



- (51) **International Patent Classification:**
A61G 5/02 (2006.01)
- (21) **International Application Number:**
PCT/GB2017/050065
- (22) **International Filing Date:**
12 January 2017 (12.01.2017)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
1600610.8 13 January 2016 (13.01.2016) GB
- (71) **Applicant:** ZHANG, Shaoyi [CN/GB]; 20 Walcott Green, Clifton, Nottingham NG11 9JF (GB).
- (72) **Inventor; and**
(71) **Applicant :** CHEN, Min [CN/GB]; 20 Walcott Green, Clifton, Nottingham Nottinghamshire NG11 9JF (GB).
- (74) **Agent:** KEVIN, Parnham; Parnham IP Services, Nottingham Clean Tech Centre, 63-67 St Peter's St, Nottingham Nottinghamshire NG73EN (GB).
- (81) **Designated States** (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,

BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

- (84) **Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

- *with international search report (Art. 21(3))*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*



WO 2017/122010 A1

(54) **Title:** A DRIVING ARRANGEMENT FOR A WHEELCHAIR

(57) **Abstract:** Traditionally, wheel chairs are provided with drive wheels with a push ring about a common hub for use by a user to drive the wheel chair. To gain more mechanical advantage users have tended to use the drive wheels directly which is dirty and can lead to trapped fingers. With the present invention push rings (9) on separate hubs (21) are provided with a mechanical coupling to the drive wheel (3). The push ring (9) can be inside or outside of their respective drive wheel (3), forward of, along with above, the drive wheel (3) for user convenience. The mechanical coupling will have a gear combination to improve performance.

A Driving Arrangement for a Wheelchair

5 This invention relates generally to wheelchairs and more particularly to the push wheel mechanism to drive the wheelchair manually by a seated user.

10 The general construction of wheelchairs is well known. A pair of main drive wheels are provided either side of a seat in a frame with typically push handles to allow the chair to be pushed from behind and each drive wheel having a push ring mounted on the same hub as the drive wheel to allow the user of the chair to propel the chair. However, with such constructions most seated users prefer to use the drive wheel itself. Using the drive wheel itself means the user's sleeves and hands get very dirty and lead to hygiene issues. It will be understood that using the larger drive wheel also gives some mechanical lever advantage compared to the smaller push wheel. It will also be understood that the push rings have relatively thin rims so grip by a user may be difficult.

15 In terms of weight positioning, the traditional wheelchair construction with a large drive wheel either side and two smaller castor wheels at the front to balance to the wheelchair is not ideal and can compromise easy pushing of the wheelchair without toppling particularly on an up slope.

20 Some wheelchairs have a drive motor for the main drive wheels with electric batteries etc. This adds significantly to weight but can assist with weight positioning in terms of driving the chair with a motor. In any event such electrically drive wheel chairs are significantly more expensive compared to hand driven wheel chairs, have a range limitation dependent upon battery charging and so act as a barrier to providing a light weight easily transported wheelchair which is both easy to unfold in a traditional manner and can be made relatively cheaply/freely available.

30 In accordance with aspects of the present invention there is provided a drive arrangement for a wheel chair, the arrangement comprising a main drive wheel connected by a drive jaw coupling to a separate push ring, the push ring coupled forward of the drive wheel upon a push ring hub with a chain or belt to a drive wheel hub, the push ring hub and the drive wheel hub have respective gears to provide part of the driving jaw coupling such that in use when the push ring is turned the wheel hub is reciprocally turned with the wheel.

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Also in accordance with aspects of the present invention there is provided a wheel chair with a driving arrangement in accordance with aspects of the present invention either side of the wheel chair.

5 The drive coupling may include a chain or a belt or a gear to gear engagement or a prop shape between gears at each end. The respective gears of the push ring hub and the drive wheel hub may provide a plurality of gear ratios between them and a selector may be provided to alter the gear ratio of the drive jaw coupling arrangement. The gears of the push ring hub may comprise a main gear and a hub gear with the hub gear presented upon a hub
10 mounting secured to a frame and the main gear is arranged around the hub gear. The hub gear may be secured to the push ring to rotate with it. The push ring may be has an inertia weight. A plurality of mountings may be provided at various positions respectively vertically and/or lateral different upon a frame.

15 The push ring may be either side, inside or outside, of the drive wheel, nearer or further from a seat. The push ring may be round, a rectangle shape or a pentagon such as an octagon, hexagon etc. The driving jaw coupling may include means to provide and/or maintain tension in the chain or chain. The drive wheel and/or the push ring may be displaceable laterally inward or away from each other to provide tension in the chain or belt.
20 The push ring may have significantly thicker rim dimension to provide better grip for a user.

The driving coupling between the push ring and the drive wheel may include a clutch to disengage the drive coupling when driven by other means such as by handles of a wheel chair.

25

Embodiments of the invention will now be described by way of example only with reference to the accompanying drawings in which:

30 Figure 1 is a schematic view of a wheelchair in accordance with aspects of the present invention;

Figure 2 is an enlarged schematic view of the main drive wheel to push ring with mechanical drive jaw coupling in accordance with figure 1;

Figure 3 is a further enlargement of the view depicted in figure 2 with a cover for the mechanical drive jaw coupling removed;

35 Figure 4 is a further depiction of the view depicted in figure 2 and figure 3 with the push ring removed;

Figure 5 is a rear depiction of the view depicted in figure 2;

Figure 6 provides a depiction from the rear of the main drive wheel removed from the frame/hub of the wheelchair;

Figure 7 is a schematic view of an alternative wheelchair in accordance with aspects of the present invention;

5 Figure 8 is a rear view of the wheel chair depicted in figure 7; and,

Figure 9 is a side view of the main drive wheel to push ring with mechanical jaw coupling in accordance with the wheelchair as depicted in figure 7 and figure 8.

Aspects of the present invention relate to essentially separating the main drive wheel
10 which engages the ground and the push ring or wheel gripped by a seated user to propel the wheelchair. The push ring is located forward and generally above the main drive wheel for ergonomic convenience and to allow better use of mechanical advantage of the push ring in terms of where the user can grip the push ring. In such circumstances the hygiene problems of dirty hands from engaging the drive wheel are reduced and the wheel chair is more
15 convenient to use.

Figure 1 provides a schematic illustration of a wheelchair 1 in accordance with aspects of the present invention. As with previous wheelchairs a frame 2 is provided with main drive wheels 3 either side of the frame 2 and castors 4 at the front of the wheelchair 1.
20 The frame 2 supports a seat 5 and a backrest 6. Handles 7 are presented from the frame 2 at the back of the wheelchair 1 and footplates 8 at the front. Push rings 9 are either side and separated from the main drive wheels 3 but coupled to the wheels 3 by a respective mechanical jaw coupling which is typically a drive chain (not shown) under a cover 10 in the view shown in figure 1.

