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(54) **JOINT FOR A BALANCED ARM SUPPORT AND ARM SUPPORT COMPRISING SUCH JOINT**

(57) The present invention relates to a joint for a balanced arm support, comprising a first leg, rotatably connected to a second leg, about an axis of rotation at least one balancing force exerting element, the balancing force

exerting element further comprises at least one damper, wherein said damper is configured for damping the rotation about the axis of rotation of said first leg with respect to said second leg.

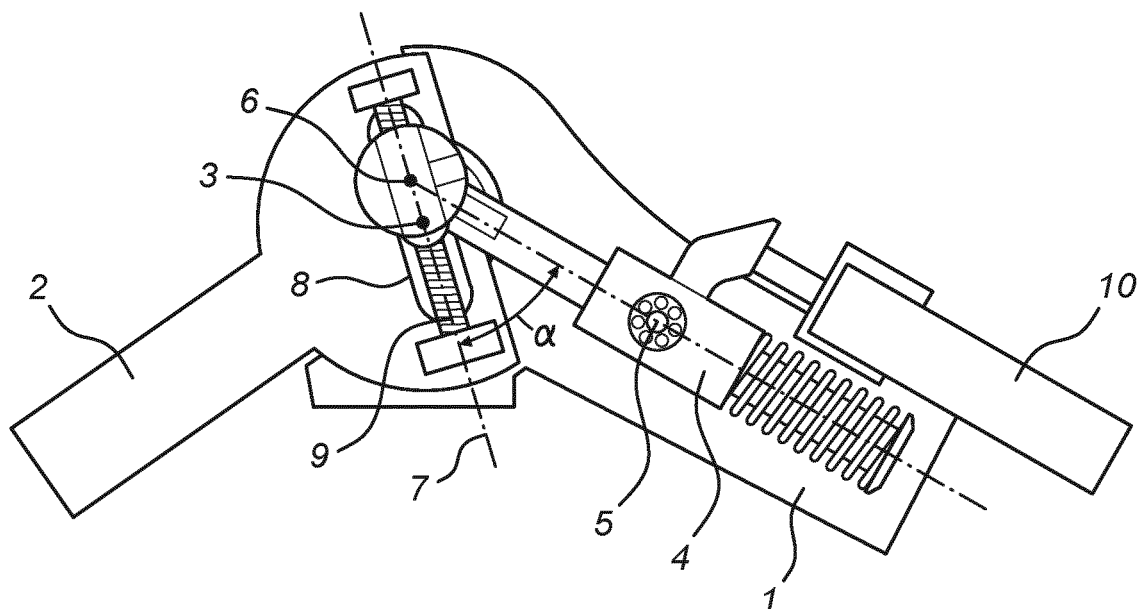


Fig. 1A

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Description

[0001] The present invention relates to a joint for a balanced arm support, an arm support comprising such joint and a wheelchair or other frame comprising such arm support.

[0002] Balanced arm supports are used as an aid for those having difficulty in lifting their arm. The support may for instance provide a force that compensates at least partly for gravity, which enables a user of the support to use his available strength for making movements from a supported position.

[0003] The amount of support, in particular the force may be adjustable, not only to the specific wish or need of a user, but also to ever changing circumstances, such as an activity that is to be performed. In case of eating or lifting of an object, a different force may be required than in case of for instance eating. For that purpose, balanced arm supports may have adjustable forces.

[0004] These forces can be adjusted in several ways, depending on the construction of the arm support. In some cases for instance the (effective) length of a spring and therewith its force may be adjustable. However, when springs are involved, relatively high forces may be required to change settings of the arm support. For that reason, (mostly electric) actuators are usually applied to assist in changing settings. However, not only does this make the arm support more expensive, it also sets restrictions to the design and results in a generally more complex device. However, it has been found that in some cases the forces which at least partially compensate gravity can in some cases behave unexpectedly. That is, they suddenly increase in magnitude which causes fast movement with high potential energy, this can lead to dangerous situations. These unexpected changes in the compensation force may be caused during accidental slip out of the armfitting, when accidentally unlocking the block function when there is no arm in the armfitting.

