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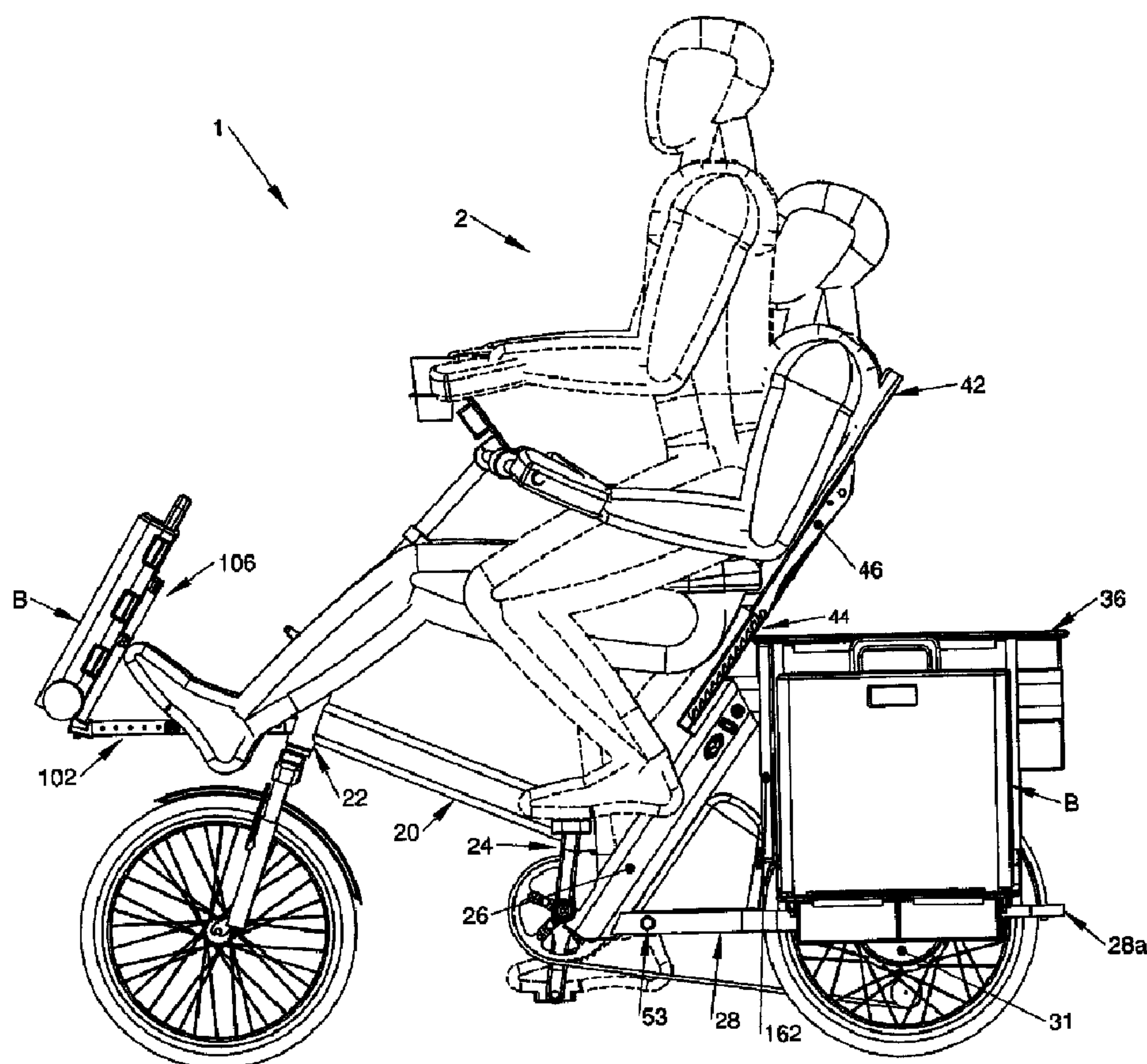
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(71) Demandeur/Applicant:
KIELLAND, PETER JOHANN, CA

(72) Inventeur/Inventor:
KIELLAND, PETER JOHANN, CA

(54) Titre : VELO A ASSISTANCE ELECTRIQUE DEUX-POSTURES A ERGONOMIE AMELIOREE

(54) Title: DUAL-POSTURE ELECTRIC ASSIST BICYCLE WITH IMPROVED ERGONOMIC FUNCTIONALITY



(57) Abrégé/Abstract:

A Dual Posture Electric Assist Bicycle having handlebars and a seat both of which are adjustable to suit either an upright or a recumbent posture without a rider dismounting. The bicycle has a movable seat bracket mounted on a support member, the seat



(57) **Abrégé(suite)/Abstract(continued):**

bracket holding both a lower, generally horizontal, seat portion and a seat back, the seat bracket engaging the support member by a ratchet which becomes disengaged when the bracket is tilted by lifting the lower seat portion, and which becomes automatically engaged when a rider's weight is applied to the lower seat portion. The handlebars are pivotable about a friction joint, and a handle is provided for adjusting the friction of this joint, the handle being accessible either to the hand or foot of the rider. The bicycle is preferably foldable to provide a dolly, and has attachable boxes for carrying substantial cargo.

ABSTRACT

A Dual Posture Electric Assist Bicycle having handlebars and a seat both of which are adjustable to suit either an upright or a recumbent posture without a rider dismounting. The
5 bicycle has a movable seat bracket mounted on a support member, the seat bracket holding both a lower, generally horizontal, seat portion and a seat back, the seat bracket engaging the support member by a ratchet which becomes disengaged when the bracket is tilted by lifting the lower seat portion, and which becomes automatically engaged when a rider's weight is applied to the lower seat portion. The handlebars are pivotable about a friction
10 joint, and a handle is provided for adjusting the friction of this joint, the handle being accessible either to the hand or foot of the rider. The bicycle is preferably foldable to provide a dolly, and has attachable boxes for carrying substantial cargo.

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Title: Dual-Posture Electric Assist Bicycle with improved ergonomic functionality**Background of the Invention**5 **1. Field of the Invention**

The present invention relates to a personal vehicle in the form of a “Dual-Posture Electric Assist Bicycle” (hereinafter referred to as a “DPEAB”).

10 The title term: "Electric Assist Bicycle" (“EAB”) refers to a well-known personal vehicle configuration comprised of a conventional bicycle and a supplementary electric drivetrain. Depending on varying road conditions and user preference, the EAB can be propelled entirely by its pedals, or entirely by its on-board electric motor, or by a combination of pedals and motor. To be classed as a legal EAB (and thereby be exempted from onerous motor vehicle regulations), the vehicle must conform to local laws governing

15 Electric Assist Bicycles, which typically call for such vehicles to be operable under pedal power alone, and to have restricted motor-power and speed capabilities.

The title term: “Dual-Posture” refers to my novel configuration of a conventional Electric Assist Bicycle. This “DPEAB” configuration has additional means which enable the EAB

20 rider to assume either a recumbent riding posture or an upright riding posture at will. These novel means and their functional advantages are referred to below under “Prior Applications”.

The present invention is concerned with improved embodiments of my Dual-

25 Posture Electric Assist Bicycle, which augment its ease-of-use characteristics with respect to my previously disclosed embodiments of a DPEAB.

2. Prior Applications

The invention relates to improvements over the DPEAB described in my previous applications, as follows:

5 Canadian Patent Application No.2,603,955, entitled "Dual posture electric assist bicycle", corresponding to PCT Publication No.WO2008/053853, having a PCT filing date of Sept. 23, 2007; and

Canadian Patent Application No.2,628,447, entitled "Wheeled dolly that unfolds into a personal vehicle", filed April 24, 2008.

