process.

[0027] Each rear side frame tube 11, 11' further extends to form a backrest-holding tube 12, 12', supporting a backrest upholstery. In the embodiment shown in Figure 1, the left and right backrest-holding tubes 12, 12' have a diameter that is smaller than that of the respective rear side frame tube 11, 11', and that matches the inner diameter of the rear side frame tubes. The backrest holding tubes are thus stabilised by being inserted and mounted in an inner lumen of the rear side frame tubes 11, 11'.

[0028] In the embodiment of Figure 1, the back tubes 12, 12' are shown at their maximally splayed, non-parallel state. It can be seen that in this position, the backrest upholstery is tight.

[0029] Figure 1 further shows the cross-bracing frame assembly 4 of the present invention, comprising left and right cross-struts 13, 13'. Per definition, the "left" cross-strut is the cross-strut 13 which is pivotally attached, with its lower end, to the lower right side frame tube 9', while the "right" cross-strut is the cross strut 13' that is pivotally attached, with its lower end, to the lower left side frame tube 9. Both cross struts 13, 13' are pivotally connected to each other by an axis 7, which lies about in the middle of the cross-struts 13, 13'. Again, as a matter of definition, a section of each cross strut that lies above the connecting point 7 is the upper section of the cross strut 13, 13', while a section of each cross strut extending below connecting point 7 is considered as the lower section of the respective cross-strut.

[0030] The cross-bracing frame assembly further comprises a lose seat 6, which, in the partially folded wheelchair of Figure 1 is seen in a partially folded, non-tight state. The seat 6 is supported on longitudinal left and right seat tubes 17, 17', with the left seat tube 17 being perpendicularly attached to the left cross-strut 13 at the top end of the latter. The left seat tube 17 and the left cross-strut 13 thus form a T-shaped structure, which is characteristic for many foldable wheelchairs. The same applies to the corresponding right side elements of the cross-bracing frame assembly.

[0031] As mentioned above, the cross-struts 13, 13' are pivotally mounted with their bottom ends at the lower side frame tubes 9, 9', thus stabilising the frame assembly of the wheelchair. In order to provide a further stabilising connection between the left and right side frames 3, 3' a link assembly is provided, which connects the upper sections of the cross-struts 13, 13' to upper side frame tubes 8, 8'. Each link assembly comprises left and right link elements 14, 14', wherein a left link element 14 is pivotally mounted, with its left-side external end, on a left upper side frame tube 8 and, with its other, inner end, to an upper section of the left cross strut 13. Accordingly, a right link element 14' is pivotally mounted, with its right-side external end, on a right upper side frame tube 8' and, with its other, inner end, to an upper section of the right cross strut 13'. A U-shaped section in each link el-

ement 14, 14' can be seen in Figure 1.

[0032] As the skilled person will readily recognise when looking at Figure 1, the transition from the unfolded to the folded position of the wheelchair is accomplished by approaching the left and right side frames 3, 3' to each other, while the various elements of the cross-bracing frame assembly are pivoting around their respective axis of pivoting. The cross-struts 13, 13' pivot, amongst other, around cross-point 7, diminishing angle between them, thus approaching a more vertical and parallel configuration when the wheelchair is folded. At the same time, the left and right link elements 14, 14' pivot around their axis supported on the left and right upper side frame tubes 8, 8' in an upward direction, as illustrated by the arrows in Figure 1. The process of folding and unfolding of the wheelchair of the present invention and the advantages thus obtained will be discussed in more detail in the following figures.

[0033] The perspective side view of **Figure 2** shows a foldable wheelchair frame assembly (50) for a wheelchair of the present invention, including the left and right side frames 3, 3' and the cross-bracing frame assembly 4. The wheels, backrest and further components of the wheelchair do not form part of the cross-bracing frame assembly and are not shown in Figure 2. These latter elements being not shown, the nature of the attachment of the left link element 14 to the left upper side frame tube 8 can be seen in more detail. The invention will further be described with respect to the left sided elements visible in Figure 2.

[0034] As can be seen from Figure 2, a link assembly comprises a supporting structure 19, mounted on the upper side frame tube 8 and pivotally harbouring the left link element 14 at its left, outer extremity. The supporting structure 19 determines the attachment of the link element 14 at the upper side frame tube 8 and the axis of pivoting of the link element 14 at the upper side frame tube 8. In particular, the axis of pivoting of the link element 14 is parallel, but not coaxial to the axis of the upper side frame tube 8. More specifically, the axis of pivoting of the link element 14 at the upper side frame tube 8 is displaced to be situated below, preferably vertically below the axis of the upper side frame tube 8. As will be illustrated in further detail below, this displacement of the axis of the link element on the upper side frame tube in a downward direction results in a diminution of the splaying of the side frames during folding.

[0035] Figure 2 also reveals the nature of the pivotal attachment of the bottom end of each cross strut 13, 13' on the respective lower side frame tubes 9, 9'. It can be seen that the right cross-strut 13' is attached, at its bottom end, to a sleeve 18, which has the same diameter as the left lower side frame tube 9, and which is coaxial with it. Accordingly, pivoting of the right cross-strut 13' pivotally attached to the lower left side frame tube 9 occurs around an axis corresponding to that of the lower side frame tube 9. The situation at the lower side frame tubes, to which the cross-struts 13, 13' are pivotally attached at their bottom ends, is thus different from the situation of the link assembly described above, which, although being attached to the upper side frame tube 8, 8', pivots around an axis which is not coaxial to the one of the upper side frame tube 8, 8', but which is displaced downwardly in parallel to the upper side frame tube 8, 8'.

[0036] In the unfolded position shown in Figure 2, the seat tubes 17, 17' abut against and are supported by left and right seat support elements 20, 20', 21, 21', mounted on the upper side frame tubes 8, 8'. Each side frame 3, 3' contains two seat support elements, one 21, 21' mounted towards the front end of the upper side frame tube 8, 8' and one 20, 20' towards the corresponding rear end of the upper side frame tube 8, 8'. The seat support elements are designed so as to provide a stable support to the seat frame tubes and thereby, to the seat. Accordingly, the seat is stabilised by the side frames, which thus carry the weight of a wheelchair user seated in the wheelchair. In the embodiment shown in Figures 1 and 2, the seat tubes 17, 17', with the wheelchair being unfolded, are thus stabilised on the inner side next to the upper side frame tubes 8, 8'. Alternatively, it could also be envisaged that the seat tubes are stabilised on the upper side of the upper side frame tubes 8, 8', for example.