[0005] It is therefore the goal of the present invention to provide an solution to the prior art, or at least an alternative that lacks the above disadvantages. The invention thereto proposes a joint for a balanced arm support, comprising a first leg, rotatably connected to a second leg, about an axis of rotation, at least one balancing force exerting element, wherein the balancing force exerting element further comprises at least one damper, wherein said damper is configured for damping the rotation about the axis of rotation of said first leg with respect to said second leg. The application of a damper allows for better control of the rotational movement between the two arms connected through the joint. The characteristic function of a damper is to suppress the uncontrolled and/or unintended fast movements whilst allowing normal and accepted movement speed to be executed. Hence, in this joint the damper is applied to maintain better control over the momentum exerting element. If at any point the momentum exerting element suddenly applies a high momentum, the legs will be moved at higher speed and with

a higher force. The higher speed and force of the legs is then damped by the damper in order to fall within the safe speed of motion of the legs.

[0006] In a further embodiment the balancing force exerting element is coupled to the first leg at a first engaging point and coupled to the second leg, at a second engaging point, arranged for exerting a balancing force in a direction from the first engaging point to the second engaging point. Yet, in an even further embodiment the second engaging point is movable along a path on the second leg for adjusting the distance from the second engaging point to the axis of rotation and therewith the torque delivered by the balancing force. Also, the angle of the balancing force exerting element with respect to the tangent of the path is releasably lockable in a position wherein the tangent is perpendicular to the direction of the force.

The first leg may at its distal end from the joint be coupled to a so called fixed world, which may be part of a wheelchair or other frame. The second leg may at its distal end from the joint comprise or be coupled to a carrier for a person's forearm. The torque at the joint is defined by a force times an arm, wherein the force may be caused by the force exerting element, while the arm is formed by the distance from the second engaging point to the axis of rotation. In a certain embodiment the force exerting element comprises at least one spring, and in certain embodiments a zero length spring, for exerting a force in the direction of the second engaging point. In a further embodiment the spring has a spring constant between 15 and 20 N/mm. However, any spring constant can be used, but this is found to be optimal for the given design and application. The torque can be adjusted by either changing the force caused by the spring, or by changing the arm. The damper is configured to damp said momentum.

The invention relates to a mechanism for changing the arm, which is provided by the second engaging point being movable along a path on the second leg for adjusting the distance from the second engaging point to the axis of rotation.

The balancing force exerting element exerts a force between the first and the second engaging point, which may have a component in the direction of the path. When the second engaging point is moved, said component of the balancing force has to be overcome.

[0007] For this may require a force that is too large for a person who wants to adjust the balancing torque, the general idea of the present invention is to eliminate, during adjustment, the component of the balancing force that impedes the adjustment. This is done by locking the angle of the balancing force exerting element with respect to the tangent of the path in a position wherein the tangent at the second engaging point is perpendicular to the direction of the force, and while the angle is locked, adjusting the distance from the second engaging point to the axis of rotation.

[0008] The second engaging point may be movable by

arranging it on a slide that is movable along a track.

[0009] In an embodiment, the path is formed by a threaded end that is axially rotatable, and the second engaging point comprises a nut arranged about the threaded end, limited in its rotation, for translating upon rotation of the threaded end. The nut may this form the aforementioned slide. For manually rotating it, the threaded end preferably comprises a knob.

[0010] The joint may further comprise an indicator for indicating that the position wherein the tangent is perpendicular to the direction of the force is reached. This may be an optical indication, but the releasable lock may also comprises a hole that is outlined with a movable pin in the position wherein the tangent is perpendicular to the direction of the force, wherein the movable pin has a first mode wherein it is locked against movement into the hole, and a second mode, wherein it is movable towards the hole and forms the indicator. In this case, a person can put the pin in the second mode, move the legs about the axis of rotation until the pin locks in the hole, move the second engaging point and put the pin back in its first mode when finished.

