



(11) **EP 3 138 548 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention
of the grant of the patent:
13.02.2019 Bulletin 2019/07

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

(21) Application number: **15183369.6**

(22) Date of filing: **01.09.2015**

(54) **CONNECTION MEANS WITH PREDETERMINED ANGULAR ALIGNMENT**

VERBINDUNGSMITTEL MIT VORDEFINIERTER WINKELAUSRICHTUNG

MOYENS DE CONNEXION AVEC UN ALIGNEMENT ANGULAIRE PRÉDÉTERMINÉ

(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**

(43) Date of publication of application:
08.03.2017 Bulletin 2017/10

(73) Proprietor: **Sunrise Medical GmbH
69254 Malsch/Heidelberg (DE)**

(72) Inventors:
• **Knopf, Michael
69234 Dielheim (DE)**

• **Ballreich, Christian
68753 Waghäusel (DE)**
• **Bergmann, Rudolf
67240 Bobenheim-Roxheim (DE)**

(74) Representative: **Weber-Bruls, Dorothee
Jones Day
Nextower
Thurn-und-Taxis-Platz 6
60313 Frankfurt am Main (DE)**

(56) References cited:
**EP-A2- 0 887 064 GB-A- 1 423 398
US-A- 5 662 345**

EP 3 138 548 B1

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

[0001] The present invention relates to a wheelchair comprising connection means for connecting drive wheels to a frame in line with the preamble of claim 1.

[0002] Known connection means for ensuring an angular alignment, e.g. for connecting a wheel directly or via additional mounting means to a frame, usually require high precision, i.e. little manufacturing tolerances, for all connection surfaces. This is true for both the surface quality as well as the surface inclination, if any. This is particularly true for a connection means for connecting a wheel to a frame, e.g. a drive wheel to a wheelchair frame, to ensure parallel alignment of the drive wheels. In the latter case manufacturing tolerances of $\pm 0.5^\circ$ could lead in a worst case scenario to drive wheels with a varying distance of up to 2 cm. This is unacceptable as it leads to undesired driving characteristics as well as irregular and excessive wear of the drive wheels.

[0003] US 5,662,345 refers to an apparatus for attaching a wheel system comprising a wheel and a stub axle to a wheelchair at one of a plurality of camber angles, the apparatus comprising: a bracket extending from the wheelchair, the bracket having inboard and outboard bifurcated legs, the length of one of the legs selectable from a plurality of predetermined leg lengths, each of the leg lengths respectively associated with one of the camber angles; a plurality of tubular members juxtaposed along the axle, the tubular member closest to the wheel prohibited from sliding along the axle, the other tubular members slideably disposed on the axle; a plurality of pairs of bracket-engaging faces, each of the pairs of bracket-engaging faces comprising respective exterior surface portions of two different ones of the tubular members, each of the pairs of faces tilted with respect to a line perpendicular to the axle by one of the predetermined camber angles; and clamping means clamping the bracket legs between ones of the pairs of bracket-engaging faces.

[0004] A wheelchair with a front wheel support which is at least approximately horizontal and has a fastening device for a front wheel assembly, with two lateral longitudinal supports and with two inclined supports which connect the front wheel support with the front ends of the longitudinal supports, and with an axle tube connecting two rear wheels of a pair of wheels, is known from EP 0 887 064 A2. The front wheel support is a transverse support and forms, together with the inclined supports and the longitudinal supports adjoining them, a three-dimensional, U-like integral support, wherein the rear ends of the longitudinal supports are connected with the axle tube.

[0005] GB 1 423 398 A relates to a jig, and more particularly, to a jig capable of precisely positioning an electrode in an electrical discharge machining process or a workpiece on a machine tool.

[0006] It is an object of the invention to further develop the wheelchair of the preamble of claim 1 such that its

connection means for connecting two parts with a predetermined angular alignment requires reduced manufacturing costs.

[0007] This object is solved by the features of the characterizing portion of claim 1. Preferred wheelchairs of the invention are described in the sub-claims.

[0008] The idea of the invention is to determine the angular alignment of the two parts by use of reference surfaces. Each part of the connection means has at least one reference surface and when connecting the parts the reference surfaces contact each other thereby ensuring a high quality angular alignment. All other surfaces can be manufactured with reduced effort and higher manufacturing tolerances.

[0009] The connection means of the wheelchair according to the invention is for connecting two parts with a predetermined angular alignment. The connection means comprises a first part with a first surface and a second surface, wherein the first surface is a first reference surface. Further, the connection means comprises a second part with a third surface and a fourth surface, wherein the third surface is a second reference surface and the second part is adapted to receive at least a portion of the first part. For example, the second part may have a substantially V-shaped or trapezoidal recess for receiving the first part, which is formed accordingly. The reference surfaces are flat. It is of utmost importance for the accurate angular alignment of the first and second parts that the reference surfaces are of adequate quality so that the reference surfaces match with the required degree of accuracy to achieve the desired angular alignment.