10 Both of these previous applications showed a conventional "Electric Assist Bicycle" augmented with the invention's "Dual-Posture" enabling means comprised of:

- 1) A footrest assembly affixed to the frame and cantilevered over the vehicle's front wheel such that the rider can comfortably support both their feet on it when and as
15 required by the vehicle's two posture modes.
- 2) A seat and inclined backrest assembly configured such that the rider can comfortably recline against it when and as required by the vehicle's two posture modes.
- 3) An extendable and pivotable handlebar assembly configured such that the rider can
20 comfortably reposition their steering grip when and as required by the vehicle's two posture modes.

When used in concert, the three enabling means listed above permit a DPEAB rider to comfortably assume either of its two riding postures in response to varying operational
25 conditions. The two posture modes are:

- 1) The rider sits in an upright posture and pedals the bicycle or pedal-assists the DPEAB's electric motor. In this posture mode, the handlebar is pivoted forward,

the rider's back is upright (unsupported) and their feet are positioned on the pedals.

This upright posture mode has several advantages:

- The upright posture mode satisfies the legal requirement that an EAB be operable under pedal power alone.
- 5 • The upright posture mode enables the rider to augment the electric motor's power when needed (when climbing hills, when carrying heavy loads or when running low on battery power)
- The upright posture mode permits lateral movement of the rider's upright and freely moving torso, thereby enabling good low-speed balance (however
10 this posture also has the disadvantage of poor high-speed aerodynamics as well as the back fatigue associated with an upright posture).

2) The rider reclines into a recumbent posture and the DPEAB is propelled solely by its electric motor. In this posture mode the rider places their feet on the footrests,
15 the handlebar is pivoted rearwards to suit their recumbent position and their back is supported against the inclined backrest. This recumbent posture mode has several advantages:

- The recumbent posture mode's foot placement onto the static footrests enables a symmetrical body-bracing effect between the rider's legs and
20 spine that is significantly more comfortable than can be provided by resting their feet asymmetrically on a rotatable pedal crank.
- The recumbent posture mode provides a smaller, more aerodynamic frontal area that improves the DPEAB's overall energy efficiency.
- The recumbent posture mode's more horizontal torso orientation provides
25 back and leg support that significantly improves the rider's comfort compared to that of the upright posture mode (however this posture has the disadvantage of immobilizing the rider's back and thereby degrades their ability to balance the vehicle at low speed).

The above listed prior patent applications also show specialized versions of the DPEAB, which are foldable to provide a two-wheel dolly that can be pushed, rather like a shopping cart, and which have a prop, which supports the dolly when stationary. This “dolly mode” makes it easy to bring the folded DPEAB into confined spaces such as elevators in apartment buildings or office towers, thereby facilitating battery charging as well as protection of the vehicle against theft and vandalism. The '447 application also shows versions of the DPEAB which can carry some cargo, both when being ridden and when in dolly mode. That application also showed an asymmetrical hinge configuration, which improves the folded dolly’s load-distribution and handling characteristics.

The present invention provides a number of improvements over my prior designs as shown in the above-mentioned applications, whereby:

1. The seat is made readily adjustable in height, even while the DPEAB is being ridden, thereby enabling the rider to more easily assume either of the vehicle’s two posture modes in response to changing road conditions;

2. The adjustability of the handlebar is improved, so that its position may more readily be moved between that suitable for upright posture and that suitable for recumbent posture. This improved handlebar mechanism also enables better control over the pivot’s frictional resistance and permits rigid clamping of the handlebars at any angle;

3. Refinements to the folding features of the DPEAB allow it to be folded into one configuration for use as a dolly, and into a second, more compact configuration when it is to be placed in a shipping box without disassembly of major parts;

4. The cargo-carrying capacity of the DPEAB is increased using detachable cargo boxes that can also be used independently as rolling delivery carts; and

5. Further battery capacity is added.

Summary of the Invention

As indicated, an important feature of the present invention is the adjustable seat. In accordance with this aspect of the invention, the frame of the DPEAB has a fixed support

for a movable seat, the support being rearwardly and upwardly inclined, and which may form a parallel extension of a rear frame member. The support carries a movable seat bracket, which holds both a lower, generally horizontal, seat portion and an inclined seat back portion, which provides a backrest against which the rider can recline. An upper part
5 of the seat bracket engages the support by pivot/connector means, which allows both sliding and pivoting relative to the support. A lower portion of the seat bracket engages the fixed support by means of a ratchet and pawl type mechanism which is disengaged when the bracket is tilted about the pivot/connector means by lifting the lower seat portion, and which is automatically engaged when the seat bracket is pivoted downwards by either
10 gravity or the rider's weight upon the seat portion. When engaged by gravity, the rider's weight on the seat provides extra locking force to provide secure support under all riding conditions.

Accordingly, the seat can be raised or lowered simply by an initial lifting of the
15 lower seat portion sufficient to disengage the ratchet enough that the rider can freely slide the seat and backrest assembly to a desired height and can then lock it in place for use simply by releasing it to let gravity re-engage the ratchet. The rider can actuate the seat mechanism while the vehicle is underway by first supporting their weight on the pedals and then holding onto the lower seat portion with one hand as they use their legs to raise or
20 lower their torso into the desired posture mode.

The ratchet is preferably fixedly carried by the support, in which case the pawl part is represented by a projection on the pivotal seat bracket engaging the ratchet. Alternatively the ratchet could be carried by the seat bracket, and engage a fixed pawl on the seat
25 support.

Instead of a ratchet and pawl combination, a pin on the lower part of the bracket could be used in combination with a fixed member having a series of holes for the pin. Another approach to implementing this seat adjustment mechanism could utilize textured

or rubberized mating portions that effectively use frictional clamping to engage its moveable seat portion to its inclined support portion.

According to another feature of the invention, the manner in which the handlebar assembly is connected to the handlebar stem allows not only pivotal adjustment of the handlebar assembly to suit the riding position, but also allows the assembly to be clamped firmly in a variety of positions, all while the vehicle is in motion. This contrasts with the design shown in my '955 application, in relation to Fig. 29, where the frictional force holding the handlebar assembly can be adjusted, however the clamping pressure required to rigidly fix the position requires sufficient torque that adjustments could not easily be done while the vehicle is in motion.

In accordance with this aspect of the invention, the upper end of the handlebar stem and the lower end of the handlebar extension member are each provided with a bracket, these brackets having opposed bearing surfaces surrounding a bore which receives a generally horizontal pivot pin allowing pivotal movement of the handlebar extension member about the horizontal pin axis; the opposed bearing surfaces preferably include friction inducing means such as radial splines. The pivot pin has a screw thread at a first end and has an enlarged second end portion, and engages the brackets in such manner as to urge the two bearing faces together when the pin is rotated in one direction. The enlarged second end portion has a handle which can be manipulated to rotate the pivot pin, and thus to increase or decrease the pressure between the bearing surfaces and thereby to clamp or unclamp the pivot position of the adjustable handlebar extension member. The handle is situated so that it can be movable by the hand of a rider without dismounting; it may alternatively be made movable by the rider's foot.

The adjustability of the handlebar assembly is primarily intended to allow the handlebars to be suitably positioned for a rider both in upright and in recumbent position.

However, the adjustability may also allow the handlebars to be used for manipulation of the dolly produced by folding the DPEAB, as shown in Fig. 6 of my '447 application.