25

The separation of the hub of the drive wheels 3 and the push rings 9 with drive mechanisms such as a preferred chain but may be a belt or a direct gear to gear arrangement or gears at each end with a rotating prop shaft between allows wheels 3 to be driven by rotation of the push rings 9. The hub gear mountings for the drive wheels 3 and/or
30 the push rings 9 will be configured to give a gear ratio for mechanical advantage whereby the speed and and/or the torque can be set for the muscular capacity and capabilities of a user. The gear ratio can be fixed or adjustably set for a user upon set up or dynamically in use dependent upon slope or terrain over which the wheel chair will be driven. As with a bicycle the drive jaw coupling can free wheel with a drive ratchet in one direction about one
35 drive gear jaw coupling with a clutch type arrangement for engagement and/or disengagement or possibly a simple brake is need to stop reverse movement down a slope when a user is not providing any forward momentum by turning the push ring 9 for forward

drive. In such circumstances aspects of the present invention provide separate push rings with a mechanical drive jaw coupling to the drive wheels so that with appropriate push ring mountings the angle, height and position forward in a wheel chair can be adjusted for a particular user. With a mechanical drive jaw coupling generally in the form of a chain drive
5 between gearing mountings a particular gear ratio can be set for conditions and a user. With a lockable free gear the push ring will not rotate so does not provide a hazard to a user allowing more convenient use of arm rests 11 by a seated user when the chair 1 is pushed by another person with the handles 7. The push rings 9 are inside the drive wheels 3 giving
10 greater so stability as well as keeping these generally dirtier drive wheels away from the user.

It will be noted that generally the push rings 9 will have a significantly larger diameter than the main drive wheels 3 which is typically the opposite of the situation with prior arrangements. In such circumstances even without any gearing in a drive jaw coupling
15 mechanism between the respective pairs of push ring 9 and drive wheel 3 there will be a mechanical advantage in terms of turning each push ring 9 with a chain or belt link to a drive wheel 3 above common sized gears, hubs or sprockets. The rings 9 may be up to twice the diameter of the main wheels 3. Normally, the rings 9 and wheels 3 will be secured with
20 respective gears on an axle with a chain or belt between the gears so that rotation of the push rings 9 will drive the drive wheels 3. The gear ratio between the respective push ring gears and the main drive wheel gears will be set for operational circumstances and possibly for the requirements of an individual user. As with a bicycle each push ring 9 and main drive
25 wheel 3 may have a number of gears which can be selected to provide different gear ratios for selection by a user during travel or fixed prior to travel for expected conditions.

Figure 2 provides an expanded illustration of the wheel 3 and ring 9 combination of the present invention depicted in the embodiment of figure 1. The cover 10 extends from a push ring hub 21 at the centre of the ring 9 towards a main wheel hub 22 in order to provide
30 some protection against finger entanglement at least by a user and/or to act as a mud flap or barrier to water spray towards a user. In the embodiment depicted a chain 23 connects the hubs 21, 22 so that turning the ring 9 at least forwards in the direction of arrowheads 24 turns the wheel 3 for forward reciprocal movement. Figure 3 provides further enlargement and detail with regard to the combination and drive jaw coupling between the hubs 21, 22
35 depicted in figure 2. The push ring hub 21 generally has some weight to provide inertia so that a main push gear 24 and a hub gear 25 can act when turned in the direction of arrowhead 24 to drive the chain 23 which in turn will turn the wheel gear 27 and so the wheel 3. The ratios of gears 25, 26, 27 can be determined as required for operation of the wheel

chair. As can be seen in figure 4 (with the push ring 9 and any weighting removed) the hub 21 is attached to the frame 2 so that the gears 25, 26 can turn and so drive the chain 23. The hub 21 can be positioned upon the frame 2 using pre-defined apertures or other mountings for different heights/forward positioning upon the frame 2 and so centre for the hub 21. Such positioning will allow the exact position of the push wheel 9 (not shown) to be selected and/or altered for user convenience as well as better operational performance. It will be understood different users will have different arm lengths to turn the push ring 9 so both positioning in terms of height and forwards may help with turning of the ring 9 as well as application of user weight to turn the wheel by forwards 'fall' on the ring 9 by gripping it.

Figure 5 and figure 6 show the jaw coupling arrangement depicted in figures 3 and 4 from the rear. The chain 23 is associated with the gear 27 upon a hub jaw coupling 28 so as described previously turning the push ring (not shown) means the chain 23 drives the wheel 23 through the gear 27 and jaw coupling 28. The gear 27 and jaw coupling 28 are themselves secured upon the frame 2. As there are wheels 3 etc. either side of the wheel chair it will be understood that the frame 2 presents respective gears 27 and jaw couplings either side of the wheelchair. The wheel 3 is generally secured to the frame 2 in a spigot like manner so the wheel 3 can freely rotate upon a spigot portion 29 of the frame 2. The wheel 3 is held in place by a fitting pin 30 and a part 31 of the gear jaw coupling 28 engages a reciprocal part of the wheel 3 to turn that wheel 3 with the gear 27.

Figures 7 to 9 illustrate an alternative embodiment of aspect of the present invention for a wheelchair 51 which has a wider base and so possibly more comfort to a user compared to the embodiment illustrated in figures 1 to 6. In the embodiment depicted in figures 7 to 9 it will be noted that a separate push ring 59 is outside of a main drive wheel 53 further away from the seat but as previously the ring 59 and wheel 53 are still connected by a drive arrangement comprising a chain 73 and gears 75, 77. Such an arrangement allows a seat 55 to be wider with a width 80 between the push rings 59 also wider which may help some users.

As previously the drive jaw coupling or arrangement comprising the respective gears, mountings and chain/belt either side of the wheel chair operate in a similar manner whereby rotation of the respective push ring turns its hub and so gears at the push gear end so that this drive is translated to the gear associated with the main drive wheel for movement of the drive wheel. It will be appreciated as described previously combinations of the gears at particularly the push ring end of the drive jaw coupling arrangement can be provided so that

different gear ratios can be selected for different conditions and users. A gear selector similar to that used on a push bicycle can be used to switch gears and so gear ratios.

5 As will be understood tension in the chain or belt will affect transfer of drive between the push ring hub and the drive wheel. This tension may be established at set up with the respective positions of the push ring and wheel in terms of mounting on the frame of the wheel chair and/or with a tensioner acting to press down upon the chain or belt against a bias spring so ensuring appropriate tension is achieved consistently. Alternatively, or additionally, the mountings for the push ring and/or the drive wheel may be displaceable
10 laterally, outwardly or inwardly, so again tensioning the chain/belt between appropriately and the mounting fixed in these lateral positions as required.

As indicated above push rings in accordance with aspects of the present invention are separated from the wheel chair and drive ring with drive via a drive jaw coupling
15 arrangement to the drive wheel. As will be appreciate use of linkages such as chains and belts can traditionally be thought to lead to mechanical power losses along with additional complexity and weight but the nature of the use of gears and gear ratios more than compensates for such losses if any along with any additional weight. It will also be appreciated that separation of the push ring and the drive wheel allows specific shaping
20 and/or sizing of the push ring for a user. Thus, if it will provided advantage the push ring may be other than round so oval, rectangular, a polygon such a pentagon, hexagon or octagon with each side edge effectively a handle for a user or another shape as required by a user. It will also be understood that the push ring on either side of the wheel chair may be differently shaped for a user's abilities, strength and/or co-ordination along with sizes and with angular
25 displacements so that a user can more easily apply alternatively, if necessary, rotation either side of the chair with grip features in the respective push handle presented as the wheel chair moves forwards.