[0010] At least one of the second and fourth surface has an elevated portion, e.g. a smooth or edged convexly shaped surface, imparting the first and/or second part with an asymmetry feature. In addition to this asymmetry feature(s) there can be an inclination deviation such that the inclination of the first and second surfaces and/or the inclination of the third and fourth surface differ from each other.

[0011] When the first part is inserted into the second part as far as possible, the second and fourth surfaces contact each other e.g. via the elevated portion(s) which forces the first and third surfaces, i.e. the reference surfaces, into close contact with each other, the first and third surfaces thereby providing the predetermined angular alignment of the first and second parts. The contact area of the first and third surfaces, i.e. the reference surfaces, must be enough to ensure a close contact so that the angular alignment is only determined by the reference surfaces.

[0012] In case the asymmetry feature is provided by an inclination difference, the difference can be in the region of up to $\pm 15\%$. For example, the inclination of the first and second reference surfaces can each be determined to be 20° , such that the second surface might have a tolerance of -0.2° and/or the fourth surface might have a tolerance of $+0.2^\circ$.

[0013] The first and second parts of the connection means may provide a force-fit connection once assembled.

[0014] Preferably, the accuracy of the angular alignment of the first and second parts only depends on the accuracy of the first and third surfaces, which serve as reference surfaces. Hence, only these two reference surfaces should have a high quality surface, e.g. a precision of at least 1 mm or at least 0.5 mm or at least 0.1 mm or at least 0.05 mm or at least 0.01 mm or at least 5 μm or at least 1 μm or at least 0.5 μm . All other surfaces can be manufactured with a lower degree of accuracy which makes the production faster and cheaper. For economical reasons the number of reference surfaces should be as low as possible, but depending on material and use one may also use more than one reference surface per part, e.g. two or three reference surfaces for each of the first and the second part of the connection means. Also, the number of reference surfaces of the first and second part could be different. For example, the first or the second part could have two reference surfaces and the other part could have only one reference surface. In this way the assembly of the parts can be facilitated as the user does not have to pay attention to the relative orientation of the parts.

[0015] The first or the second part may comprise an axle mount on which a wheel, such as a drive wheel of a wheelchair, can be mounted. The axle mount may directly receive a wheel axle or comprise additional means for receiving a wheel axle such as a wheel axle of a drive wheel of a wheelchair. The other part, which does not comprise the axle mount, may comprise a mounting means for mounting the same to a frame structure such as a frame of a wheelchair or for mounting the same to a wheel mounting assembly which in turn is mounted to the frame of a wheelchair.

[0016] Also, both the first and the second part can be mounted on a frame structure. For example, the first part with an axle mount can be rotatably mounted on a frame, e.g. via a pin or a screw, and only the second part, which is also mounted on the frame, provides a specific angular alignment of the first part, e.g. of the wheel coupled to the axle mount. In this manner it can be ensured that two wheels, e.g. drive wheels of a wheelchair, are aligned mutually parallel.

[0017] The predetermined angular alignment may serve to ensure a certain camber and/or toe-in angel, particularly in combination with wheels, e.g., drive wheels of a wheel chair.

[0018] The first part and/or the second part may further comprise a fixation means for releasably fixing the first and second parts directly together. Any fixation means known to the skilled person can be used, such as screw, bolt, pin, quick pin and/or rivet. Also external fixation can be used, such as a clamp or screw clamp. This is also true for the fixation of the first and/or second parts to a frame.

[0019] The elevated portion may be convexly curved

and can be formed by two flat surfaces with different angles to one another, wherein the intersection point may be rounded off. The elevated portion may also be formed by a rounded or curved surface, e.g. a convexly curved surface. The elevated portion can but does not have to cover the entire respective surface, but can be a small elevation only sufficient to meet its purpose. The elevation can also be provided by external parts, e.g. a bolt or screw inserted into the first and/or second part. The surfaces and/or the entire parts can be at least partly formed by milling.

[0020] A method for manufacturing a connection means for connecting two parts with a predetermined angular alignment comprises the following steps: providing a first part with a first surface and a second surface, wherein the first surface is a first reference surface; providing a second part with a third surface and a fourth surface, the second part being adapted to receive at least a portion of the first part, wherein the third surface is a second reference surface. At least one of the second and fourth surface is provided with an asymmetry feature like e.g. an elevated portion. When the first part is inserted into the second part, the second and fourth surfaces contact each other via the elevated portion which forces the first and third surfaces, i.e. the reference surfaces, into contact with each other, the first and third surfaces providing the predetermined angular alignment of the first and second parts.

[0021] In the method, the surface comprising the elevated portion can be formed by milling.

[0022] A wheelchair comprises a frame and at least two drive wheels, wherein the drive wheels are connected to the frame via connection means according to the invention for ensuring that the wheels are mutually parallel.