[0037] It is noted that the left and right frame assemblies 3, 3' in Figure 2 are different from those in Figure 1 and thus represent a different embodiment. For example, the front vertical side frame tubes 10, 10' are slightly skewed in Figure 2, in contrast to the embodiment shown in Figure 1. However, this does not affect in any way the functioning of the foldable wheelchair frame assembly of the present invention.

[0038] **Figure 3** shows the wheelchair frame assembly 50 of Figure 2 in a completely folded position. As can be seen, in this position the cross-struts 13, 13' and also longitudinal section of the link elements 14, 14' are in a vertical or close-to-vertical orientation, with the side frames 3, 3' being in the most approached position. It is noted that the rear and front, left and right seat tube support elements 20, 20', 21, 21', mounted on the upper side frame tubes 8, 8', are displaced with respect to each other in a rear-to-front direction so as not to hinder the folding of the wheelchair by abutting against each other. The skilled person will further note that the U-shaped section of each link element 14, 14', in Figure 3, encompasses about half or a little less of the respective upper side frame tubes 14, 14'. The U-shaped geometry of the link element 14, 14' is thus designed so as not to hinder the folding by abutting against the upper side frame tubes 8, 8', thus allowing maximum approximation of the left and right side frames 3, 3' in the folded position. Accordingly, the U-shaped section of the link element 14, 14' is a technical consequence of the fact that the axis of pivoting of the link element attached to the upper side frame tube 8, 8' is situated below, preferably vertically below the upper side frame tubes 8, 8'.

[0039] **Figure 4** shows the wheelchair frame assembly of Figure 2 in a left lateral view, in which the frame tubes

of the right side frame 3' are substantially hidden.

[0040] **Figure 5** shows in further detail the supporting structure 19 for pivotally mounting the link element 14 to the upper side frame tube 8 (not shown). It can be seen that the link element 14 comprises an annular or hollow cylindrical part 30 at its one (outer) extremity, which serves to the pivotal attachment at the upper side frame tube 8 (not shown). Of course, other than completely tubular structural elements may be selected by the skilled person for achieving pivotal attachment of the link element to the upper side frame tubes. An oblong component of the link element first follows a U-shape 31 and then assumes a more straight section 32, which comprises openings 40, enabling pivotal attachment of the other (inner) extremity of the link element 14 to the respective cross-strut 13. Between the U-shaped 31 and the straight sections 32 there is a transitional section 33, which has an inwardly bent, slightly S-shaped configuration, for the purpose of approaching the straight section at the inner extremity of the link element to the respective cross strut 13 and enabling optimal pivotal attachment to the latter.

[0041] The supporting structure 19 comprises rear and front link-standoff elements 34, 35, each of which carries or comprises a cylindrical section 36, 37, having a diameter equal or slightly smaller that the inner diameter of the annular section 30 of the link element 14, so that the cylindrical sections 36, 37 together form an axle of pivoting for the link element at the upper side frame tube. The link-standoff elements are mounted at the underside of the upper side frame tube 8 (not shown) by screws 38, 39, stably and pivotally attaching the link element 14 to the side frame 3 (not shown).

[0042] **Figure 6** is a front view of the left link element 14, showing the angular or hollow cylindrical part 30 serving for the pivotal attachment at the side frame 3 (not shown), a longitudinal component having a U-shaped section 31 and a subsequent straight section 32, the latter comprising one or more holes for pivotal attachment to the cross-strut 13 (not shown). The inwardly-bent section 33 having a slight S-like configuration (Figure 5) cannot be discerned in the view shown in Figure 6.

[0043] **Figures 7 and 8** are a left side front view and a top view, respectively onto the link element 14 and the supporting structure 19 for mounting it to the upper left side frame 8 (not shown). In both figures, the inwardly-bent section 33 having a slight S-like configuration discussed above with respect to Figure 15 is visible.

[0044] **Figure 9** is an exploded view of a second embodiment for a supporting structure 19 in the frame assembly of the invention. In this embodiment, there is only one link-standoff element 34 carrying a cylindrical section 36 serving as an axle for the pivoting link element 14. In this embodiment, the cylindrical section 36 has a longer rear-to-front extension so as to traverse, when the link assembly is mounted, the entire angular part 30 of link element 14. Again, a vertically extending screw 38 is used to mount the link-standoff-element 34 to the upper side frame tube 8 (not shown). The embodiment shown in Figure 9 comprises an end cap 45, which is fixed by way of a small screw 46 into a axial threading provided in the cylindrical section 36, thus permitting the pivotal attachment of the link element 14 to the supporting element 19 mounted on the side frame 3 (not shown).

[0045] **Figure 10** is an exploded view of a third embodiment for a supporting structure 19 in the frame assembly of the invention. In this embodiment, the cylindrical section 36 is a piece that is separate from the link-standoff elements 34 and 35, contrary to the embodiments discussed above, where the cylindrical section and the standoff-elements form a single piece. The rear link-standoff element 34 of this third embodiment has an annular configuration enclosing a hollow cylinder. A sleeve 49 is provided in the hollow cylindrical lumen of the rear link-standoff element 34, retaining the cylindrical section 36 at an annular protrusion 48 at the rear end of the latter. Again, the cylindrical section serves as an axle of the link element when mounted, extending through the annular part 30 of the link element 14 and into an annular section of the front link-standoff element 35. A cap 45 is attached with an axially extending screw 46 to the front end of the cylindrical section 36, thus retaining the cylindrical section between the rear and front link-standoff elements of the supporting structure 19.

[0046] The skilled person will note that the second and third embodiment of the supporting structure may facilitate to some extent the attachment of the link element to the side frame 3, in particular to the upper side frame tube 8. This is because in these embodiments, the link standoff elements 34 and 35 may be separately fixed by way of screws 38 and 39 to the upper side frame tube, the link element being attached in a subsequent step by guiding and fixing the cylindrical section 36 through the link-standoff elements and the annular part 30 of the link element. In the embodiment of Figure 5, all elements, that is the link-standoff elements and the link element 14 have to be fixed essentially simultaneously to the upper side frame tube 8.