5 The cargo-carrying capacity of the DPEAB of this invention is also enhanced as compared to that of my aforesaid previous applications. One particular new feature is a front cargo-carrying support frame, which is mounted at the front end of the footrest support, and which may carry a box either in folded condition or in expanded, loaded condition. This support frame is attached to the footrest support by means which allow the support frame to be adjusted between a sloping condition for the folded box, and an upright
10 condition for the expanded box. Such means include a bracket at the front end of the footrest support having an upper bearing surface which lies at a first angle, of say 15 degrees to the footrest support axis, and which engages the lower bearing surface at the base of a frame member which lies at a second angle, of say 75 degrees, to the support frame member axis. This provides, for example, that in one orientation the support angle
15 between the support frame member and the footrest support is 60 degrees (i.e. second angle minus first angle), and when the frame member is rotated 180 degrees about the axis of the frame member this support angle is 90 degrees (i.e. first angle plus second angle).

In accordance with another aspect of the present invention, the DPEAB is foldable
20 in two distinct folded configurations. The first folded configuration is like that described in my previous applications as aforesaid, in which the front and rear wheels are locked side-by-side, but separated by an amount which allows the vehicle to be stable in its dolly configuration. Usually the wheels will be separated by an amount greater than the radius of the front and rear wheels, which are preferably of the same size. The second configuration
25 locks the wheels closer together, so that the folded DPEAB is of minimum size and suitable for being packed into a shipping container, without substantial disassembly.

Another feature of this invention, also suggested in my aforesaid '447 application, is a folding hinge for folding the DPEAB into the dolly configuration, in which configuration

the front and rear wheels of the DPEAB are side by side and spaced apart, wherein the hinge axis is arranged to slope upwardly and forwardly from the vertical when the DPEAB is unfolded and resting upright on a level surface, whereby when the DPEAB is folded into the dolly configuration both the wheels slope inwardly when the dolly is seen in end view.

5 This hinge asymmetry thereby adjusts the folded vehicle's center of gravity for better stability during maneuvers.

Brief Description of the drawings.

Preferred embodiments of the invention will now be described by way of example
10 with reference to the accompanying drawings, in which;

Fig. 1 is a side elevation of a DPEAB similar to that of my Canadian '955 application;

Fig. 2 is a side view of my new DPEAB in accordance with one aspect of the present invention;

15 Fig. 3 is a side view of the DPEAB of Fig. 2, when used in recumbent posture;

Fig. 4 is an oblique, partly rear view of the DPEAB of Fig. 2;

Fig. 5 is a detailed side view of the seat adjustment mechanism of my new DPEAB;

Fig. 6 is a detailed view of the handlebar adjustment mechanism of the same DPEAB, and also shows a steering lock and a hinge lock for use in the dolly mode;

20 Fig. 7 shows a view of the footrest above the front wheel, and which is combined with a front cargo support;

Fig. 8 is a detailed view of the hinge, which allows folding of the DPEAB;

Fig. 9 is a side view of the DPEAB when folded into dolly configuration and parked;

25 Fig. 10 is an oblique view of the DPEAB in dolly configuration being maneuvered;

Fig. 11 is a view of a folded, wheeled carrier box, showing a modification of the box made to suit it for use with the present invention;

Fig. 12 is an oblique rear view of the DPEAB of this invention, showing battery storage;

Fig. 13 is an enlarged side view of the housing for the electrical components of the same DPEAB;

Fig. 14 is an oblique view of a modified version of the DPEAB of this invention, with additional cargo-carrying capacity, and showing the use of a stand;

5 Fig. 15 is an oblique view the DPEAB supported by a stand with its rider reclining on it while using a laptop computer;

Fig. 16 is an enlarged view of a multifunction laptop rest affixed to the handlebar;

Fig. 17 is an oblique view of the DPEAB of Fig. 2 when folded into a compact configuration suitable for a shipping container;

10 Fig. 18 is an oblique view of a non-folding version of the DPEAB of the present invention, and which also illustrates usage of a cargo box when separated from the vehicle.

Detailed Description.

15 Fig. 1: Basic DPEAB of prior applications

Fig. 1 shows the Dual Posture Electric Assist Bicycle 1 described in my previous above-mentioned PCT and Canadian '955 applications. The rider 2 can propel the DPEAB by sitting upright and pedaling crank 3, or can sit in a recumbent posture, as shown in Fig. 1, leaning against seat/backrest assembly 4 with feet resting on footrests 5 while the
20 DPEAB is propelled by the electric motor 6. The footrests for both feet are the same height, which is more restful than resting on pedals at different locations. Pivoting the handlebar assembly 7 about bracket 7a, against frictional forces, allows the rider to steer the DPEAB in either mode. The handlebar assembly also typically includes an upper joint 7b, which allows telescopic adjustment and rotational adjustment of the handlebars. Upper
25 joint 7b typically includes an easily accessed quick-release clamping mechanism. The telescopic adjustment allows the handlebar length to be suited to the rider; the rotational adjustment is for compactly folding the DPEAB for shipment. The hinge mechanism 8 connects front and rear frame spars 9 and 10, which extend horizontally from the head tube 12 to the base of the seat assembly 4, giving a fairly high "step-over" height to the frame.

Seat assembly 4 may be raised or lowered to accommodate upright and recumbent riders however its conventional telescoping seatpost height adjustment means cannot be readily operated by the rider while underway.

5 **Figs. 2 to 5: Improved frame and adjustable seat**

Figs. 2 to 4 show details of the frame of a preferred embodiment of the present invention. The frame has been modified from the Fig. 1 configuration, and also from that of my '447 application, which was similar to Fig. 1 except in having frame spars 9 and 10 sloping down at similar shallow angles to the hinge 8. In Fig. 2, rider 2 is shown in both
 10 upright and recumbent postures with respect to DPEAB 1 to better illustrate its two modes of operation. The vehicle's seat mechanism is shown configured for use by an upright rider (shown in dashed outline) while its handlebar mechanism is shown configured for use by a recumbent rider (shown in solid outline). For use in upright posture mode, the handlebar mechanism would be swung forward and possibly lowered to provide optimal pedaling
 15 ergonomics according to the rider's preference.

Compared to the '447 application, the frame has been modified so that firstly the front frame spar 20 now slopes downwardly from the head tube 22 to the upper part 24a of hinge 24 at a steeper angle than that used in my '447 application. Furthermore, the hinge 24 has a
 20 lower part 24b to which is connected an upwardly sloping rear frame spar 26 and a lower rearwardly extending member 28 which carries the axle of rear wheel 30; this rear wheel may be driven by a hub mounted electric motor 31, partly shown in Fig. 2. The member 28 includes a loop portion 28a extending around the rear of this wheel, as shown for example in Fig. 4. The upper end of frame spar 26 is connected to an upper rearwardly extending
 25 rear frame member 32 connected to the lower rear member 28 by front and rear vertical members 34 and 34', also seen in Figs. 3, 4, 12 and 13. The vertical members 34 and 34' also support a horizontal shelf 36 behind the seat. These parts provide a robust support for cargo and will be further described below in relation to Fig. 12. The fact that hinge 24 is

lower than in both of my previous applications gives this DPEAB a low step-over height, making it more accessible to short or elderly riders.

5 Figs. 2, 3 and 5 illustrate the new adjustable seat of this invention. The lower, generally horizontal seat portion 40 and the seat back 42, instead of being connected separately to the frame members as in most of my prior designs, are here both mounted on a fixed seat support member 44 having its lower portion welded to the front of the frame member 26, and extending upwardly and rearwardly at an angle of about 60 degrees to the horizontal, being in effect a parallel extension of member 26. The seat traveling along support member 44 thereby experiences both horizontal and vertical motion that enable rider 2 to correctly adjust the seating mechanism either forwardly and downwardly for optimal recumbent operation of the DPEAB or else rearwardly and upwardly for optimal upright operation of the DPEAB.