[0023] These and other features of the invention will now be described by way of example with reference to the accompanying drawings, of which:

- Figure 1a is a schematic view of a connection means according to the invention;
- Figure 1b is an enlarged view of the second surface of the first part with an elevated portion;
- Figure 2 is a schematic view of a connection means according to the invention assembled to a frame;
- Figure 3 is a schematic cross sectional side view of a first part comprising an axle mount connected to a second part comprising an axle support via screws;
- Figure 4 is a schematic perspective view showing a first part comprising an axle mount connected to a second part comprising an axle support;
- Figure 5 is a schematic perspective view showing an exemplary first part of the invention;
- Figure 6a is a schematic side view of a wheelchair of the invention;

- Figure 6b is a schematic top view of a wheelchair of the invention;
 Figure 6c is a schematic back view of a wheelchair of the invention;
 Figure 7 is a schematic top view of a wheelchair of the invention with connection means according to the invention.

[0024] The connection means as illustrated in figure 1a shows a first part 1 which is at least partially inserted into a second part 2 as far as possible. The first part comprises a first surface 3 and a second surface 4, wherein the first surface 3 is a first reference surface. The second part 2 at least partially receives the first part 1 and has a third surface 5 as well as a fourth surface 6, wherein the third surface is a second reference surface. The connection means according to figure 1 has a substantially V-shaped or trapezoidal form. The first part 1 may not entirely enter into the second part 2 such that a head space 7 remains. The first part 1 may also comprise a head protrusion 8, e.g. of the same material as the first part 1 or of another material, e.g. rubber, which may contact a respective opposite surface of the second part 2.

[0025] As can be seen in figure 1, the first part 1 is received by the second part 2 and in an end position the second surface 4 of the first part 1 contacts the fourth surface 6 of the second part 2. An elevation of the second surface 4 ensures contact of the reference surfaces, namely the first surface 3 and the third surface 5. As can be seen, only the reference surfaces ensure the angular alignment of the first and second part 1, 2. Therefore, only the reference surfaces, namely first and third surfaces 3 and 5, have to be manufactured with a sufficient accuracy to achieve a certain angular alignment.

[0026] The second surface 4 is provided with the elevated portion as illustrated in figure 1b such that it becomes convexly curved over a length L. In particular, the second surface 4 may be formed by two substantially straight surfaces which are rounded with a radius R at an intersection point. With increasing convexity value a, a surface inclination angle W2 of the second part 2 should be equal to or greater than 90° to avoid manufacturing problems. The convexity value a should not come too close to zero to ensure that the elevated portion contacts the fourth surface 6 of the second part 2 at a predetermined location.

[0027] Figure 2 is a schematic view of a connection means according to the invention assembled to a frame 14. The first part 1 comprises an axle mount 11 for receiving a drive wheel axle 9 from a drive wheel 10. It is now of high importance to ensure the orientation of the drive wheel 10 relative to the frame 14. This is accomplished by the assembly of the two parts 1, 2 forming the connection means according to the invention. The first part 1 is mounted to the second part 2, i.e. a portion of the first part 1 is inserted into a respective recess of the second part 2. The first part 1 may be secured to the second part 2, e.g. by one or more screws or other equiv-

alent means. In this way the reference surfaces contact each other and the angular alignment of the parts and therefore of the wheel 10 and the frame 14 is determined, as the second part 2 belongs to the frame 14 or is mounted to the frame 14. Figure 2 again shows the benefits of the invention, namely to have preferably only one reference surface for each of the first and second parts 1, 2. In contrast, manufacturing all surfaces, namely the first through the fourth surface 3 to 6, to fully contact the respective opposing surface is time and cost consuming. Nevertheless, due to unavoidable manufacturing tolerances the surface inclination angle W1 cannot be manufactured so that the first and second part 1, 2 perfectly match to one another. The invention provides a solution, namely two contacting reference surfaces and one surface with an elevated portion to ensure contact of the reference surfaces.

[0028] Figure 3 is a schematic cross sectional side view of a first part 1 comprising an axle mount 11, for receiving an axle 9 of a wheel 10, connected to a second part 2 comprising or forming part of a wheel mounting assembly 13. The first part 1 is releasably attached to the second part 2 by use of screws. The second part 2 may be part of a frame 14 to which a wheel 10 shall be mounted. With the setup as illustrated in figure 3 a predetermined angular alignment of the wheel 10 relative to the frame 14 can be ensured.

[0029] Figure 4 is a schematic perspective view showing a first part 1 comprising an axle mount 11 connected to the second part 2 comprising a wheel mounting assembly 13. A portion of the first part 1 is inserted into the recess of the second part 2 which is shaped to receive the first part 1. Both the first part and the second part comprise one reference surface which contact each other once the first part 1 is inserted into the second part 2 as far as possible. The parts may be fixed by one or more screws or other fixation means.

[0030] Figure 5 is a schematic perspective view showing an exemplary first part 1 of the invention. The first part comprises a first surface 3, which is flat and serves as a reference surface, and a second surface 4 with an elevated portion. Two flat portions of the second surface 4 of the second surface 4 have an angle of 182° to one another to provide a convexly curved surface.