[0047] The above description of the preferred embodiments are by no means to be construed as limiting the scope of the present invention. Various variations and modifications are thus encompassed by the present invention. For example, in the wheelchair shown in Figure 1, many frame elements are referred to as tubes, these elements having a generally tubular structure. However, some of these frame elements, such as the seat tubes, for example, may comprise further structures and deviate from the configuration of a perfect tube. Therefore, the terms "tube" or "strut" mentioned in the present specification is not intended to limit in any way the geometrical configuration of the frame elements of the present invention. Hollow cylindrical tubes may in some instances have beneficial properties and are therefore the lightest and best mode for realising the invention. However, it is equally possible to use frame elements and struts having non circular cross-sections, including all kinds of bars and frames currently used in construction of wheelchairs or

in metallic construction in general, for example.

[0048] As a further example for variations encompassed by the present invention, it is possible to provide each left and right cross strut 13, 13', independently in the form of a double or twin-tube arrangement in order to further stabilise and strengthen the overall framework. An arrangement of tubular cross-bracing cross-struts in the form of a twin tube arrangement is disclosed in Figures 1-5 of US 2006/0145456, for example. Further variations and adaptations of the teaching of the concept of the present invention can be easily envisaged by the skilled person.

Claims

1. A foldable wheelchair frame assembly (50) comprising:

   - a pair of left and right side frames (3, 3') each comprising upper and lower left and right frame tubes (8, 9; 8', 9') with longitudinal axis;
   - a cross-bracing frame assembly (4) coupling the side frames (3, 3') together for movement transversely between a spaced apart deployed position and a proximate folded position, said cross-braced frame assembly (4) comprising at least two crosswise arranged struts (13, 13');
   - a link assembly comprising a pair of link elements (14, 14'), each linking one of the side frames (3, 3') to a section of a strut (13, 13') of the cross-bracing frame assembly, each of said link elements being pivotally mounted to said strut and to one of said side frames;
   - a supporting structure (19, 19') for pivotally mounting each of said link elements (14, 14') to said side frame (3, 3') around an axis of pivoting, wherein said axis is displaced in parallel with respect to the longitudinal axis of said corresponding upper frame tube of said side frame.

2. The foldable wheelchair frame assembly (50) of claim 1, wherein said axis of pivoting of said link element (14, 14') is displaced below the longitudinal axis of said upper frame tube (8, 8') of said side frame (3, 3').

3. The foldable wheelchair frame assembly of claim 1 or 2, wherein said axis of pivoting of said link element (14, 14') is displaced vertically below the longitudinal axis of said upper frame tube (8, 8') of said side frame (3, 3').

4. The foldable wheelchair frame assembly of any one claims 1 or 2, wherein said link element (14, 14') comprises a U-shaped section designed to partially encircle said upper frame tube (8, 8') in a folded position of the wheelchair (1).

5. The foldable wheelchair frame assembly (50) of any one the preceding claims, comprising two horizontally arranged, left and right parallel seat tubes (17, 17') each mounted to an upper end of each of said at least two struts (13, 13') of said cross bracing frame assembly (4), said parallel seat tubes extending in a rear-to-front direction and being suitable for the mounting of a seat surface (6).

6. The foldable wheelchair frame assembly (50) of any one the preceding claims, comprising at least a pair of seat-tube support (20, 20'; 21, 21') mounted on each of said upper frame tubes (8, 8'), wherein, with the frame assembly being unfolded each of said seat tube is supported on said seat tube support mounted on said upper frame tube.

7. The foldable wheelchair frame assembly (50) of any one of the preceding claims, wherein said supporting structure (19, 19') comprises at least one link-standoff element (34) mounted on said upper side frame tube (8, 8'), said link-standoff element being adapted to carry a cylindrical section (36), wherein said link element (14) is adapted to be pivotally mounted on said cylindrical section carried by said link-standoff element.

8. The foldable wheelchair frame assembly of any one of the preceding claims, wherein said supporting structure (19, 19') comprises at least one link-standoff element (34) mounted on the bottom side of said upper side frame tube (8, 8').

9. The foldable wheelchair frame assembly of any one of the preceding claims, wherein the link element (14, 14') comprises an annular or hollow cylindrical section (30) designed to be pivotally mounted on a cylindrical section (36) of said supporting structure.

10. The foldable wheelchair frame assembly according to any one of the preceding claims, wherein the link element (14, 14') comprises a longitudinal section (31, 32, 33) attached to an annular or hollow cylindrical section (30), said longitudinal section comprising a U-formed section (31) and a straight section (32), said straight section comprising a bushing for pivotally attaching the link element to one of said cross-wise arranged struts (13, 13').

11. A link assembly in a foldable wheelchair (1) for pivotally attaching a link element (14) to a side frame (3, 3') of the wheelchair, said link element (14) comprising an annular section (30) for pivotal attachment of the link element to the side frame, a U-shaped section (31) and a straight section (32) suitable to pivotally attach the link element (14) to a cross-strut (13) of the foldable wheelchair, said link assembly further comprising a supporting structure (19) for at-

taching an axle of pivoting extending substantially in parallel, but downwardly displaced to an axis of an upper side frame tube (8) of said wheelchair.