As indicated above the frame of a wheel chair in accordance with aspects of the
30 present invention can have a number of mountings set within it so the appropriate mountings are used for a particular user. These mountings can be variable in terms of vertical position in the chair as well as laterally (forwards/backwards) to give variety of push ring positions and so convenience at least for a user in terms of easy of turning these push rings when seated in the chair on the seat.

35

The push rings in accordance with aspects of the present invention may also more conveniently have an inertia weight element formed integrally with the push ring or added as

required to improve smoothness of rotation of the push ring and so drive movement of the drive wheel/chair. More weights can be added for individual users or for advantage as a training feature for rehabilitation/strengthening of a user.

5 As will be appreciated user grip to turn the push ring is important so due to the separate nature of that push ring this can be designed for better grip by having a thicker rim dimension or other features to aid grip in use. The push rings will be readily detachable for folding or collapse of a wheel chair through possibly a wing nut or similar. Similarly, as
10 separable unit, the main wheel hub (with or without the drive wheel attached), the drive coupling and the push ring hub (with or without the push ring attached) be separable from the remainder of a wheel chair for easy of transportation and/or storage along with maintenance of this unit whilst a replacement allows the wheel chair to continue to be used.

15 It will be appreciated by those skilled in the art that any number of combinations of the aforementioned features and/or those shown in the appended drawings provide clear advantages over the prior art and are therefore within the scope of the invention described herein.

Claims

1. A driving arrangement for a wheel chair, the arrangement comprising a main drive wheel connected by a drive jaw coupling to a separate push ring, the push ring coupled forward of the drive wheel upon a push ring hub with a chain or belt to a drive wheel hub, the push ring hub and the drive wheel hub have respective gears to provide part of the driving jaw coupling such that in use when the push ring is turned the wheel hub is reciprocally turned with the wheel.
5
2. An arrangement as claimed in claim 1 wherein the respective gears of the push ring hub and the drive wheel hub provide a plurality of gear ratios between them and a selector may be provided to alter the gear ratio of the drive jaw coupling arrangement.
10
3. An arrangement as claimed in claim 1 or claim 2 wherein the gears of the push ring hub comprise a main gear and a hub gear with the hub gear presented upon a hub mounting secured to a frame and the main gear is arranged around the hub gear.
15
4. An arrangement as claimed in claim 3 wherein the hub gear is secured to the push ring to rotate with it.
- 20 5. An arrangement as claimed in any preceding claim wherein the push ring has an inertia weight.
6. An arrangement as claimed in any preceding claim wherein a plurality of mountings are provided at various positions respectively vertically and/or lateral different upon a frame.
25
7. An arrangement as claimed in any preceding claim wherein the push ring may be either side, inside or outside, of the drive wheel, nearer or further from a seat.
8. An arrangement as claimed in any preceding claim wherein the push ring has one of the following shapes round, a rectangle shape or a pentagon such as an octagon, hexagon etc.
30
9. An arrangement as claimed in any preceding claim wherein the driving jaw coupling includes means to provide and/or maintain tension in the chain or chain.

10. An arrangement as claimed in any preceding claim wherein the drive wheel and/or the push ring are displaceable laterally inward or away from each other to provide tension in the chain or belt.

5 11. A driving arrangement for use with a wheel chair substantially as hereinbefore described with reference to the accompanying drawings.