[0031] Figure 6a is a schematic side view of a wheelchair 12 of the invention without a seat and backrest. The wheelchair 12 comprises a frame 14 and two drive wheels 10 each attached via a drive wheel axle 9 to an axle mount 11 which in turn is secured to the frame 14 via a wheel mounting assembly 13. Figures 6c and 6b show a schematic top and back view, respectively, of a wheelchair of the invention showing the parallel alignment of the drive wheels 10. The wheelchair 12 as illustrated in Figure 7 comprises connection means according to the invention to ensure mutual parallel alignment of the drive wheels 10. Therefore, the wheelchair 12 comprises one connection means for each of the wheels 10.

[0032] The features disclosed in the foregoing descrip-

tion, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, as appropriate, may, separately, or in any combination of such features, be utilized for realizing the invention in diverse forms thereof.

Claims

1. A wheelchair (12) with a frame (14) and two drive wheels (10), wherein the drive wheels (10) are connected to the frame (14) via connection means for connecting two parts with a predetermined angular alignment, the connection means comprising:

a first part (1) comprising a first surface (3) being a first reference surface; and
a second part (2) adapted to receive at least a portion of the first part (1) and comprising a third surface (5) being a second reference surface,

characterized in that

the first and second reference surfaces are flat, and the first part (1) comprises a second surface (4) and the second part (2) comprises a fourth surface (6), wherein at least one of the second and fourth surfaces (4, 6) is provided with at least one asymmetry feature in form of an elevated portion being formed by two flat surfaces with different angles to one another, with the intersection point being rounded off, or by a rounded and/or curved surface, and wherein, when the first part (1) is inserted into the second part (2), the second and fourth surfaces (4, 6) contact each other with the asymmetry feature forcing the first and second reference surfaces (3, 5) into close contact with each other, and wherein the first and second reference surfaces (3, 5) determine the predetermined angular alignment of the first and second parts (1, 2), such that the accuracy of the angular alignment of the first and second parts (1, 2) only depends on the accuracy of the first and second reference surfaces (3, 5).

2. The wheelchair of claim 1, wherein the first or the second part (1, 2) comprises an axle mount (11).
3. The wheelchair of claim 2, wherein the other of the first or second part (1, 2) comprises a mounting means for mounting the same to the frame (14) of the wheelchair (12).
4. The wheelchair of any of the preceding claims, wherein the predetermined angle is a camber and/or toe-in angle.
5. The wheelchair of any of the preceding claims, wherein the first part (1) and/or the second part (2)

further comprise a fixation means for releasably fixing the first and second parts (1, 2) together.

6. The wheelchair of any of the preceding claims, wherein at least one of the second and fourth surfaces (4, 6) is provided with an inclination deviation as further asymmetry feature such that the inclination of the first and second surfaces and/or the inclination of the third and fourth surface differ from each other.
7. The wheelchair of claim 6, wherein the inclination deviation of the second surface is up to -15%, and/or the inclination deviation of the fourth surface is up to +15%.

Patentansprüche

1. Rollstuhl (12) mit einem Rahmen (14) und zwei Antriebsrädern (10), wobei die Antriebsräder (10) mit dem Rahmen (14) durch ein Verbindungsmittel zum Verbinden zweier Teile mit einer vorbestimmten Winkelausrichtung verbunden sind, wobei das Verbindungsmittel Folgendes umfasst:

ein erstes Teil (1), das eine erste Oberfläche (3) umfasst, die eine erste Bezugsoberfläche ist; und
ein zweites Teil (2) zur Aufnahme von zumindest einem Abschnitt des ersten Teils (1), und umfassend eine dritte Oberfläche (5), die eine zweite Bezugsoberfläche ist,

dadurch gekennzeichnet, dass

die erste und zweite Bezugsoberfläche eben sind und
das erste Teil (1) eine zweite Oberfläche (4) umfasst und das zweite Teil (2) eine vierte Oberfläche (6) umfasst,
wobei zumindest eine der zweiten und vierten Oberfläche (4, 6) mit zumindest einem Asymmetriemerkmal in Form eines gewölbten Abschnitts versehen ist, der durch zwei ebene Oberflächen mit unterschiedlichen Winkeln zueinander, wobei der Schnittpunkt abgerundet ist, oder durch eine gerundete und/oder gekrümmte Oberfläche ausgebildet ist und wobei, wenn das erste Teil (1) in das zweite Teil (2) eingebracht ist, die zweite und vierte Oberfläche (4, 6) in Kontakt miteinander sind, wobei das Asymmetriemerkmal die erste und zweite Bezugsoberfläche (3, 5) in engen Kontakt zueinander zwingt, und wobei die erste und zweite Bezugsoberfläche (3, 5) die vorbestimmte Winkelausrichtung des ersten und zweiten Teils (1, 2) bestimmen, sodass die Genauigkeit der Winkelausrichtung des ersten und zweiten Teils (1, 2) nur von der Genauigkeit der ersten und zweiten Bezugsoberfläche (3, 5) abhängt.