In another embodiment the damper is configured for damping impact speeds between 0.05 m/s and 0.9 m/s, and preferably between 0.1 m/s and 0.5 m/s, wherein said speed has a maximum shock energy of 15 J, and preferably of 10 J. It has turned out that this specific range of damping properties allows to solve the problems of the prior art, whilst maintaining good operability of the arm support. The damper is certain embodiments attached at a location distal to the balancing force exerting element. However, in other embodiment the damper is attached to the balancing force exerting elements. This increases the flexibility of applying a damper. Since the arm support might comprise a plurality of joints, some being located in smaller places than others. It is therefore necessary to allow for distal application of a damper. Also, it might be thinkable that one damper is applied and parallelly connected to all joints.

[0011] The invention will now be elucidated into more detail with reference to the following figures. Herein:

- Figure 1A shows a first view on a joint according to the present invention;
- Figure 1B shows a schematic representation of figure 1A.

[0012] Figure 1A shows a first view on a joint according to the present invention. The figure shows a joint for a balanced arm support, comprising a first leg (1), rotatably connected to a second leg (2), about an axis of rotation (3), at least one balancing force exerting element (4), the balancing force exerting element (4) further comprises at least one damper (10), wherein said damper (10) is configured for damping the rotation about the axis of rotation (3) of said first leg (1) with respect to said second leg (2), coupled to the first leg at a first engaging point (5); and coupled to the second leg, at a second engaging

point (6); arranged for exerting a balancing force in a direction from the first engaging point (5) to the second engaging point (6); wherein the second engaging point is movable along a path (7) on the second leg (2) for adjusting the distance from the second engaging point (6) to the axis of rotation (3) and therewith the torque delivered and thereby the balancing force. The second engaging point (6) is positioned on a slide (8) that is movable along the threaded end (9).

[0013] The angle alpha of the balancing force exerting element with respect to the tangent of the path is releasably lockable in a position wherein the tangent is perpendicular to the direction of the force. Schematic view in figure 1B shows the same parts schematically.

Claims

1. Joint for a balanced arm support, comprising:

- a first leg (1), rotatably connected to;
- a second leg (2), about an axis of rotation (3);
- at least one balancing force exerting element (4), **characterized in that** the balancing force exerting element further comprises at least one damper, wherein said damper is configured for damping the rotation about the axis of rotation of said first leg with respect to said second leg.

2. Joint according to claim 1, wherein the balancing force exerting element is;

- coupled to the first leg at a first engaging point (5); and
- coupled to the second leg, at a second engaging point (6); arranged for exerting a balancing force in a direction from the first engaging point (5) to the second engaging point (6).

3. Joint according to claim 2, wherein the second engaging point is movable along a path (7) on the second leg (2) for adjusting the distance from the second engaging point (6) to the axis of rotation (3) and therewith the torque delivered by the balancing force;

4. Joint according to any of the preceding claims, wherein the force exerting element comprises at least one spring, for exerting a force in the direction of the second engaging point.

5. Joint according to claim 4, wherein the spring has a spring constant between 15 and 20 N/mm.

6. Joint according to any of the preceding claims, wherein the damper is configured for damping impact speeds between 0.05 m/s and 0.9 m/s, and preferably between 0.1 m/s and 0.5 m/s, wherein said speed has a maximum shock energy of 15 J, and

preferably of 10 J.

7. Joint according to any of the preceding claims,
wherein the damper is attached at a location distal
to the balancing force exerting element. 5
8. Joint according to any of the preceding claims,
wherein the damper is attached to the balancing
force exerting element. 10
9. Arm support comprising a joint according to any of
claims 1-8. 15
10. Wheelchair or other frame comprising an arm sup-
port according to claim 9. 15