12. A foldable wheelchair (1) comprising a frame assembly (50) according to any one of claims 1-10.

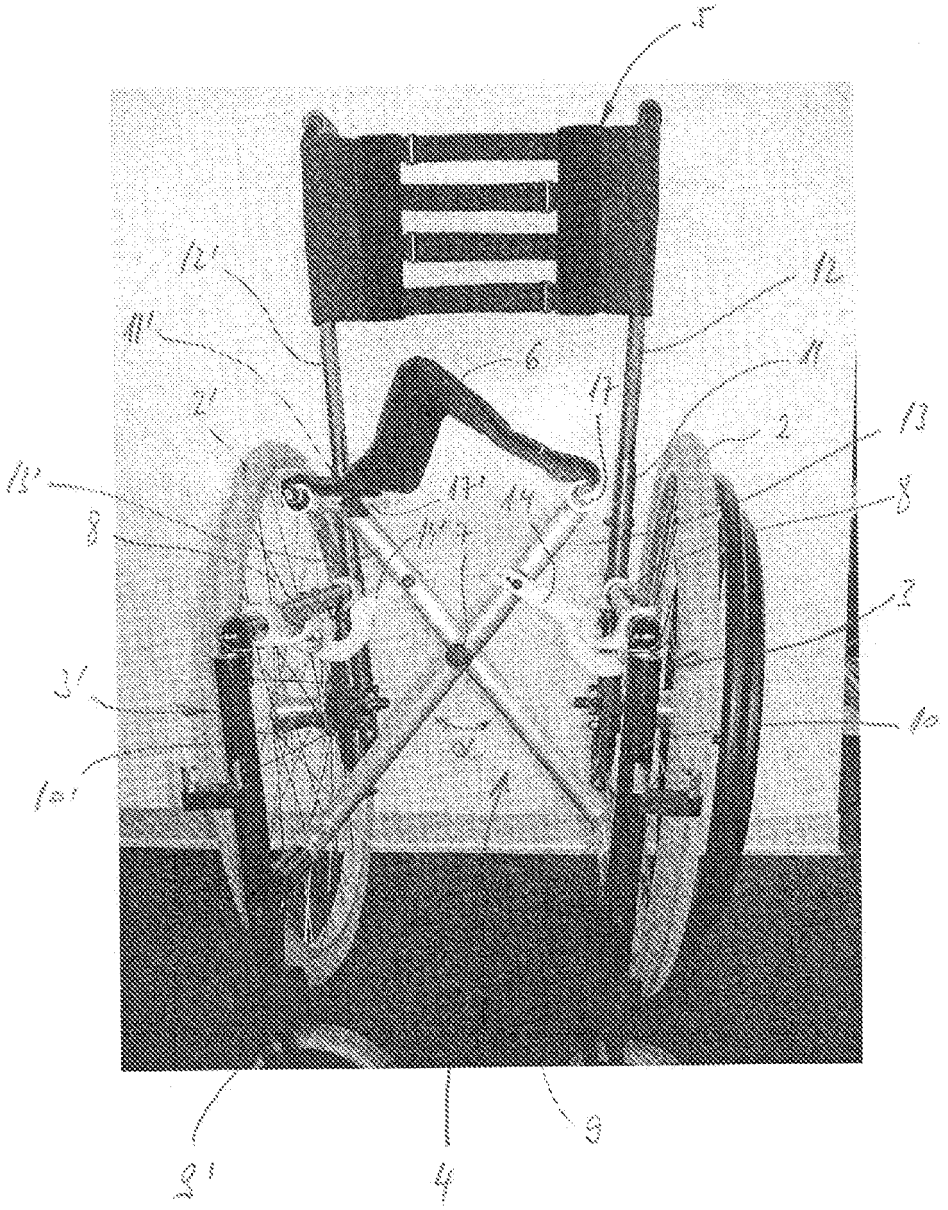

Fig. 1

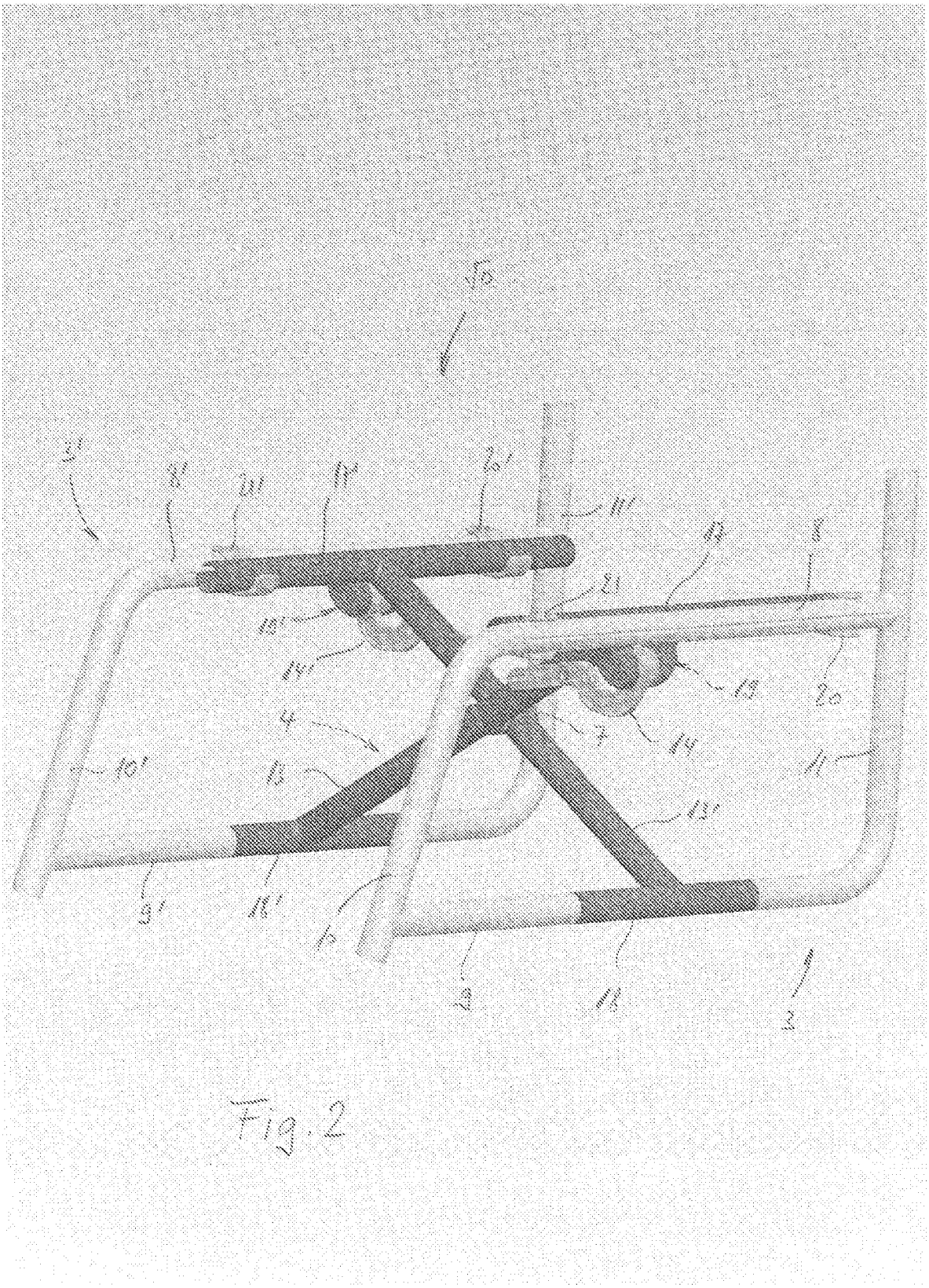

Fig. 2

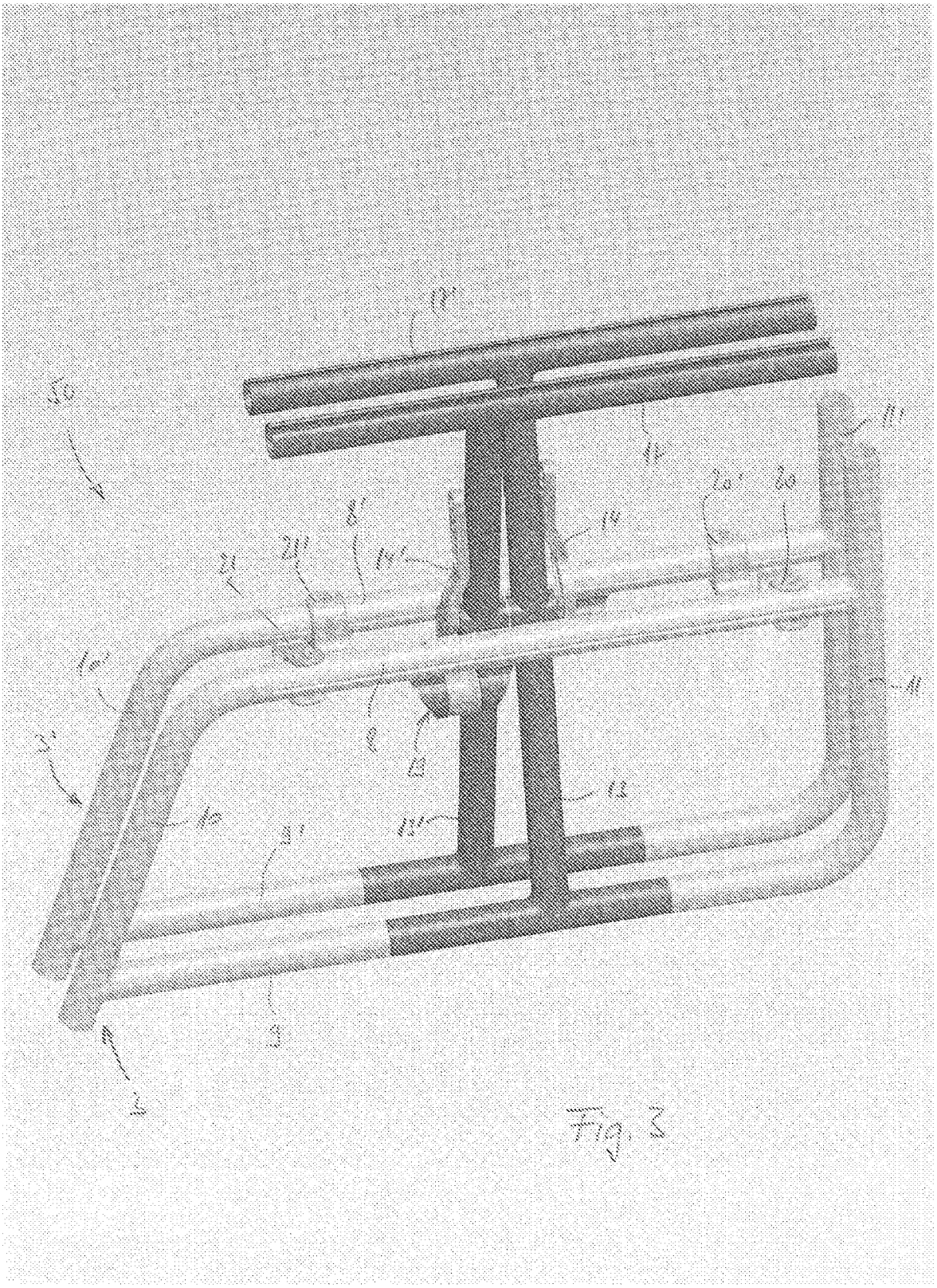