2. Rollstuhl nach Anspruch 1, wobei das erste oder das zweite Teil (1, 2) eine Achsenhalterung (11) umfasst.
3. Rollstuhl nach Anspruch 2, wobei das andere des ersten oder zweiten Teils (1, 2) ein Montagemittel zum Montieren desselben an den Rahmen (14) des Rollstuhls (12) umfasst.
4. Rollstuhl nach einem der vorangehenden Ansprüche, wobei der vorbestimmte Winkel ein Sturz- und/oder Vorspurwinkel ist.
5. Rollstuhl nach einem der vorangehenden Ansprüche, wobei das erste Teil (1) und/oder das zweite Teil (2) ferner ein Befestigungsmittel zum lösbaren Aneinander-Befestigen des ersten und zweiten Teils (1, 2) umfasst/umfassen.
6. Rollstuhl nach einem der vorangehenden Ansprüche, wobei zumindest eine der zweiten und vierten Oberfläche (4, 6) mit einer Neigungsabweichung als weiteres Asymmetriemerkmal versehen ist, sodass die Neigung der ersten und zweiten Oberfläche und/oder die Neigung der dritten und vierten Oberfläche sich voneinander unterscheidet/unterscheiden.
7. Rollstuhl nach Anspruch 6, wobei die Neigungsabweichung der zweiten Oberfläche bis zu -15 % beträgt und/oder die Neigungsabweichung der vierten Oberfläche bis zu +15 % beträgt.

Revendications

1. Fauteuil roulant (12) avec un châssis (14) et deux roues d'entraînement (10), dans lequel les roues d'entraînement (10) sont reliées au châssis (14) par des moyens de connexion pour relier deux pièces avec un alignement angulaire prédéfini, les moyens de connexion comprenant :

une première pièce (1) comprenant une première surface (3) étant une première surface de référence ; et
 une deuxième pièce (2) adaptée pour recevoir au moins une partie de la première pièce (1) et comprenant une troisième surface (5) étant une deuxième surface de référence,

caractérisé en ce que

les première et deuxième surfaces de référence sont planes, et
 la première pièce (1) comprend une deuxième surface (4) et la deuxième pièce (2) comprend une quatrième surface (6),
 dans lequel au moins une des deuxième et quatrième surfaces (4, 6) est pourvue d'au moins une ca-

ractéristique d'asymétrie sous la forme d'une partie élevée étant formée par deux surfaces planes avec des angles différents l'une par rapport à l'autre, le point d'intersection étant arrondi, ou par une surface arrondie et/ou incurvée, et
 dans lequel, lorsque la première pièce (1) est insérée dans la deuxième pièce (2), les deuxième et quatrième surfaces (4, 6) se touchant mutuellement avec la caractéristique d'asymétrie forçant les première et deuxième surfaces de référence (3, 5) en contact étroit l'une avec l'autre, et
 dans lequel les première et deuxième surfaces de référence (3, 5) déterminent l'alignement angulaire prédéfini des première et deuxième pièces (1, 2), de telle sorte que la précision de l'alignement angulaire des première et deuxième pièces (1, 2) dépend uniquement de la précision des première et deuxième surfaces de référence (3, 5).

2. Fauteuil roulant selon la revendication 1, dans lequel la première ou la deuxième pièce (1, 2) comprend un support d'essieu (11).
3. Fauteuil roulant selon la revendication 2, dans lequel l'autre de la première ou la deuxième pièce (1, 2) comprend un moyen de montage pour monter celle-ci sur le châssis (14) du fauteuil roulant (12).
4. Fauteuil roulant selon l'une quelconque des revendications précédentes, dans lequel l'angle prédéfini est un angle de carrossage et/ou un angle de pincement.
5. Fauteuil roulant selon l'une quelconque des revendications précédentes, dans lequel la première pièce (1) et/ou la deuxième pièce (2) comprennent en outre un moyen de fixation pour fixer de manière détachable les première et deuxième pièces (1, 2) ensemble.
6. Fauteuil roulant selon l'une quelconque des revendications précédentes, dans lequel au moins une des deuxième et quatrième surfaces (4, 6) est pourvue d'un écart d'inclinaison comme autre caractéristique d'asymétrie de telle sorte que l'inclinaison des première et deuxième surfaces et/ou l'inclinaison des troisième et quatrième surfaces se différencient l'une de l'autre.
7. Fauteuil roulant selon la revendication 6, dans lequel l'écart d'inclinaison de la deuxième surface va jusqu'à -15 %, et/ou l'écart d'inclinaison de la quatrième surface va jusqu'à +15 %.