15 The support member 44 is in the form of an I beam having a channel 44a on each side, defined by the front and rear flanges 44b. The seat portion 40 and back 42 are held by a seat bracket 46 movable along this support member 44, to simultaneously adjust the height of the seat and its distance from the front of the frame. The bracket 46 is U-shaped in cross section, having flanges which partly enclose sides of the support member 44, and close to its upper end these flanges carry pivot/connector pins 48 having inwards projections which are slidable and pivotable relative to the support 44, while being retained within side channels 44a. A lower portion of the support 44 has a fixed ratchet 50 of upwardly inclined teeth situated in each of its side channels 44a, and the teeth of these ratchets can be engaged by inwardly projecting parts of pins 52 located near the base of the side flanges of bracket 46. The combination of pins 52 and seat bracket 46 provide in effect a pawl mechanism engageable with the ratchet 50, so that the seat bracket can be raised simply by lifting the lower seat portion 40, disengaging the ratchet teeth from pins 52 while the bracket pivots on pins 48, and when the required height has been reached the rider simply applies their weight to the seat portion to firmly engage the ratchet. The seat can be

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similarly disengaged when it is required to lower the seat. When the rider stands on the vehicle's pedals, both raising and lowering can be done without dismounting.

Figs. 3, 4 and 8: Pedal-dock feature

5 As described in my '955 and '447 applications, a pedal-dock fixture 53 may be provided for ergonomically positioning crank 3 during recumbent operation. In place of the magnet-tipped arm of my '955 application, this fixture 53 (shown in Figs. 2 and 12 and also shown at a larger scale in Figs. 8 and 13) is comprised of a frictional pad and threaded pad-carrier that is mounted onto frame member 28 and horizontally adjustable such that it provides
10 light friction onto crank 3, thereby exploiting the transmission's freewheel to arrest the crank's rotation as it passes adjacent to said frame member. One friction pad material that is well suited to this task is the "loop" portion from the common "hook and loop" fabric closure referred to as Velcro™. During recumbent operation, the crank will thereby be lightly held in the near horizontal attitude shown in Fig. 3. This crank configuration and
15 orientation minimizes the possibility of a pedal grounding during hard cornering. The pedal-dock also insures consistent pedal positioning so that the rider will have minimum difficulty when placing their feet onto the pedals during transitions from recumbent posture mode to upright posture mode.

20 **Fig. 6: Improved handlebar adjustment**

Fig. 6 shows the improved locking or clamping handlebar pivot of this invention, as indicated generally at 60; this is an improvement on the designs of handlebar pivot described in my previous applications as aforesaid, in which the frictional resistance to movement could be adjusted, but was not adjustable by the rider while in motion; i.e. the
25 rider could move the handlebars to a desired position, but could not clamp them firmly in such position without dismounting to apply extra torque to its frictional clamping mechanism.

As shown in Fig. 6, the upper end of handlebar stem 62 is provided with a lower bracket 64, which provides a generally flat, circular face not visible in Fig. 6. Similarly, the lower end of handlebar extension member 66, which is the main part of the handlebar assembly 7, has an upper bracket 68, with a similar circular surface facing that of the bracket 64. These inwardly facing surfaces are bonded to radially splined rings 70, and are mated together by a generally horizontal pivot pin 72, having at one end portion a screw thread in engagement with the bracket 68, and having its other end portion enlarged so as to bear against the outer surface of the bracket 64, so that rotation of the pin 72 increases or decreases pressure between the bearing surfaces. The enlarged end portion of the pin 72 includes a handle 74 which is accessible to the rider without dismounting so that turning this handle tightens or loosens the pressure between the facing surfaces of brackets 64 and 68 and their radially splined mating surfaces 70, and so clamps or unclamps the brackets. In this way, when the rider has chosen a good pivot position for the handlebars, the handlebar extension 64 can be clamped in place. The handle 74 could also be operated by the rider's foot.

While the above mechanism uses two single sided brackets 64 and 68, a similar mechanism could be applied to a double-sided, U-shaped bracket attached to one member receiving between its flanges a bracket attached to the other member, as shown in Fig. 29 of my aforesaid '955 application. More complex alternatives to using radial splines 70 to positively mate brackets 64 and 68 might also be employed, for example: using randomly micro-textured mating surfaces formed directly on the two bracket's facing surfaces.

Fig. 6: Steering lock for dolly operation

Fig. 6 also shows at 80 a dolly steering lock, which allows the orientation of the front wheel relative to the head tube 22 to be locked when the DPEAB is folded into dolly mode, as described below, to ensure that the front wheel remains parallel to the rear wheel in this condition. This lock comprises a spring loaded plunger 82 which is capable of fitting into a notch or recess in the steering stem 62 at a particular orientation of the stem in

the head tube, and urged into such notch by a spring (not shown) contained in boss 84 fixed to the outside of the head tube 22. The plunger 82 has a transverse pin 86 which can alternatively rest in a shallow recess 88 in the boss 84, in which state the plunger 82 is clear of the stem 62 and cannot accidentally engage the notch in stem 62, or in a deep recess 90 in which case the plunger 82 will engage the notch when the latter is in the rotational position corresponding to that desired for the dolly configuration.

Figs. 6 and 7: Footrest and front cargo carrier and fairing.

Another feature shown in Fig. 6 is the bracket 100, which holds the footrest support bar 102 shown in Figs. 2 and 3 and thereby facilitates disassembly for more compact storage. This is similar to what is shown in my aforesaid '447 application; here the support bar is held onto the bracket by a screw 104, as shown in Fig. 7. This latter figure shows an additional feature not shown in my previous applications as aforesaid, namely a front cargo carrier 106 mounted at the front of the footrest support bar 102. As shown, the support bar 102 front end has a mounting bracket 108 with an upper bearing surface 108a which receives a lower bearing surface of the base 110 of a support frame member 112 for the cargo carrier, these parts being held together by screw 114. Support frame member 112 has cross members 113 for holding a box B to be described below with reference to Fig. 11. The upper bearing surface 108a of the bracket 108 lies at a first angle of 15 degrees to the axis of bar 102, while the lower bearing surface of base 110 lies at a second angle of 75 degrees to the axis of the member 112. This means that with the parts oriented as shown, the member 112 lies at 60 degrees to the bar 102; however, if screw 114 is loosened, the frame member 112 can be rotated on its axis 180 degrees, and upon tightening of the screw the frame member 112 will be held at 90 degrees to the bar 102. This makes for easy adjustment of the orientation of the frame member 112 between the inclined condition shown in Fig.3, where the box B held by frame member 112 is empty and collapsed, and therefore acts as a rudimentary wind fairing, to the condition of Fig. 14, for example, where the box B is expanded and carries a load. To increase comfort and efficiency, a larger and more aerodynamic wind fairing may be affixed to the same inclined front cargo carrier 106

(see fairing 115 in Fig. 4). To support the rider's feet, foot-pegs 101 are provided which are selectably affixed through a plurality of holes 103, thereby permitting adjustment of foot position to suit varying rider physiques.