Fig. 3

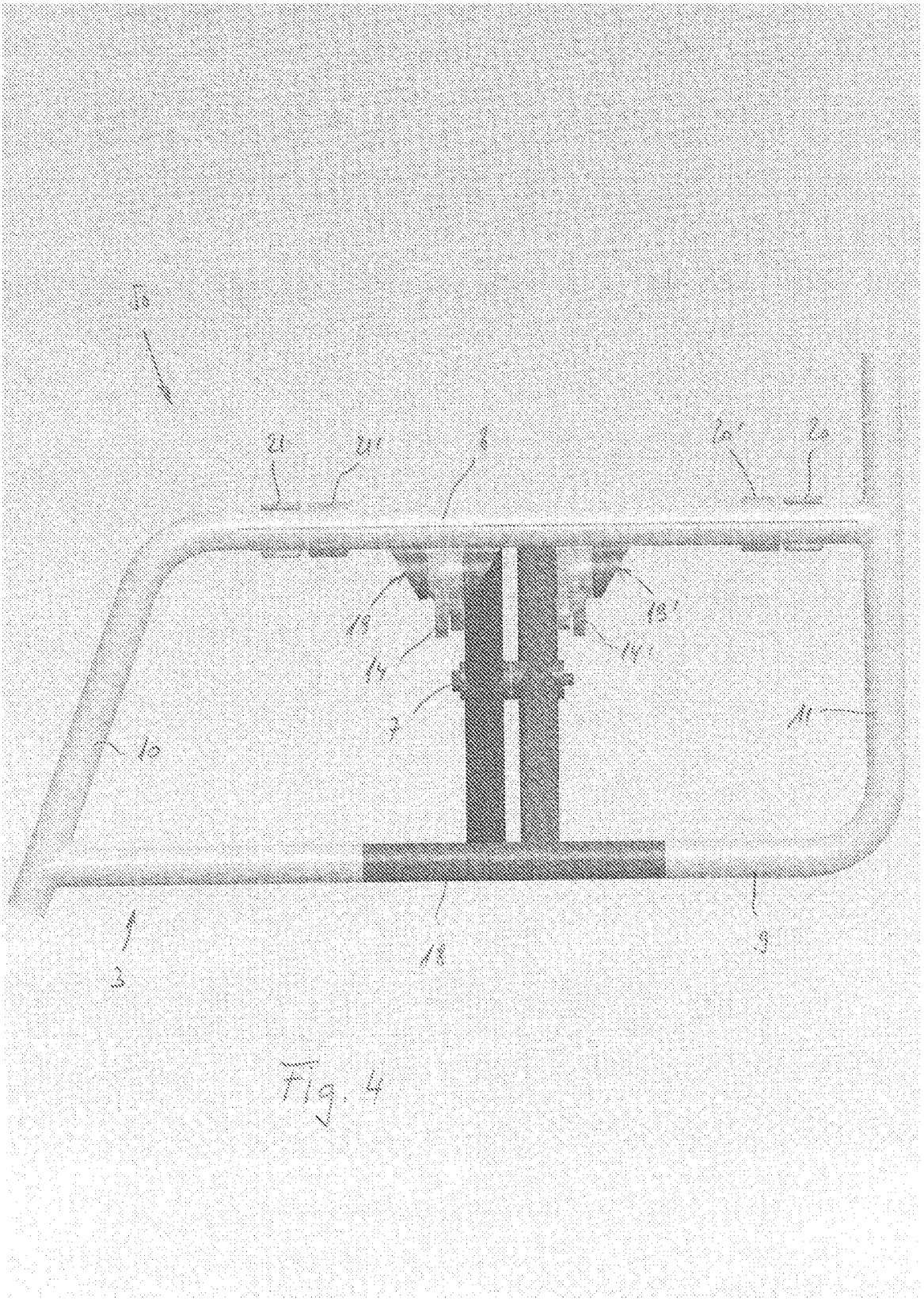

Fig. 4

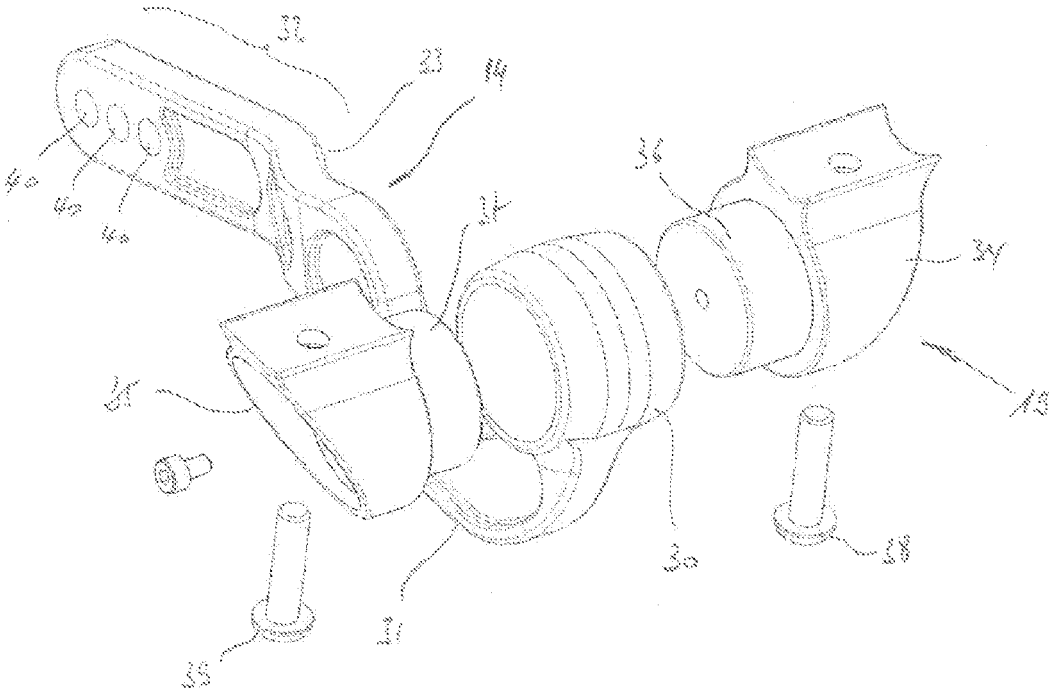

Fig. 5

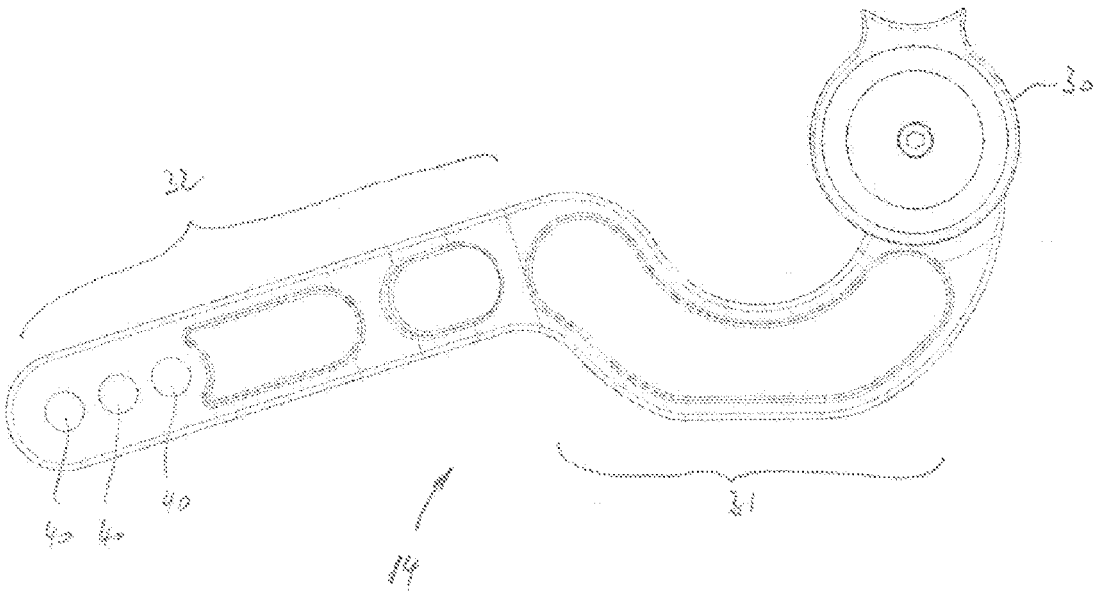

Fig. 6

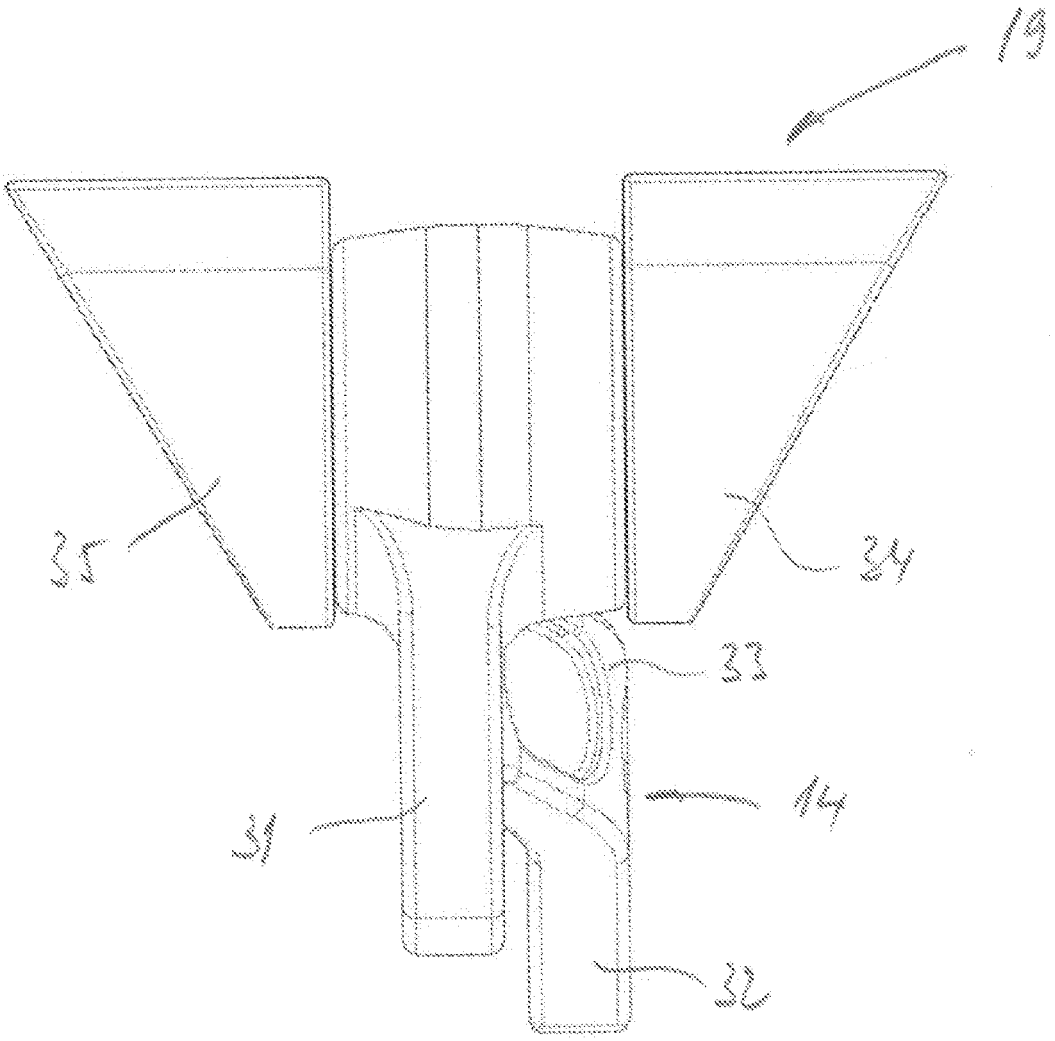

Fig. 7