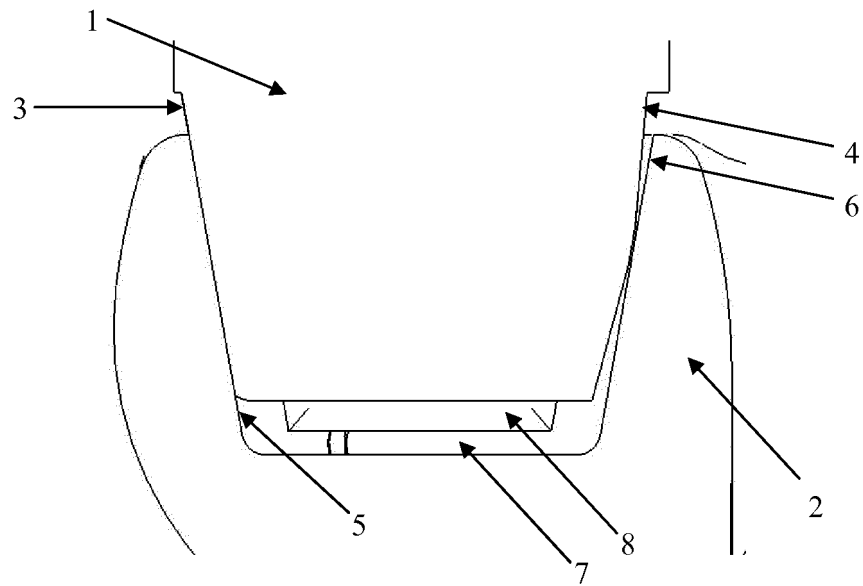


Fig. 1a

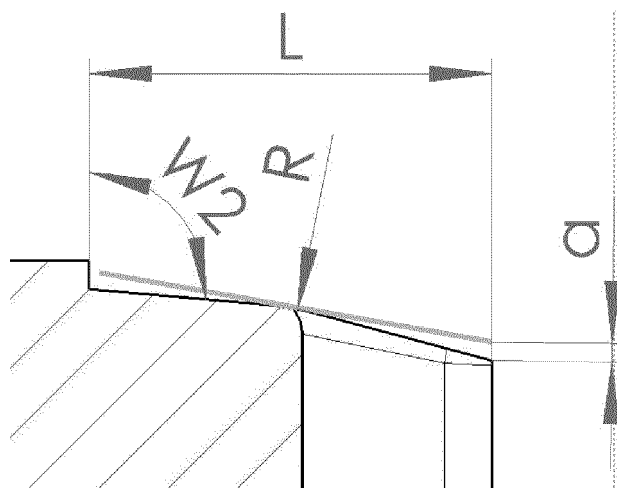


Fig. 1b

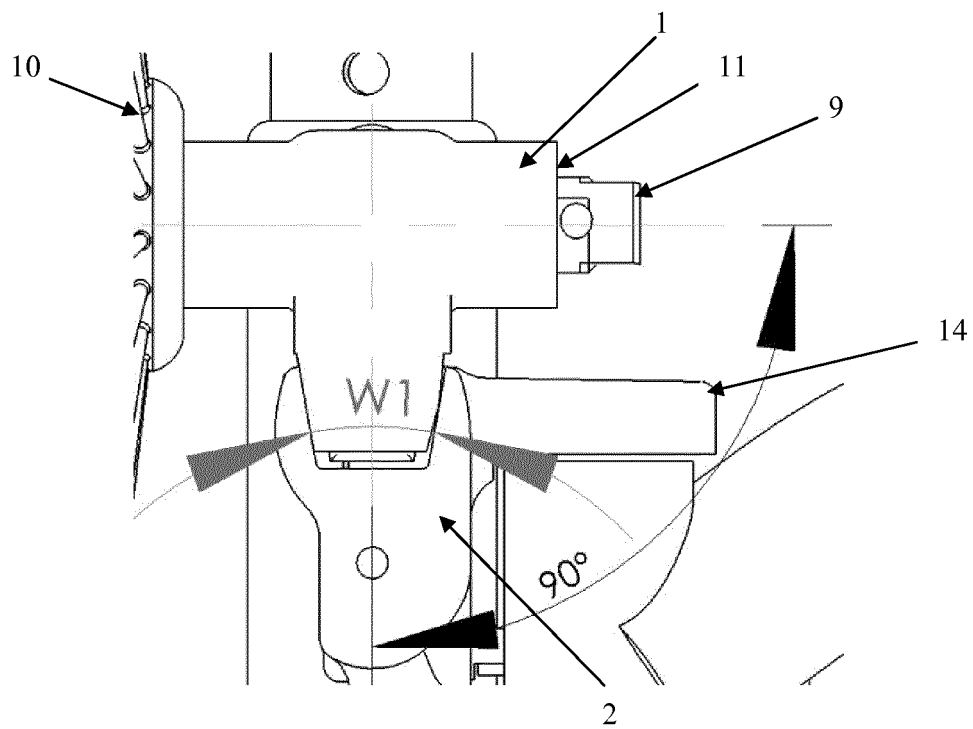


Fig. 2

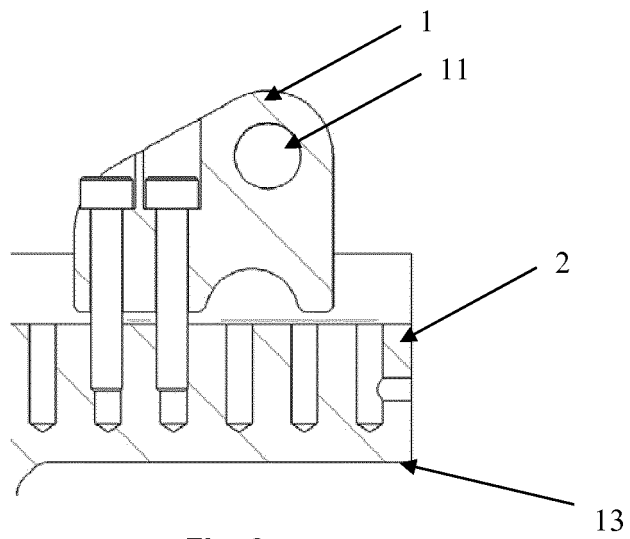


Fig. 3