5 **Figs. 8 to 10: Improved hinge and dolly operation**

Fig. 8 shows the central hinge 24 used for folding the DPEAB. The lower part 24b of this hinge, which is solidly attached to the rear frame parts 26, 28, and which supports the pedal crank 3, has an upwardly extending swivel pin received in the hollow upper hinge part 24a which is solid with the front frame spar 20. This swivel pin has a threaded bore
 10 which receives a bolt 120 having a large head suitable for turning by hand and which overlies the upper hinge part 24a to hold this onto the lower part 24b. The head of bolt 120 may have a clearly visible notch 120a, which enables a rider to visually monitor whether or not the bolt remains safely tightened. The lower hinge part 24b has three notches at its upper edge, one of these being shown at 122 in Fig. 6, and in the normal operative
 15 condition of the DPEAB this first notch is engaged by a projection 124 on the upper hinge part, as shown in Fig. 6. In Fig. 8, notch 122b is used to receive projection 124, when locking the frame into its dolly mode condition as shown in Figs 9 and 10. The third notch (not visible) is used to lock the frame into its compact storage mode shown in Fig. 17. Unscrewing of the bolt 120 allows the upper hinge part 24a to be lifted to disengage from
 20 notch 122, whereupon the front and rear frame parts of the DPEAB can be folded.

As seen in Figs. 6, 8, 9 and 10, if the rear of the DPEAB is held stationary, and the front is swung around to the left, the second notch 122b will be engaged when the front has reached the dolly condition; the wheels will be side-by-side and aligned assuming the front
 25 wheel dolly lock 80 has been engaged as discussed with reference to Fig. 6. If the DPEAB is folded the other way (i.e. the front wheel swings to the right instead of the left), the third notch (not visible) will be engaged when the DPEAB has been folded into compact shipping form as shown in Fig. 17, wherein the wheels are closer together than in the dolly form.

The hinge 24 incorporates another feature which was referred to in my previous '447 application, but which was described with reference to a rather different frame and hinge construction. This feature was an arrangement which ensures that in the dolly folded condition, as best shown in Fig. 9, both wheels slope inwardly towards the center of gravity of the dolly, to give a dolly having good handling stability. By contrast, it may be noted that in my earlier '955 application, Figs. 21, 23, and 24 show a dolly in which the rear wheel is vertical, giving a dolly which is less stable than with the present Fig. 9 arrangement. This result is achieved by having the axis of hinge 24 sloping forwards at a small angle to the vertical, as measured when the DPEAB has both wheels on a level surface and is upright. With this design, if the front part is folded while the rear is held fixed, the front wheel will rise as it is folded; the result is that when the front wheel has reached the dolly position, and is set down on the level surface, then both front and rear frames slope inwardly at similar angles, as shown in Fig. 9, thereby distributing the load more equally onto the two wheels. The preferred hinge geometry for good dolly handling characteristics is approximately 2 degrees of forward axis lean however this value may vary somewhat according to differing wheel diameter and overall frame geometry as well as the weight characteristics of the vehicle's various components and the distribution of its cargo.

Fig. 10 shows the DPEAB in dolly configuration, which is similar to that of Fig. 6 of my '447 application. Here the handlebar assembly 7 has been swung forwardly on the pivot 60 described with reference to Fig. 6, so that it can be used to maneuver the dolly. In the '447 application, the DPEAB had a telescoping ground support stand which could be lowered both to support the unfolded DPEAB, and to support the front of the dolly. Fig. 9 illustrates the fact that such a support is not essential for use in the dolly mode. Instead, the crank 3 can be manipulated so that a lower pedal touches the ground, and if this lower pedal is to the rear of bottom dead center, then it will support the front of the dolly since the chain connection to the wheels will restrict its motion. If the pedal were in front of

bottom dead center, this would not work since the pedal crank 3 would tend to free-wheel backwards. Other stand configurations for supporting the front of the dolly may be implemented using more obvious mechanical means such as the prop shown in the '447 application. A more robust prop stand for supporting the unfolded DPEAB is described
5 below with reference to Fig. 14.

Figs. 11 and 12: Cargo carrying boxes, and battery placement

Fig. 10 shows two cargo containers B in the form of collapsible boxes, the same as shown in Fig. 4. Fig. 11 shows a suitable box B which is a commercially available item,
10 known as a "Go-Cart" folding cart, available for example from Complete Business Systems International Inc., U.S.A, having, in expanded form, an exterior size of 15 1/8 inches long by 16 1/2 inches wide by 16 inches deep, modified to suit it for use with this invention. The basic box is formed of molded plastic, and is comprised of rigid front panel 130' and rigid rear panel 130 joined by side and bottom panels which are foldable, so that the box
15 can be reduced in thickness to a few inches, when empty, or can be expanded for carrying all kinds of loads. The box has wheels 132 at its lower corners, and has an extendible handle 134 for ease of wheeling around when loaded, as shown in Fig. 18. As shown in Fig. 11, this basic box is modified for use with this invention in having four hooks 136 affixed to the rear panel 130; these hooks can engage with various holding elements on the
20 front carrier frame 106, and on side carrier parts of the DPEAB to be described. For example, on the front carrier frame 106 of Fig. 7, the hooks 136 engage onto cross members 113 of the frame. Hooks 136 are shown having holes which align with corresponding holes in their respective holding elements, thereby permitting a pin to be padlocked through them for theft protection (not illustrated). The front panel 130' of box B
25 may also include solar energy to electrical energy conversion elements that permit the batteries of DPEAB to be charged when operated in sunny conditions (also not illustrated).

Fig. 12 illustrates how the boxes B and batteries may be supported on the rear of the DPEAB. Lower rear horizontal frame members 28 each support a lower side floorboard or

shelf 140, and these shelves provide support for one box B on each side of the DPEAB, either in collapsed or expanded condition. The hooks 136 are engaged with holding elements in the form of horizontal projections 138 extending inwardly from vertical frame members 34 and 34' to form a robust attachment means for box B; these frame projections are not seen in Fig. 12 but can be seen in Fig. 13 and Fig. 18. Again, these projections 138 have holes 138a for locking the hooks in place with padlocks. The shelves 140 may also support batteries 142 held underneath the shelves, thereby positioning these heavy components low to the ground for good handling characteristics. Batteries 142 may be similar to the heavy, lead-acid batteries commonly used for motorized wheelchairs or else utilize suitably formatted higher performance battery chemistries such as nickel metal hydride, lithium-iron phosphate or hydrogen fuel cell technology. Shelves 140 are typically affixed to the DPEAB using quick-connect fixtures, thereby permitting rapid swapping of spent battery modules for ones that have been recharged while the vehicle was in use. This battery-swapping capability facilitates use of the vehicle for energy intensive applications such as courier delivery. When box B is disengaged from the vehicle, shelf 140 may be used to transport sundry cargo boxes and the shelf 36 behind the seat can be used to support additional cargo. Passengers may also be transported by seating them on shelf 36 and supporting their feet on shelves 140 (not illustrated).

In addition, Fig. 12 shows additional storage space in the form of drawers 144 and 146 which can be used to house additional batteries. Drawers 144, 146 can be slid out rearwardly from between the vertical rear frame members 34', thereby providing further battery modules that can be quickly swapped to minimize down-time during re-charging. As described in my previous '955 application, additional batteries such as cylindrically formatted cells 147 may be stored inside frame member 32.

Fig. 13: Housing for electric and electronic components

Fig. 13 shows further details of electronics and battery storage. As shown, the hollow rear frame member 26 is arranged to house the necessary electric or electronic

controls and circuitry, which may include: a transformer for charging the batteries, a throttle modulated motor controller, a battery management system, computational hardware for a data display system, etc. Battery charging is done from a mains connector socket 150, and close to this is an on/off toggle switch 152 and a key lock switch 154. If there is
 5 insufficient space inside the sloped lower frame member 26 to house all the necessary electronic equipment then the contiguous upper, horizontal frame member 32 may also be used for that purpose.