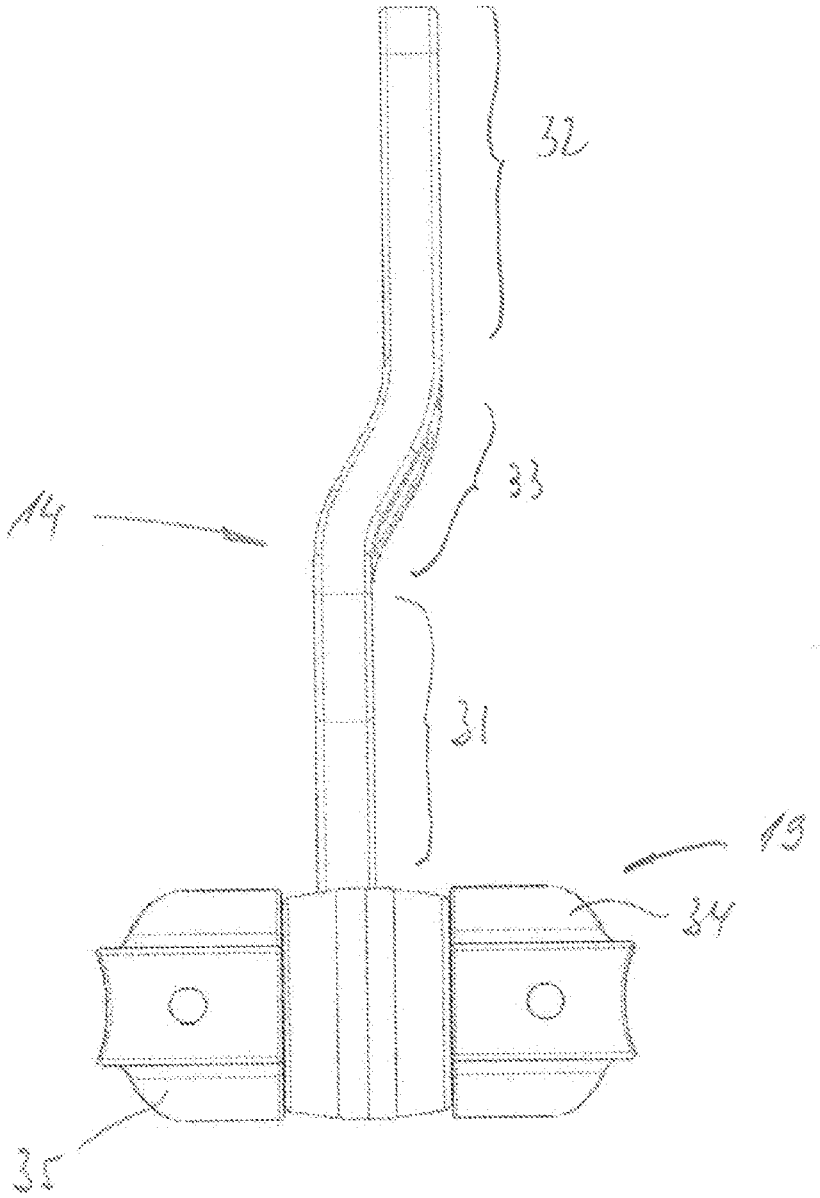

Fig. 8

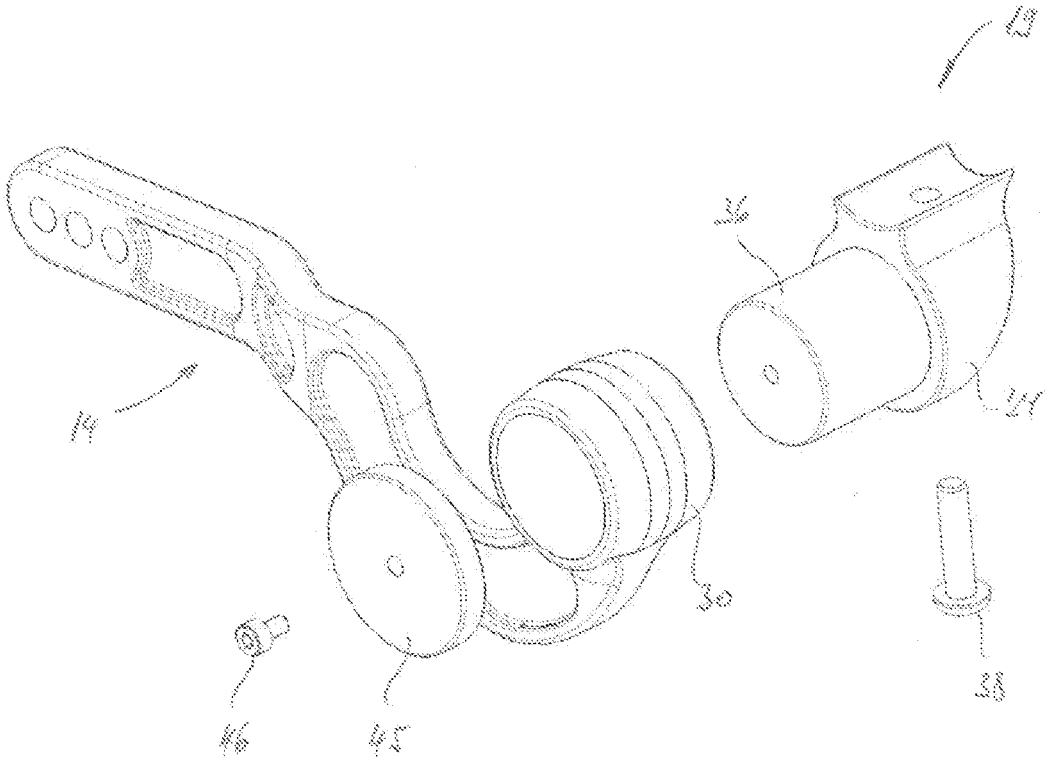

Fig. 3

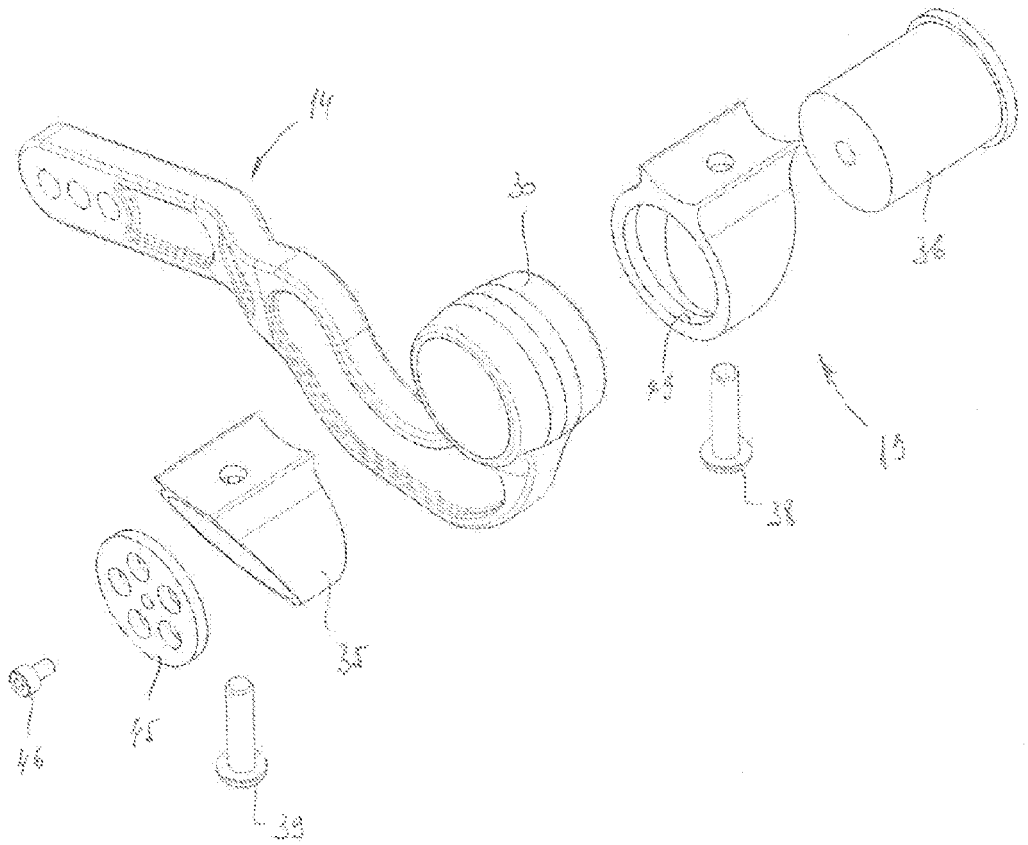

Fig. 10

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EUROPEAN SEARCH REPORT

Application Number
EP 07 12 3240

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2007/007811 A (SWANY CORP [JP]; MIYOSHI ESTUO [JP]) 18 January 2007 (2007-01-18) * figures 26,27,17,22 *	1-12	INV. A61G5/08
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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	9 May 2008	Petzold, Jan

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09-05-2008

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