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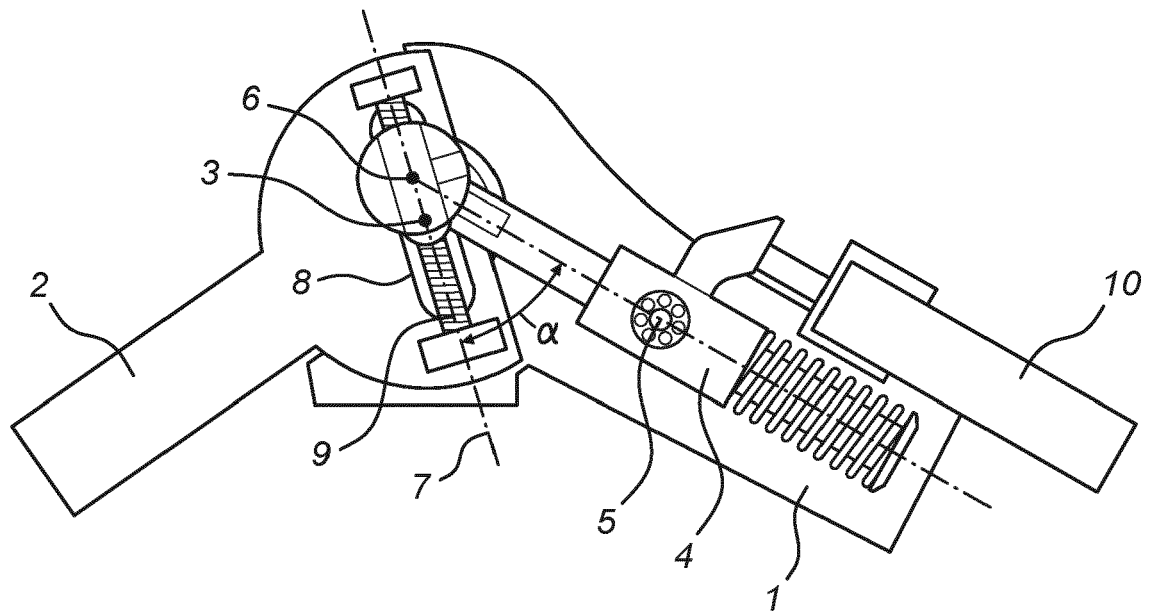


Fig. 1A

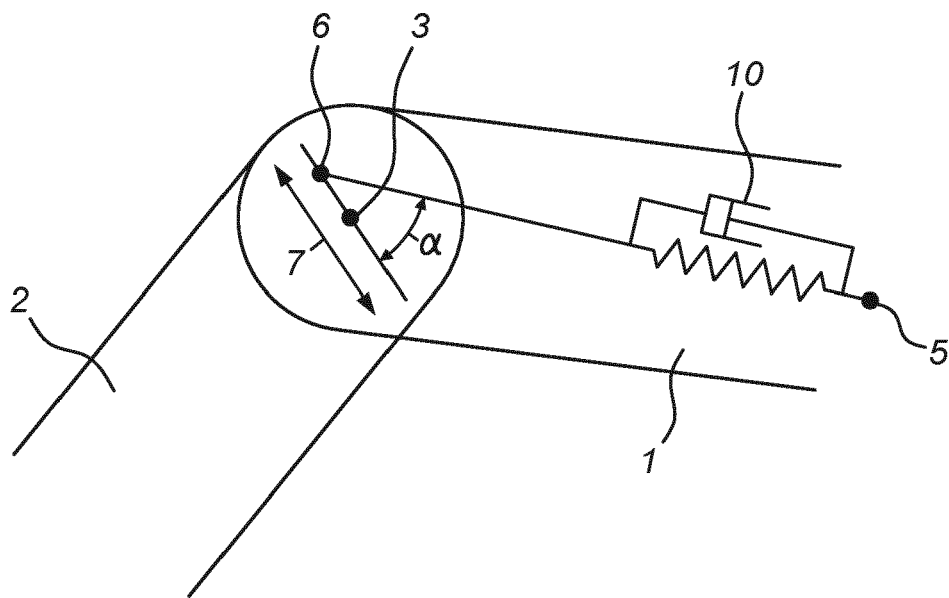


Fig. 1B



EUROPEAN SEARCH REPORT

Application Number
EP 21 15 7076

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	US 5 571 274 A (HOLSTENSSON LARS [SE]) 5 November 1996 (1996-11-05) * column 2, line 19 - column 3, line 30 * * figures 1-2 * -----	1,2,4,5, 9,10 3,6-8	INV. A61G5/12
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			TECHNICAL FIELDS SEARCHED (IPC)
			A61G A61B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 29 June 2021	Examiner Ong, Hong Djien
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			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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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
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29-06-2021

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