Fig. 13 also shows a small compartment 156 positioned just to the rear of frame member
 10 26 and having a hinged lid 156a. Extension cord 157 for recharging the vehicle's batteries may be coiled and stored inside compartment 156 for use in conjunction with mains socket 150. Alternatively, mains socket 150 may be eliminated and extension cord 157 internally connected through the front of compartment 156 to the battery charging components housed within frame member 26. When cord 157 is coiled in the bottom of compartment
 15 156, sufficient space remains for storage of sundry items such as sunglasses, maps, water bottle etc.

Figs. 14 to 16: Further cargo carrying features

Fig. 14 shows how storage space on the DPEAB may be optimized for transporting
 20 cargo. Shown are three of the boxes B previously described, and an additional large rear box 160 which is fixed to upper rear shelf 36 and which has a sloping front panel conforming to the slope of the seat back. A fold-down rear door 163 provides access into box 160. Support frame member 112 and cross members 113 are shown in their vertical configuration previously described for Fig. 7, thereby enabling all three collapsible,
 25 detachable rolling boxes B to be transported in their expanded state for maximum cargo carrying capacity.

When not being ridden, the DPEAB may be supported by two props or stands 162 pivotally connected to the vertical rear frame members 34. Props 162 are also shown in Fig. 2, Fig 3,

Fig. 8 and Fig 13 however in those figures the props are swung up and secured into their stored position by tightening pivot clamp 168. When both prop stands 162 are lowered and engaged onto the ground, the vehicle is immobilized and securely supported in an upright attitude, thereby permitting rear access door 163 to be left open as shown to serve as a
 5 work bench or display area. Thus, the cargo-laden DPEAB can serve as a mobile workstation for tradespersons, delivery couriers or street vendors.

If one of the two prop stands 162 is lowered and clamped at an appropriate angle using its pivot clamp 168, that prop effectively forms a conventional bicycle “kickstand” onto which
 10 the DPEAB can be temporarily leaned as its prop engages into the ground. This more conventional mode of parking the vehicle (shown in Fig.18) may be used to facilitate repetitive “stop-and-start” cargo handling tasks such as delivering newspapers or harvesting handpicked crops. In such delivery scenarios, the rider can move their vehicle from place to place, without fully mounting or dismounting it, simply by standing on a
 15 pedal and using the throttle to propel the vehicle between stops (not illustrated).

If the DPEAB is being used to deliver postal packages (which legally require that they be protected at all times), then suitable security and theft-prevention features may be provided. For example, a motion sensor and alarm siren may be included in the vehicle’s electronics
 20 package, thereby discouraging theft or tampering while the parked vehicle is momentarily left unattended at each delivery site. This alarm system could be activated by key lock 154 however to further enhance the ergonomic functionality of such an alarm system, the rider could carry a short-range radio frequency transmitter on their person that communicates with a receiver in the vehicle’s electronics package. If the rider moves further than several
 25 metres away from their temporarily parked DPEAB, the loss of radio frequency communications would automatically arm the vehicle’s alarm system and disable its electric propulsion system. To further inhibit unauthorized use of the vehicle, the alarm might also activate a solenoid that short-circuits one or more of the windings in electric motor 31, thereby converting it into an electric generator that would slow down any would-

be thief who might attempt to pedal away on the unattended DPEAB. Other more prosaic security means may also be included such as lockable covers on boxes B and traditional style bicycle locks.

- 5 Other usage scenarios can exploit the cargo carrying characteristics of this vehicle. For example: police and other emergency personnel can more efficiently navigate through dense urban congestion with adequate equipment onboard to perform their work. Similarly: tradespersons and service technicians, together with the tools of their trade, can more easily travel in congested urban environments than when using traditional vehicles
10 such as automobiles or trucks.

- One commercial application that is particularly well-suited to the characteristics of the present invention is courier delivery. Couriers typically use large trucks or vans to deliver packages to widely spaced customers. However, when delivering small packages in dense
15 urban areas, these large vehicles are energy inefficient. Furthermore, while parked in front of delivery sites, they exacerbate local traffic congestion. The solution to this urban delivery problem has traditionally been to utilize bicycle messengers however their range and cargo carrying capacity are quite limited. The improved solution I propose is to mount a heavy-duty, bicycle rack on the front bumper of the courier delivery vans and use it to
20 carry the cargo-carrying DPEAB described above. The driver of such a DPEAB-equipped delivery van can thereby optimize the efficiency of their route by continuously evaluating upcoming package deliveries and local traffic conditions. When delivering a number of suitably small packages into a dense urban area, the driver can park their large van, unload the DPEAB and then use it deliver those packages onto it a more energy-efficient and
25 environmentally responsible manner.

The decision on when and where package deliveries should be completed using the DPEAB and when they should be completed using the delivery van that carries it could simply be left to the driver's personal discretion and judgment. Alternatively, more

rigorous routing and delivery mode computations that utilize time and cost optimization algorithms could be automatically calculated within the sophisticated software package that large courier companies typically use to track and route their package deliveries. If such mapping data are computed, they could be updated in real-time onboard the DPEAB using
 5 appropriate data communication and computation equipment that is integrated into the vehicle's electronics hardware package and discussed above with regard to Fig.13. These data could then be conveyed to the rider using a handlebar display module such as that shown in Fig. 16.

10 Other stationary uses for the DPEAB (that are similar to the "street vendor mode" shown in Fig. 14) may enabled by deploying both of props 162. For example, Fig. 15 shows rider 2 reclined comfortably and securely on seat 40, 42 while the vehicle is held vertical by its lowered props 162. This usage mode illustrates how a typical commuter might use their DPEAB in various modes. Once their personal transportation and work tasks are complete,
 15 their DPEAB might be folded into its dolly configuration and wheeled into their residence or workplace for secure and convenient charging of its battery packs. While charging its batteries, the dolly might also be unfolded and supported by lowering both its props 162 to the floor as shown, thereby configuring a comfortable lounger for activities such as watching TV.

20 Fig. 15 and Fig 16 show details of a multifunction table 164, also indicated in earlier drawings, that provides improved ergonomic functionality while lounging upon the DPEAB. Table 164 is adjustably clamped to the handlebars at an angle such that the rider can re-position it to provide ergonomic support tasks such as reading a book. A lower
 25 table ledge 165 may be provided to secure a small laptop computer 168 to the inclined table surface, thereby converting the parked DPEAB into an ergonomic computer workstation. An upper, differently inclined table extension 167 may also be provided that may include a hole sized to serve as a beverage cup holder.

Table 164 is useful for augmenting the functionality of the DPEAB when it's propped up for use as a lounging chair, however the same table may also be used while the vehicle is underway. Fig. 16 is an un-obscured, larger-scale view of the table 164 shown in Fig. 15. As described in my previous applications, digital display module 158 presents relevant operational data to the rider while the vehicle is moving (vehicle speed, state of batteries, possibly moving map data, etc). For improved ergonomics, display module 158 may be incorporated into table 164, either by forming the table from clear plastic so that displayed data are visible when module 158 is affixed to the table's underside or else by providing a suitable viewing aperture as shown. While the DPEAB is being used as a vehicle, table 164 may also be used to hold a paper data display in place such that the rider can consult it while underway. For example; a commuter might use some elastic bands to secure a street map to the inclined table surface or a courier might attach relevant business documents such as waybills for customers along their delivery route.