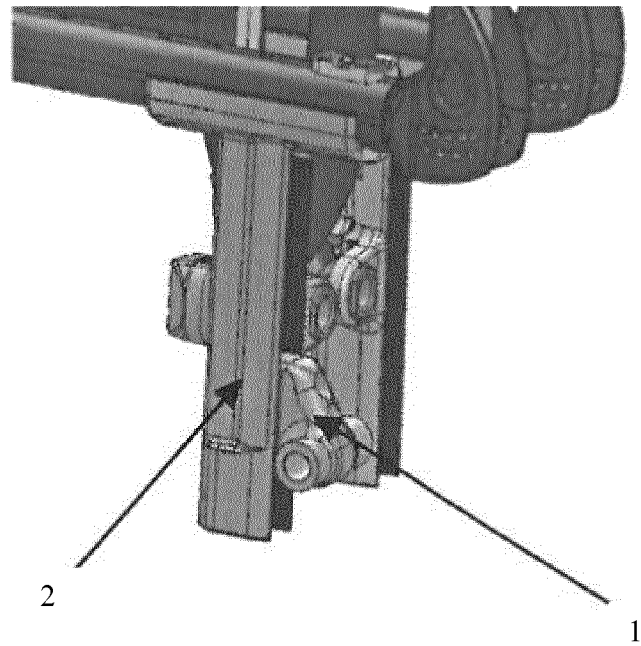


Fig. 4

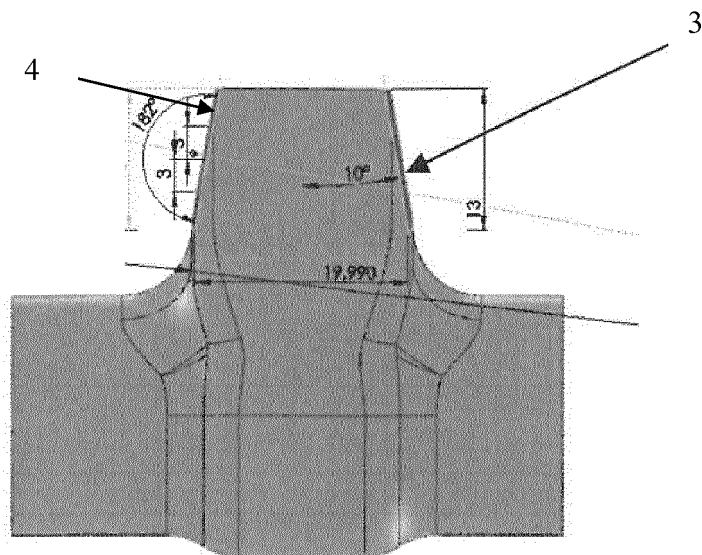


Fig. 5

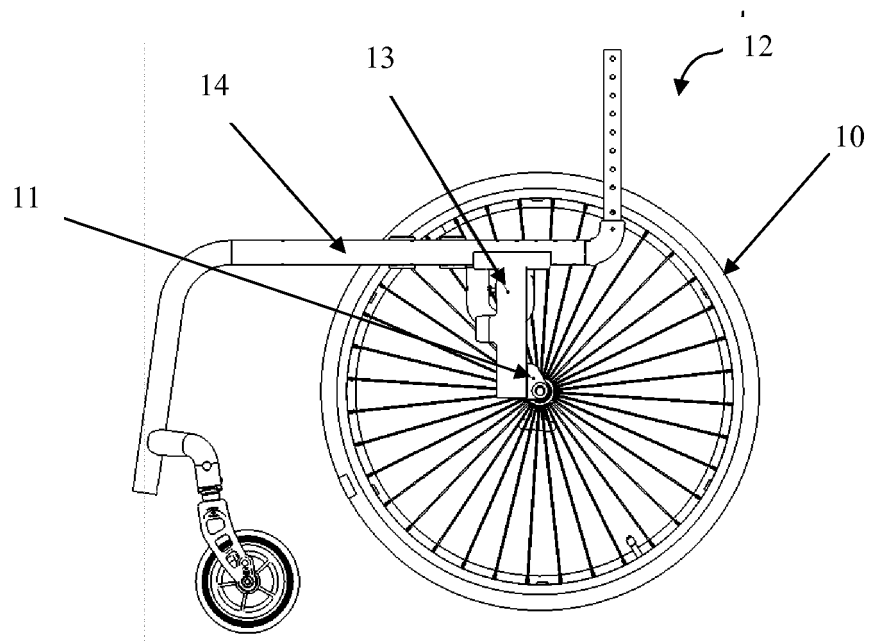


Fig. 6a

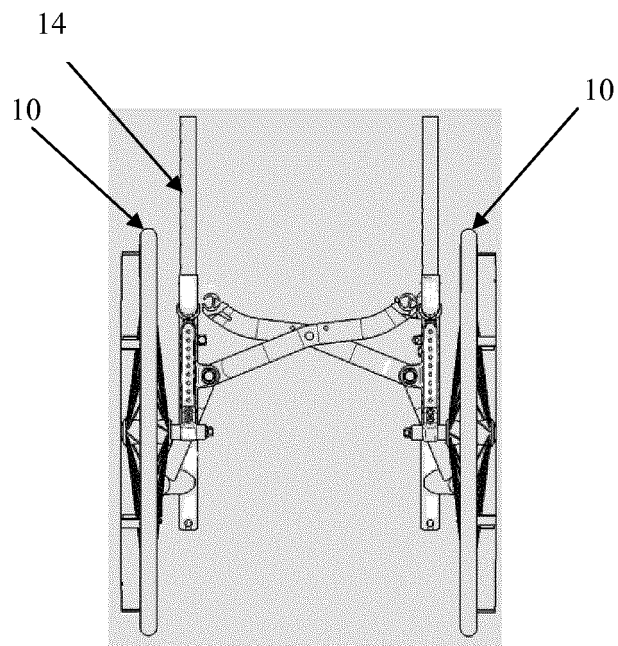


Fig. 6b