12. A wheel chair with a driving arrangement either side of the wheel chair as claimed in any of claims 1 to 11.

10

13. A wheel chair substantially as hereinbefore described with reference to the accompanying drawings.

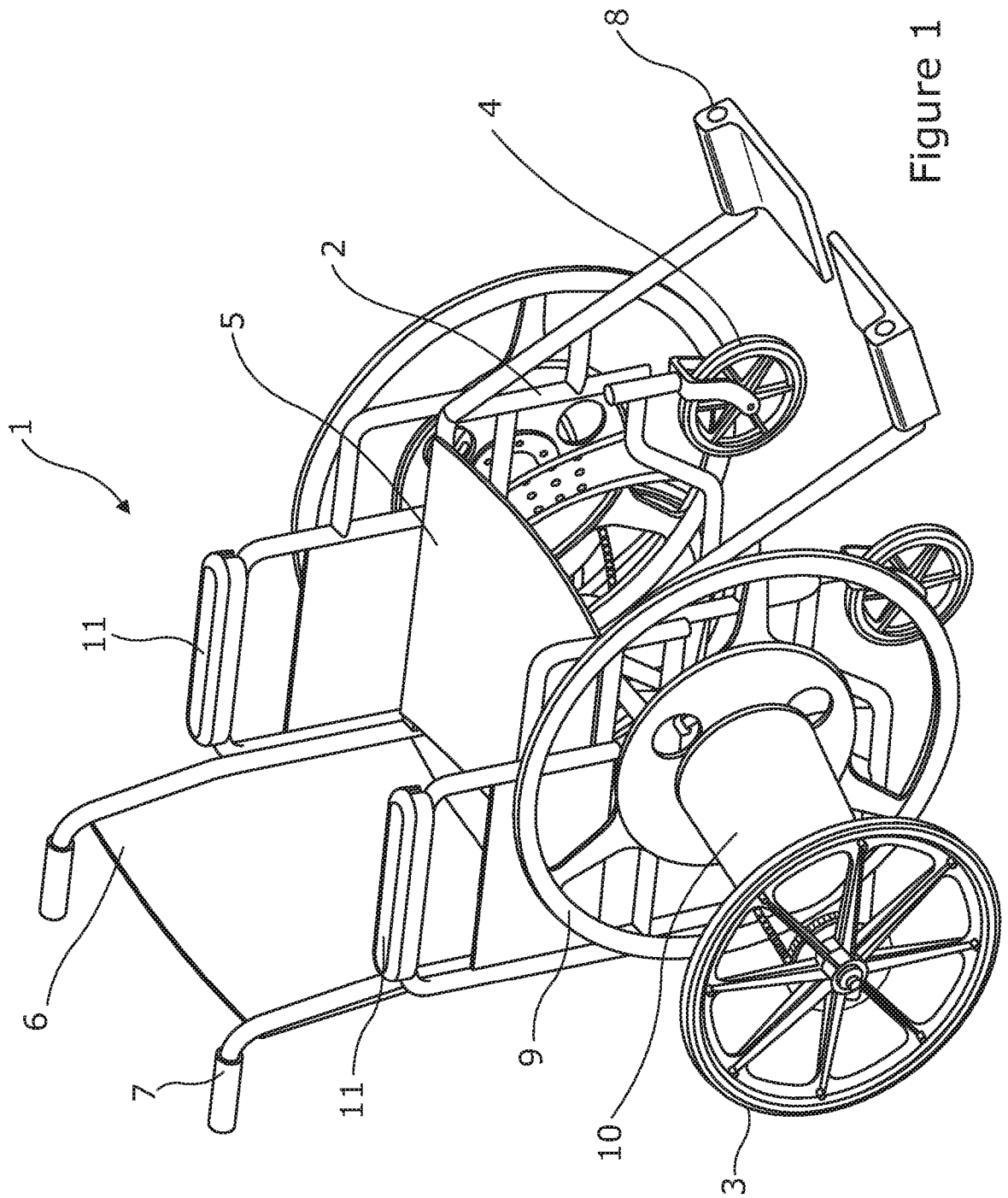


Figure 1

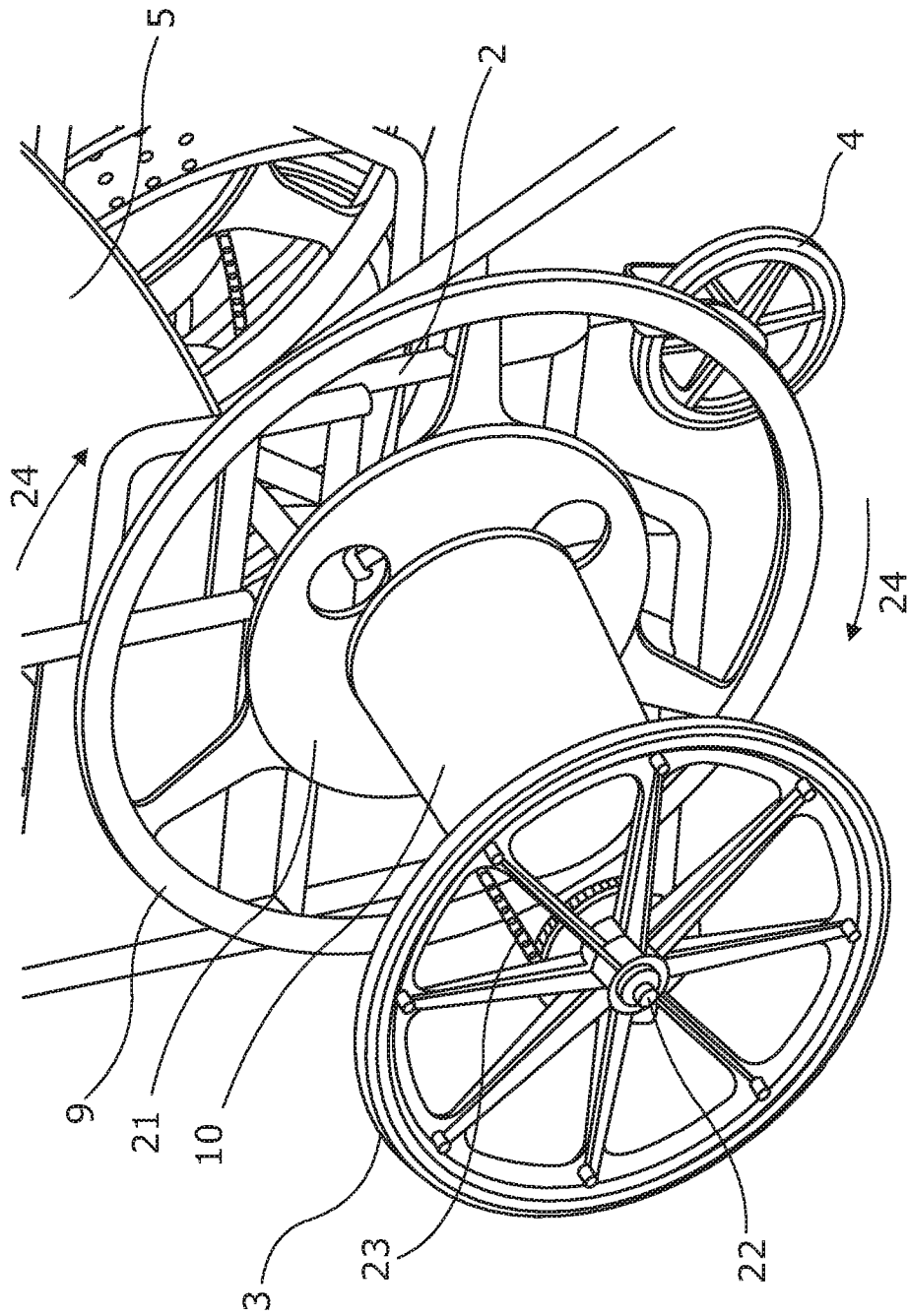


Figure 2

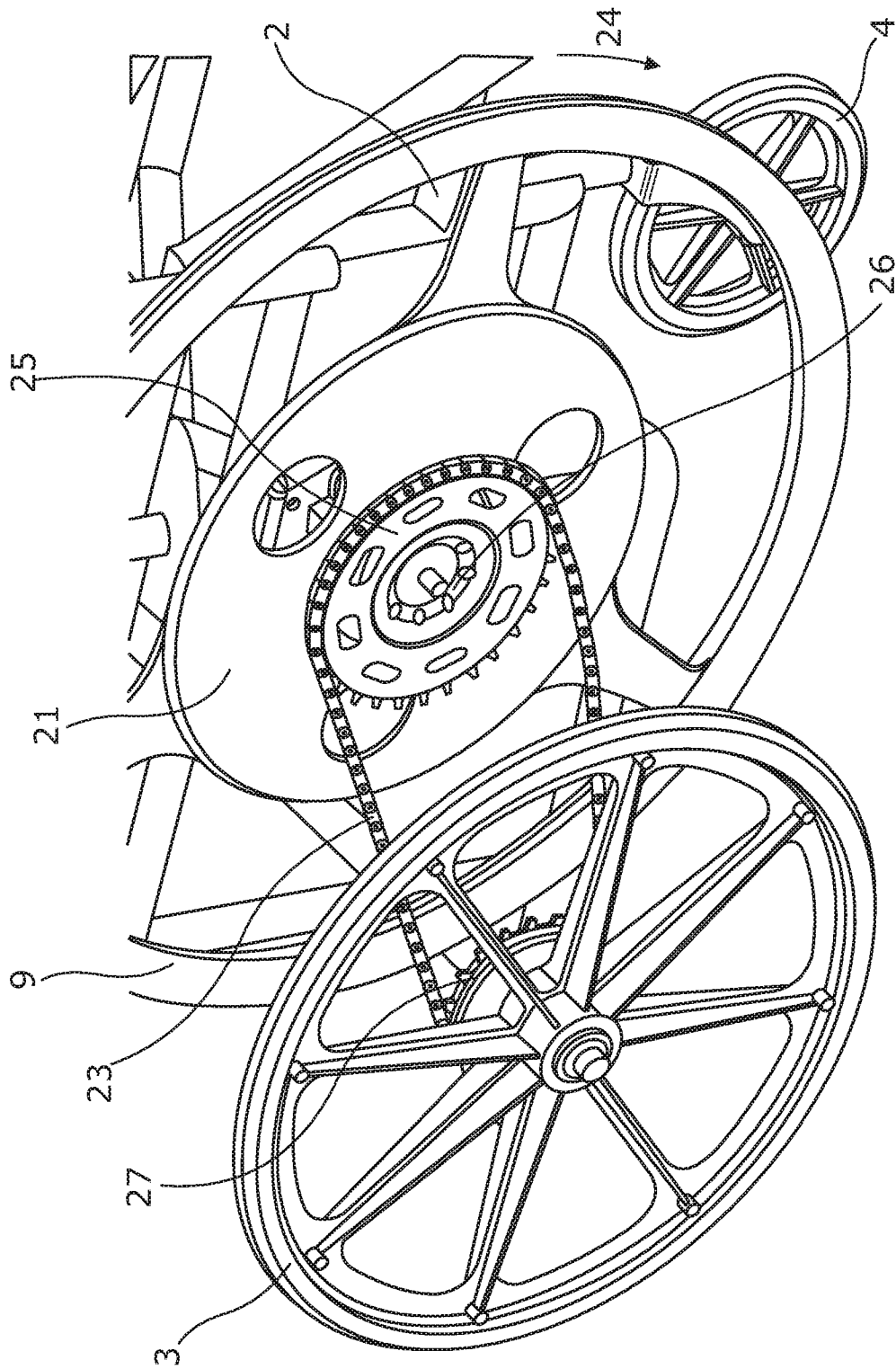


Figure 3

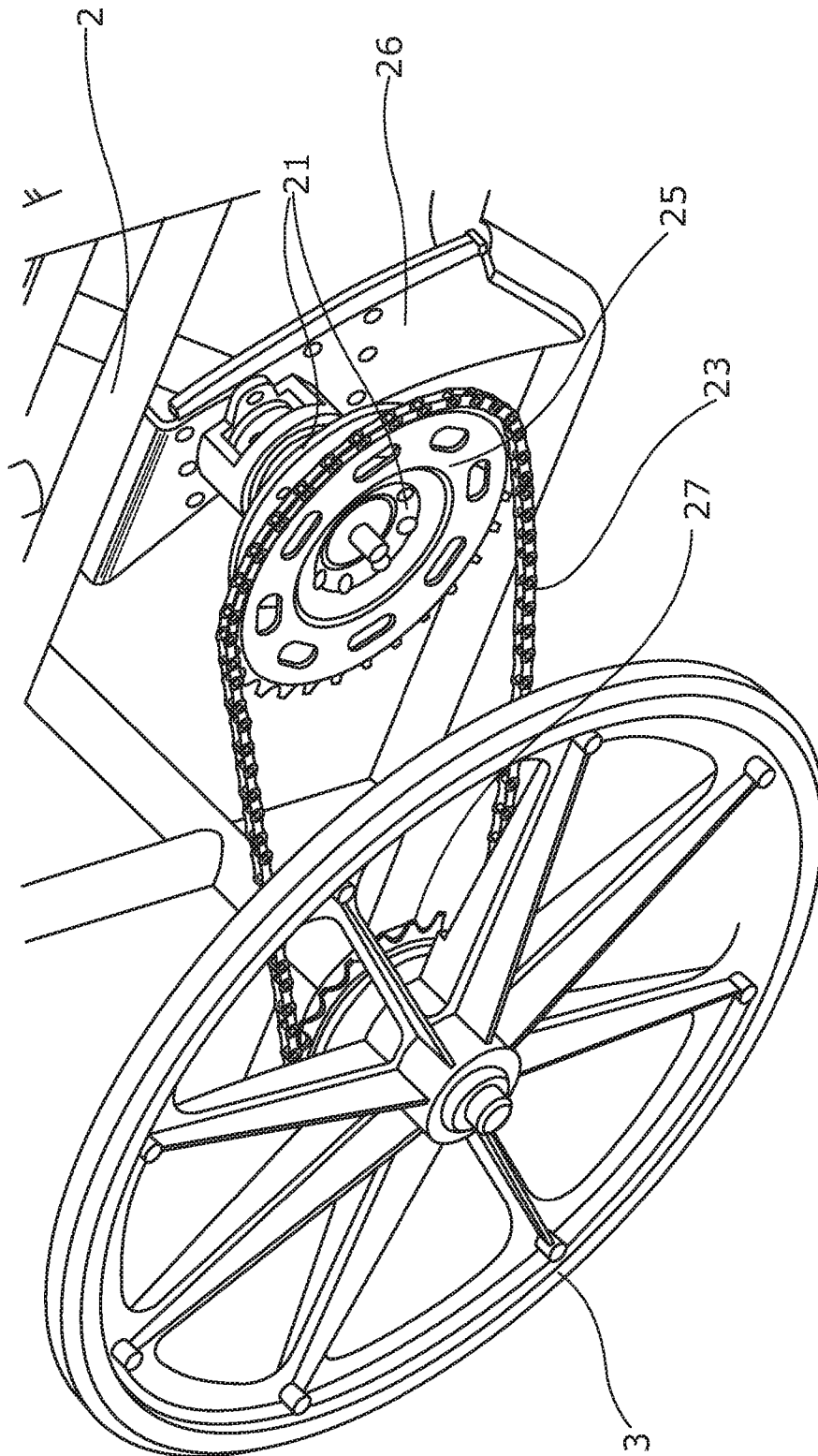


Figure 4