Fig. 17: Folding for shipping

Fig. 17 shows how the DPEAB can be compactly folded for shipment in a shipping container C (for clarity, one side of container C is not shown). As described above with reference to Fig. 6 and Fig. 8, the DPEAB is folded about hinge 24 in the opposite direction to that which is used to configure the vehicle into its dolly mode (i.e. spar 20 is swung to the right of spar 26 as shown). In this compact configuration, the third notch in hinge part 24b is engaged and the wheels are about 12 inches apart. Also, the upper portion of the handlebar extension member 66 has been twisted about an upper joint corresponding to joint 7b of Fig. 1, through about 90 degrees, to fit beside the frame. Also, the seat bracket 46 has been removed from the top of the support 44, and fitted into the top of the container, and one pedal crank has been mounted inwardly to reduce the stored vehicle's overall width. These fairly simple operations allow the DPEAB to be fitted within a compact shipping container, which is acceptable as baggage, by major airlines, without substantial disassembly.

Fig. 18: Non-folding DPEAB

Fig. 18 shows a DPEAB, which has much in common with that described with reference to Figs. 2 to 17, but which is not foldable. Thus, the forward-sloping front frame member 20' directly connects to contiguous top rail 170 to provide extra strength and member 26 can be made vertical instead of sloped as shown for the folding versions. This version of the DPEAB frame is simpler to fabricate and stronger than the folding version, and may therefore be particularly useful as a vehicle for carrying heavy loads in developing countries. A further advantage of this non-folding version is that additional, lead-acid type batteries 172 can be carried aboard the more rectangular frame provided by vertical frame member 26.

Fig. 18 shows two box B's "docked" onto the DPEAB and a third box B, detached from the vehicle and configured for temporary local use that is independent of the parked vehicle. This enables a shopping usage scenario in which a consumer might use their DPEAB to travel to a shopping center and then detach one of its boxes B for use as a shopping trolley inside the stores. All purchased items would then remain in the trolley throughout the journey's subsequent shopping phase, its "transport-items-home" phase and its "placement-on-shelves-at-home" phase, thereby improving the vehicle's ergonomic functionality.

It is appreciated that certain features of the invention, which are, for clarity, described in the context of separate embodiments, may also be provided in combination in a single embodiment. Conversely, various features of the invention that are, for brevity, described in the context of a single embodiment, may also be provided separately or in any suitable subcombination.

Parts list

Fig. 1 Prior application

1. Bicycle
2. Rider
3. Pedal crank
4. Seat/backrest assembly
5. Footrests
6. Electric motor
7. Handlebar assembly
8. Hinge mechanism
9. Front frame spar
10. Rear frame spar

Figs. 2 to 5: New versions of bicycle: seat adjustment

20. Front frame spar
- 20' Sloped spar (non-folder)
22. Head tube
24. Hinge
- 24a. Hinge upper part
- 24b. Hinge lower part
26. Rear frame spar
28. Lower rearwardly extending member
- 28a. Loop portion of member 28
30. Rear wheel
31. Electric motor
32. Upper rearwardly extending member
- 34 and 34': Front and rear vertical members
36. Horizontal rear shelf
40. Horizontal seat portion
42. Seat back
44. Fixed seat support
- 44a. Seat support channel
- 44b. Front and rear flanges of seat support.
46. Seat bracket
48. Pivot pins of seat bracket
50. Ratchet for seat support
52. Pins for engaging ratchet

Figure 6: Handlebar adjustment, and steering lock for dolly

60. Handlebar swivel
62. Handlebar stem
64. Lower bracket
66. Handlebar extension member
68. Upper bracket
70. Radially splined rings (was "washers")
72. Pivot pin

- 74. Handle
- 80. Dolly steering lock
- 82. Spring loaded plunger
- 84. Boss for dolly steering lock
- 86. Transverse pin
- 88. Shallow recess
- 90. Deep recess

Figure 7: Footrest and front cargo carrier

- 100. Bracket for footrest
- 101. Foot pegs
- 102. Footrest support bar
- 103. Foot peg adjustment holes
- 104. Screw for footrest support bar
- 106. Front cargo carrier
- 108. Mounting bracket
- 108a. , , , bearing surface
- 110. Base of support frame member
- 112. Support frame member
- 113. Cross members
- 114. Screw for frame member 112
- 115. Fairing

Figs. 8 to 10: Hinge and dolly operation

- 120. Hinge bolt
- 120a. Hinge bolt notch
- 122. Notch in hinge part 24b
- 124. Projection on upper hinge part 24a

Figs. 11 to 13: Cargo boxes B and battery placement

- 130. Box panel (rear)
- 130'. Box panel (front)
- 132. Box wheels
- 134. Box handle
- 136. Box hooks
- 138. Horizontal projection (on frame for box hooks)
- 138a. Holes in 138 for locking
- 140. Shelf or floorboard
- 142. Battery (Lead acid wheelchair bat)
- 144. Upper battery drawer
- 146. Lower , , ,
- 147. Batteries (in frame)

Fig. 13: Housing for electrics

- 150. Mains connector socket
- 152. On/off switch

- 154. Lock
- 156. Small compartment
- 156a. Lid of 156
- 157. Extension cord
- 158. Data display module

Fig.14 to 16: Further load carrying

- 160. Upper rear box
- 162. Pivot props
- 163. Fold-down door
- 164. Multifunction handlebar table fixture
- 165. Table support ledge for laptop or book
- 166. Table horizontal portion
- 167. Beverage holder
- 168. Laptop computer
- 169. Pivot clamp

Fig. 17
Shipping box C

Figs. 18a and 18b: Non-folding bicycle

- 20'. Front frame member
- 170. Top rail
- 172. Additional batteries

I claim:

1. A Dual Posture Electric Assist Bicycle, wherein:

5 a frame with a fixed seat support member which is rearwardly and upwardly inclined,

a movable seat bracket mounted on said support member, said seat bracket holding both a lower, generally horizontal, seat portion and a seat back,

10 wherein an upper part of the seat bracket engages the support member by a pivot/connector means which allows both sliding and pivoting of the bracket relative to the support member, and wherein a lower portion of the seat bracket engages the fixed support member by interengaging means which become disengaged when the bracket is tilted about the pivot/connector means by lifting the lower seat portion, and which become automatically engaged when the seat bracket is pivoted downwards by rider's weight on the lower seat portion.

15

2. The Dual Posture Electric Assist Bicycle of claim 1, wherein the support member forms a parallel extension of a rear frame member.

20 3. The Dual Posture Electric Assist Bicycle of claim 1, wherein the interengaging means comprises a ratchet and pawl mechanism.

4.. The Dual Posture Electric Assist Bicycle of claim 3, wherein the ratchet is fixed to the support, and in which the pawl part is represented by a lower projection on the pivotal seat bracket engaging the ratchet.

25

5. The Dual Posture Electric Assist Bicycle of claim 1, wherein the interengaging means comprises a pin on the lower part of the bracket, and a fixed member having a series of holes to receive the pin.

6. A Dual Posture Electric Assist Bicycle, wherein:

an upper end of a handlebar stem and the lower end of a handlebar extension member are each provided with a bracket, these brackets having opposed bearing surfaces surrounding a bore which receives a generally horizontal pivot pin allowing pivotal
5 movement of the handlebar extension member about the pin axis, and

wherein the pivot pin has a screw thread at a first end portion and an enlarged second end portion, and engages the brackets in such manner as to urge the opposed bearing faces together when the pin is rotated in one direction;

the improvement that the second end portion has a handle which can be
10 manipulated to rotate the pivot pin to increase or decrease the pressure between the opposed bearing surfaces and thus to clamp or unclamp the pivot position of the handlebar extension member, and

wherein the handle is situated so that it can be movable by a rider without dismounting.

15

7. The Dual Posture Electric Assist Bicycle according to claim 6, wherein the handle is arranged to be made movable by the rider's foot.