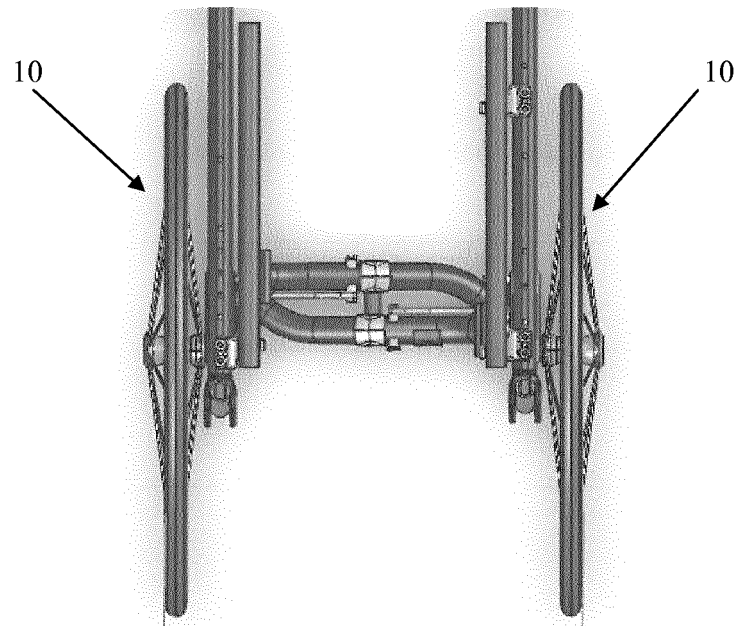


Fig. 6c

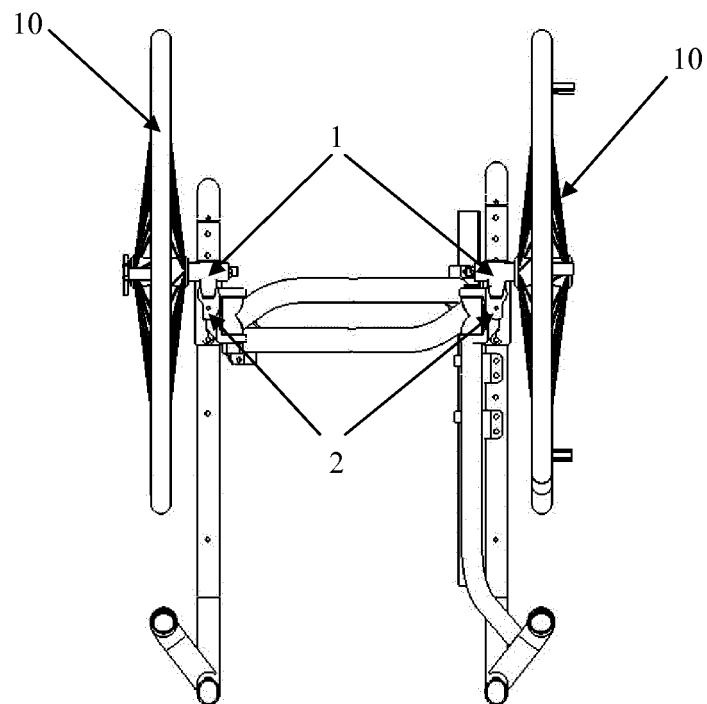


Fig. 7

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 5662345 A [0003]
- EP 0887064 A2 [0004]
- GB 1423398 A [0005]