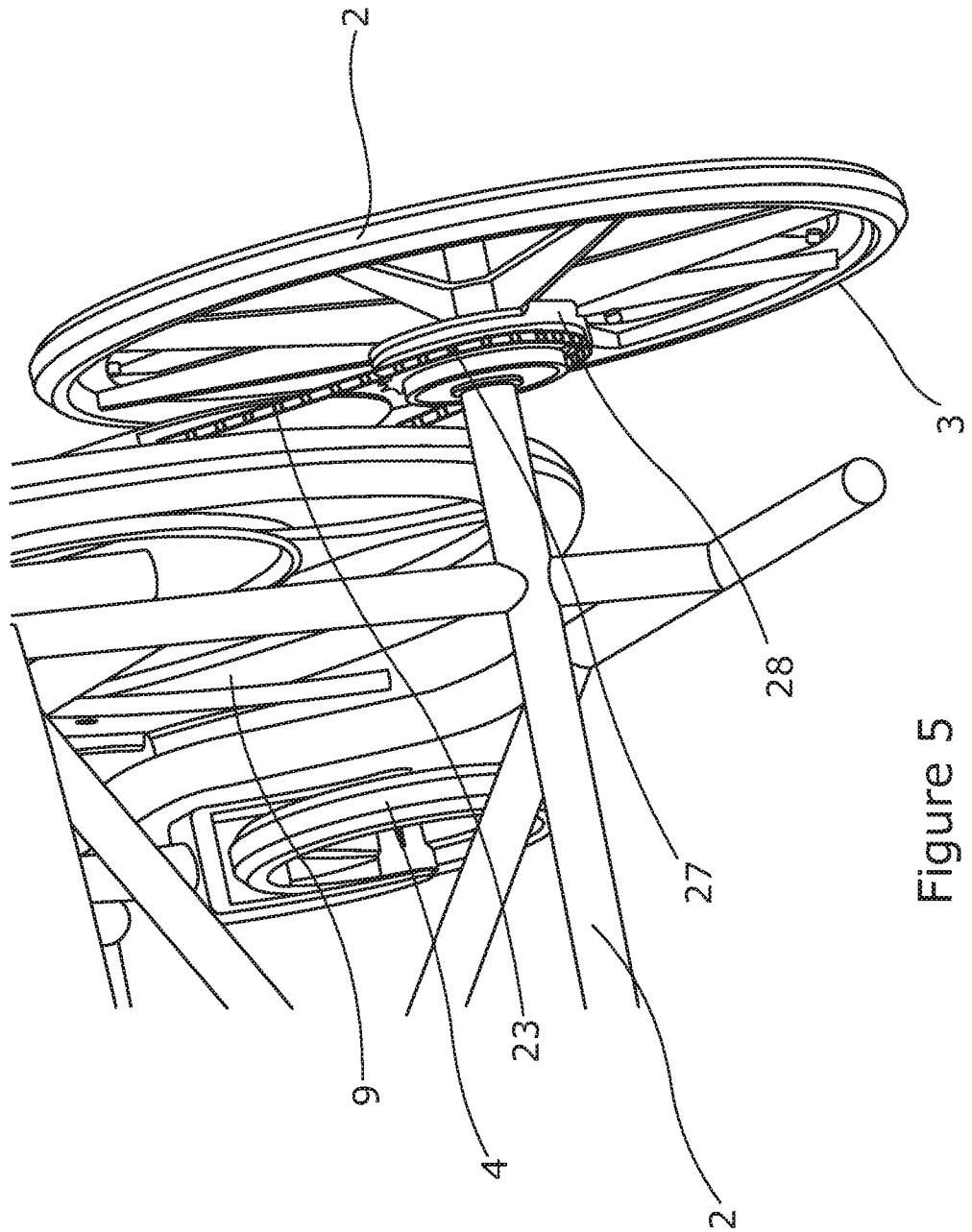


Figure 5

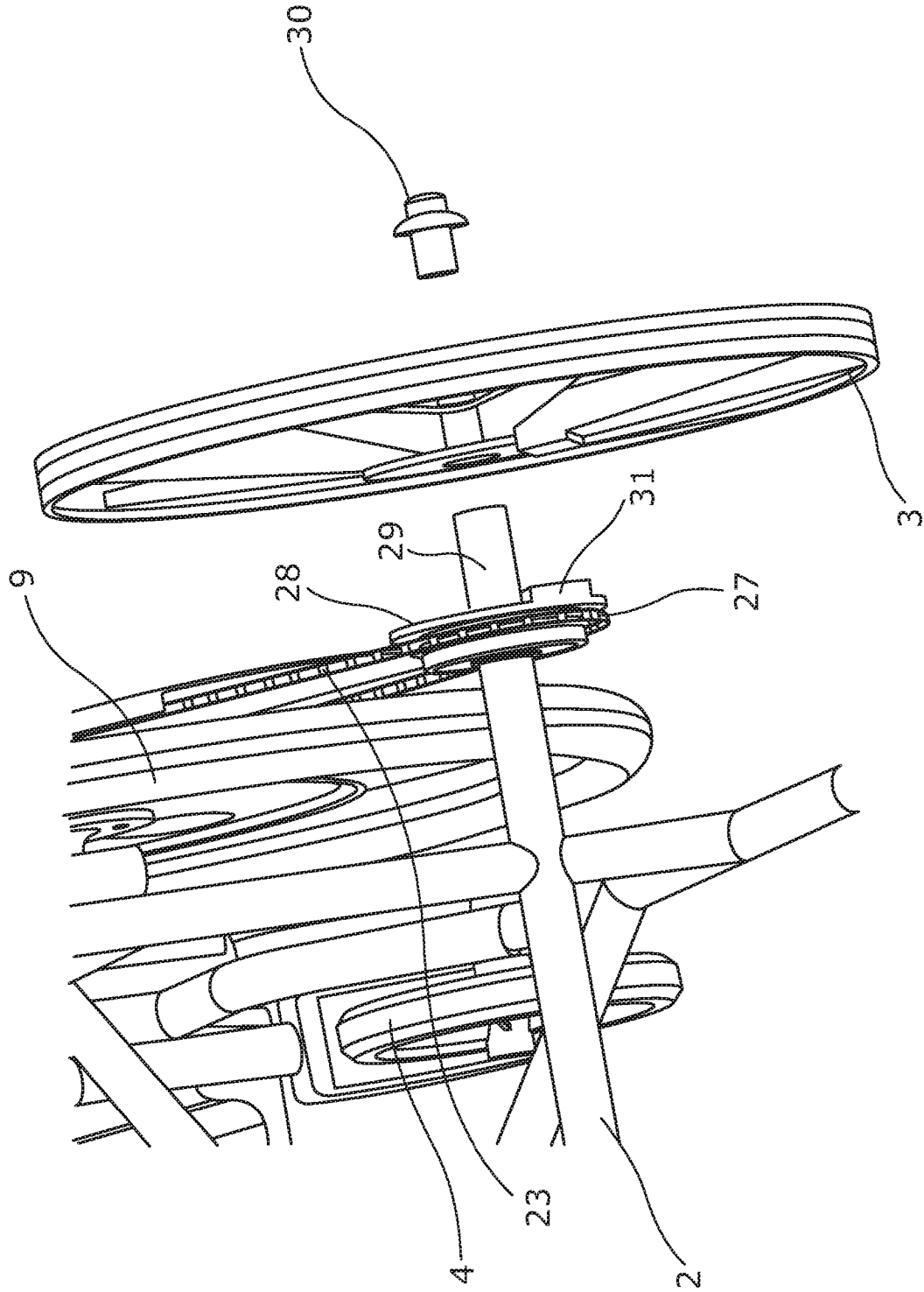


Figure 6

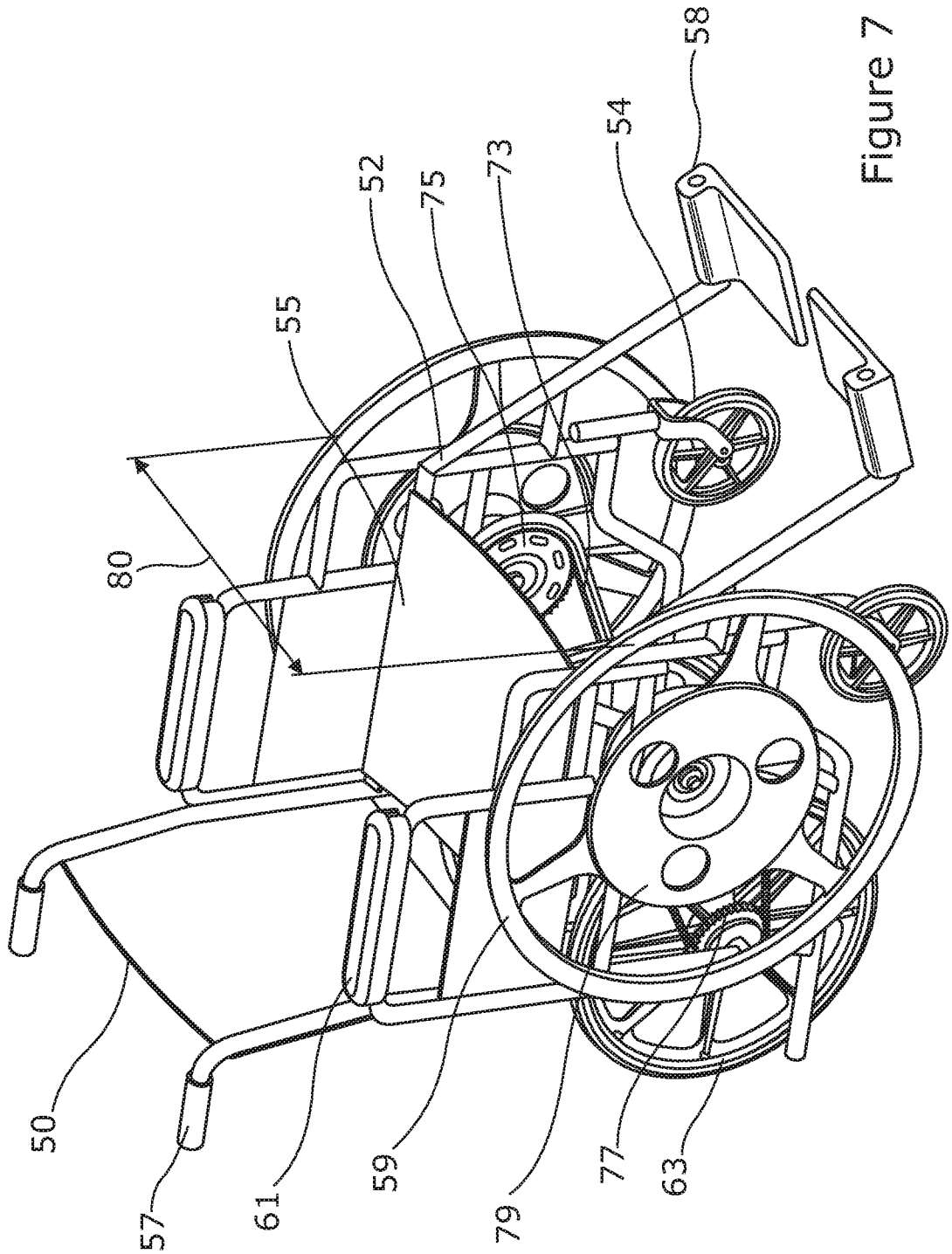


Figure 7

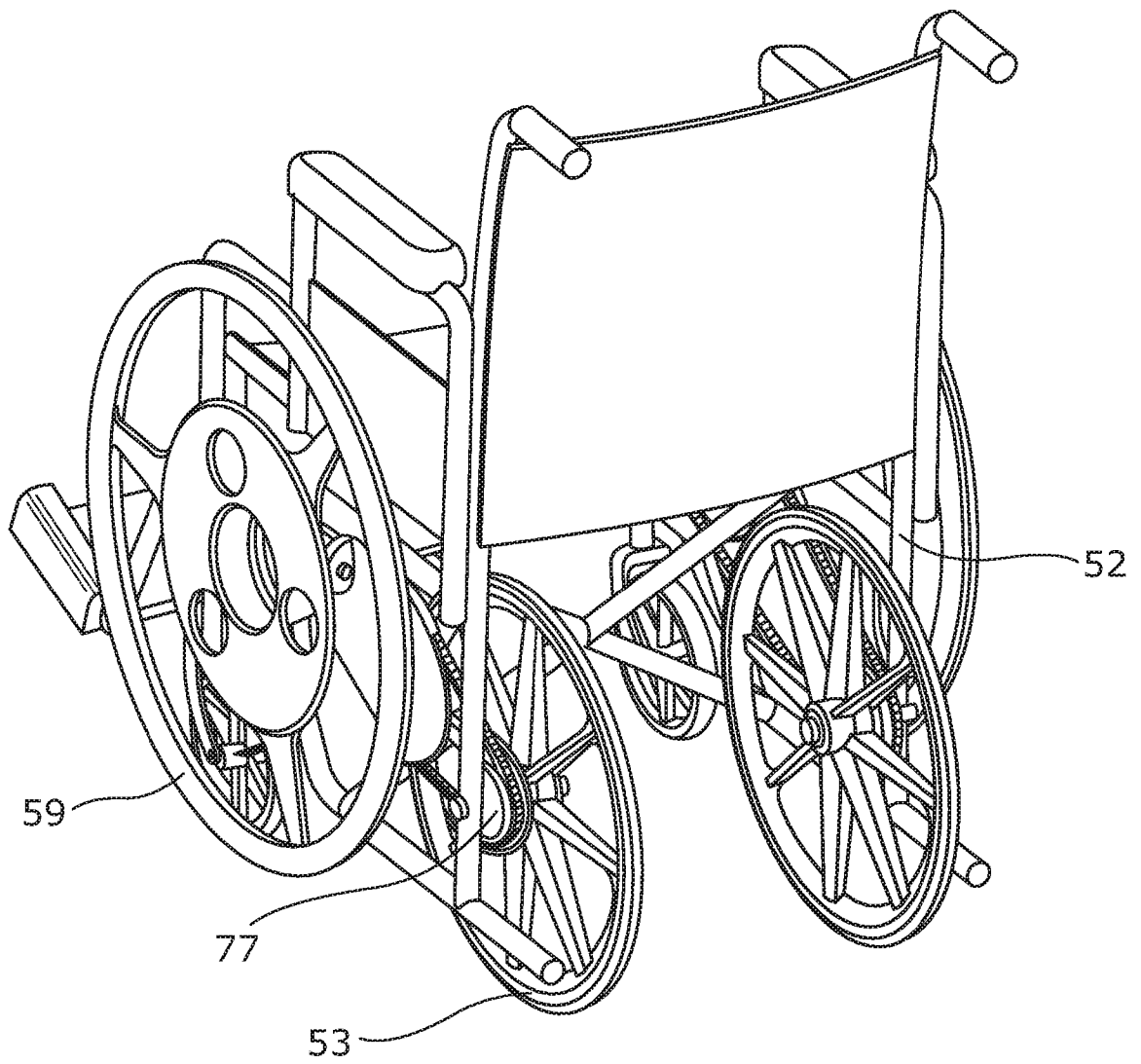


Figure 8

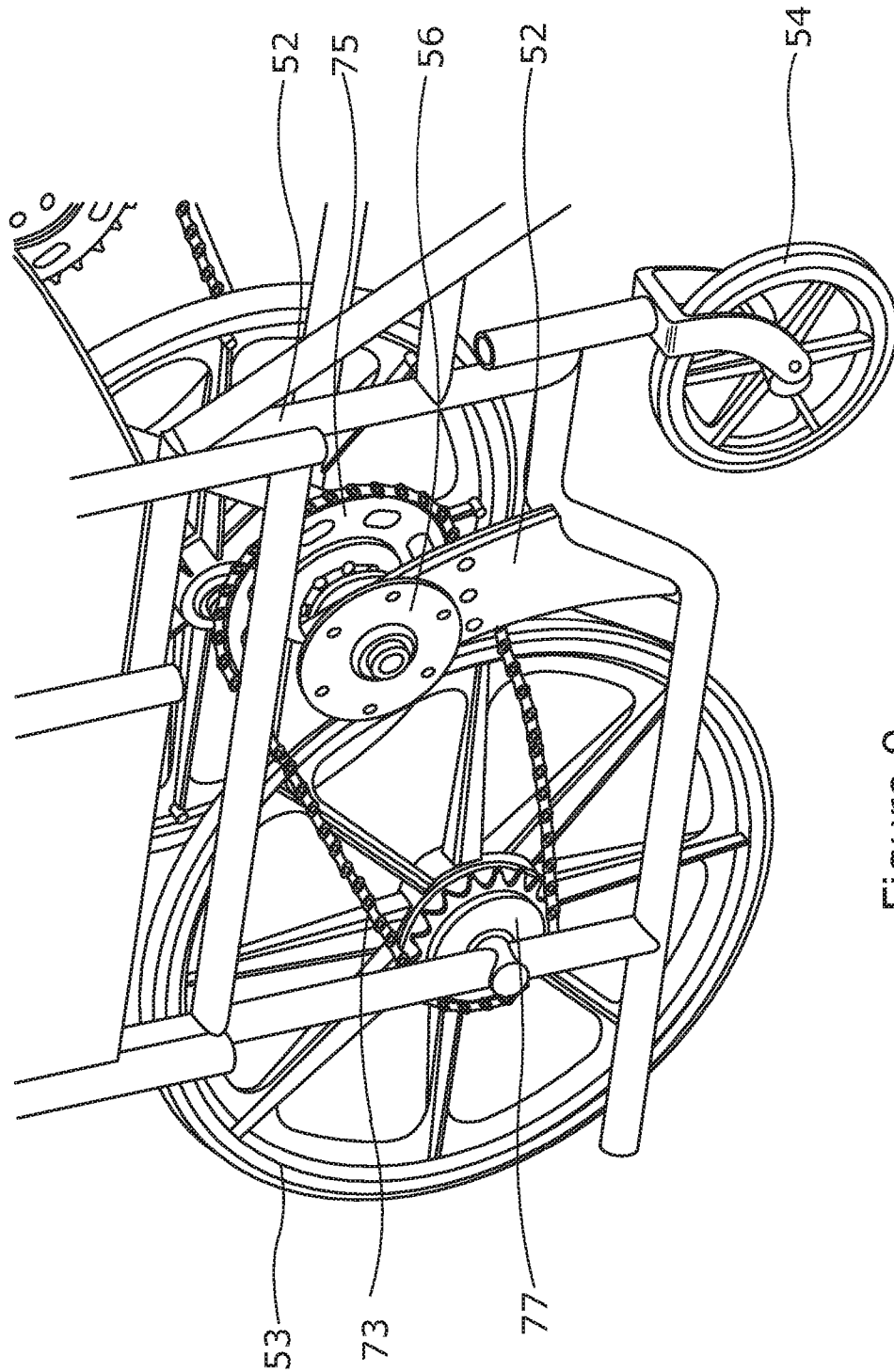


Figure 9

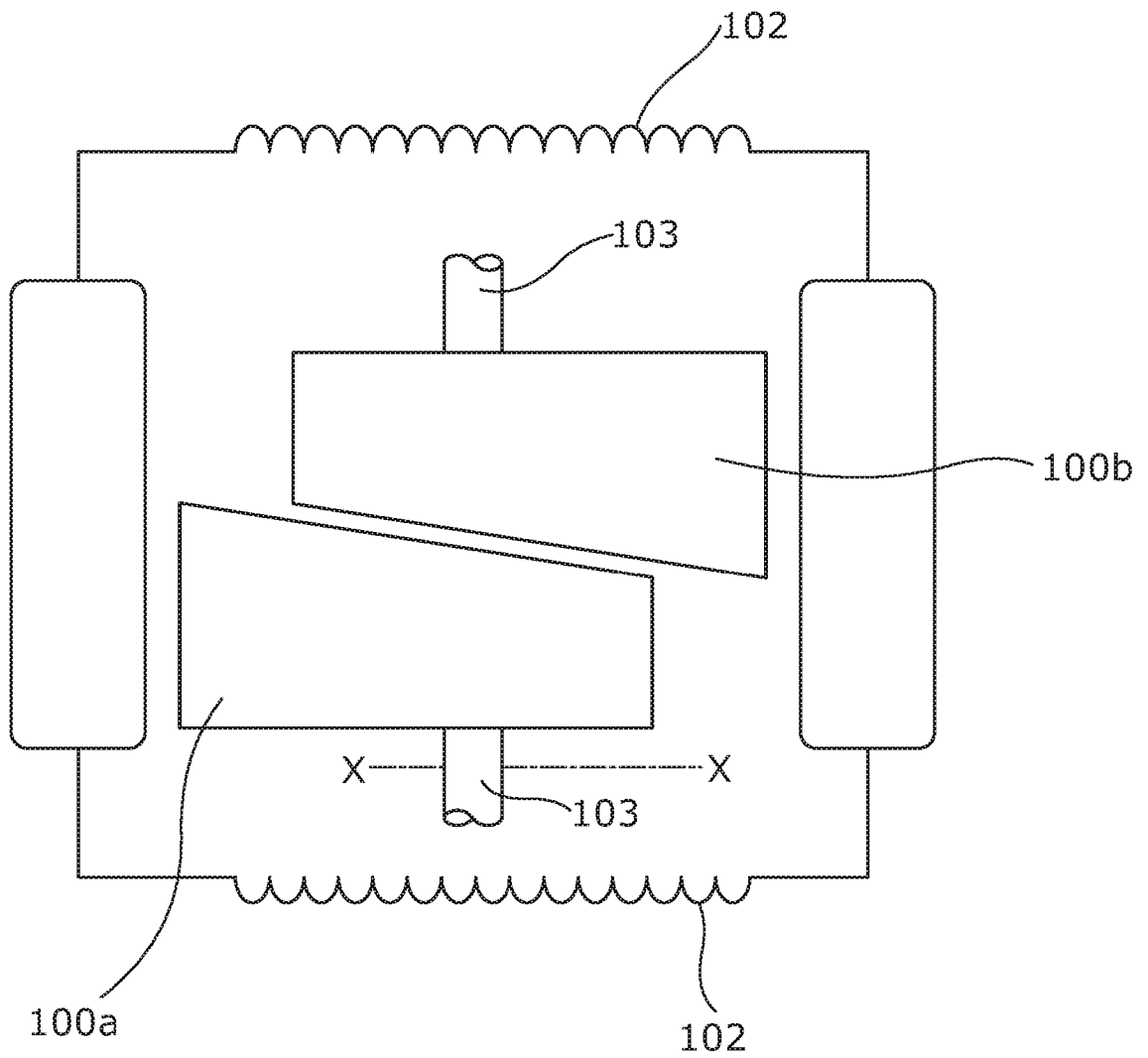


Figure 10

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2017/050065

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61G5/02
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
A61G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	US 2013/113178 A1 (GOLDISH GARY D [US] ET AL) 9 May 2013 (2013-05-09) paragraphs [0022] - [0027], [0031]; figures 1-5, 14A-C, 17A, 17B -----	1-9,12
X	DE 31 10 687 A1 (ZOGEL FLORIAN) 5 January 1983 (1983-01-05) page 9, last paragraph - page 10, last paragraph page 12, paragraph 4 - page 10, last paragraph; figures 1, 2, 4 ----- -/--	1,2,5, 7-9,12

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier application or patent but published on or after the international filing date
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Date of the actual completion of the international search 9 May 2017	Date of mailing of the international search report 12/06/2017
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Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Petzold, Jan
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INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2017/050065

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	----- US 6 047 980 A (MARGHERITA ANTHONY [US] ET AL) 11 April 2000 (2000-04-11) column 5, line 5 - column 9, line 4; figures 1-10	1,5-8,12
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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