8. The Dual Posture Electric Assist Bicycle according to claim 6 or 7, wherein the opposed
20 bearing surfaces include friction inducing means such as radial splines.

9. A Dual Posture Electric Assist Bicycle, having a footrest above its front wheel mounted on a footrest support, and a front cargo-carrying support frame which is mounted at the front end of the footrest support, wherein this support frame is attached to the footrest
25 support by adjustable means which allow the support frame to be adjusted between a sloping condition and an upright condition.

10. The Dual Posture Electric Assist Bicycle of claim 9, wherein the adjustable means include a bracket at the front end of the footrest support having an upper bearing surface

which lies at a first angle to the footrest support axis, and which engages the lower bearing surface at the base of a frame member which lies at a second angle to the support frame member axis,

5 whereby in one orientation the support angle between the support frame member and the footrest support is equivalent to the second angle minus the first angle, and when the frame member is rotated 180 degrees about the axis of the frame member this support angle is equivalent to the first angle plus the second angle.

10 11. A Dual Posture Electric Assist Bicycle, wherein the bicycle is foldable about a hinge in two distinct folded configurations, the first folded configuration providing a dolly in which the front and rear wheels are placed side-by-side, but separated by an amount which allows the vehicle to be stable for wheeling about, and the second folded configuration being such that the wheels are closer together than in the first configuration and such that the folded bicycle is of minimum size and suitable for being packed into a shipping container without
15 substantial disassembly;

and wherein said hinge has means for retaining the folded bicycle in both of said folded configurations.

20 12. A Dual Posture Electric Assist Bicycle, the bicycle being foldable about a hinge into dolly configuration in which the front and rear wheels of the bicycle are side by side and spaced apart, wherein the hinge axis is arranged to slope upwardly and forwardly from the vertical when the bicycle is unfolded and resting upright on a level surface, whereby when the bicycle is folded into the dolly configuration both the wheels slope inwardly when the dolly is seen in end view.

25

13. A Dual Posture Electric Assist Bicycle having a crank suitable for pedaling the bicycle by a rider when in upright posture, the bicycle further comprising a pedal-dock feature including a friction pad and an adjustable pad-carrier mounted on a frame member adjacent the bicycle crank, said pad-carrier being adjustable so as to allow the friction pad

to provide light friction to the crank as it turns, and being effective to hold the crank in near-horizontal position when the rider is not pedaling.

5 14. A Dual Posture Electric Assist Bicycle having cargo-carrying means including a pair of collapsible boxes mounted on opposite sides of a rear wheel of the bicycle, said boxes and bicycle having interengaging means which allow ready removal of the boxes.

10 15. A Dual Posture Electric Assist Bicycle according to claim 14, wherein said interengaging means include hooks on inner sides of the boxes and holding elements on a rear frame part of the bicycle.

16. A Dual Posture Electric Assist Bicycle according to claim 15, wherein said hooks and holding elements have corresponding apertures for receipt of locking means.

15 17. A Dual Posture Electric Assist Bicycle according to claim 14 or 15, wherein said boxes include a pair of wheels, and an extendible handle.

20 18. A Dual Posture Electric Assist Bicycle according to claim 6, further comprising a table adjustably clamped to the handlebar extension member and adapted to provide support for an item such as a book or laptop computer.

19. A Dual Posture Electric Assist Bicycle according to claim 18, wherein said table includes a drink holder.

25 20. A method for delivering courier packages and the like, comprising carrying said packages in a vehicle which also has carrying means for an electric assist bicycle, parking said vehicle in a neighborhood, and delivering said packages to locations in said neighborhood by means of said electric assist bicycle.

Application number/numéro de demande: 2655495

"A Compact Disk"

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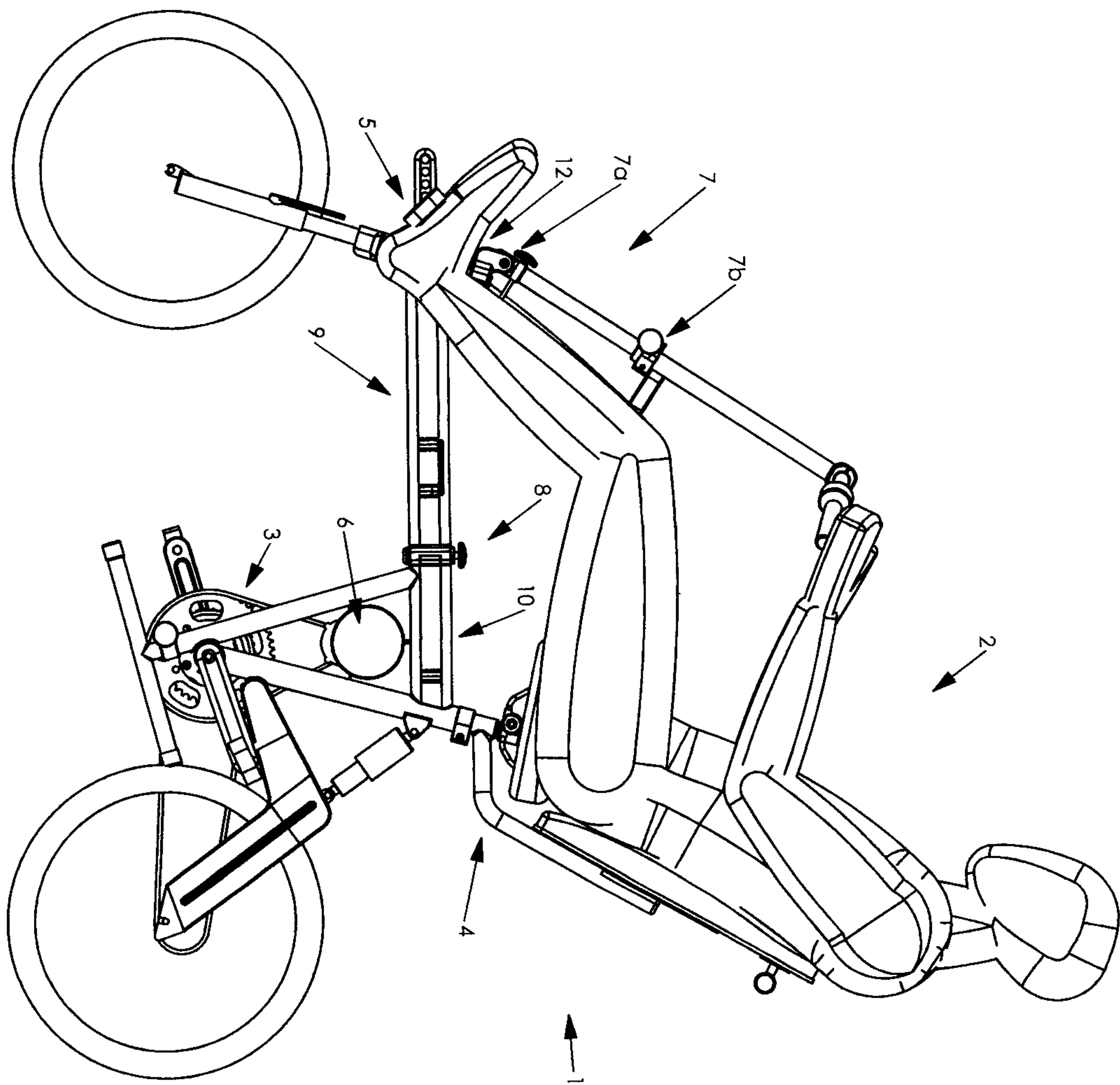


FIGURE 1 (prior application)

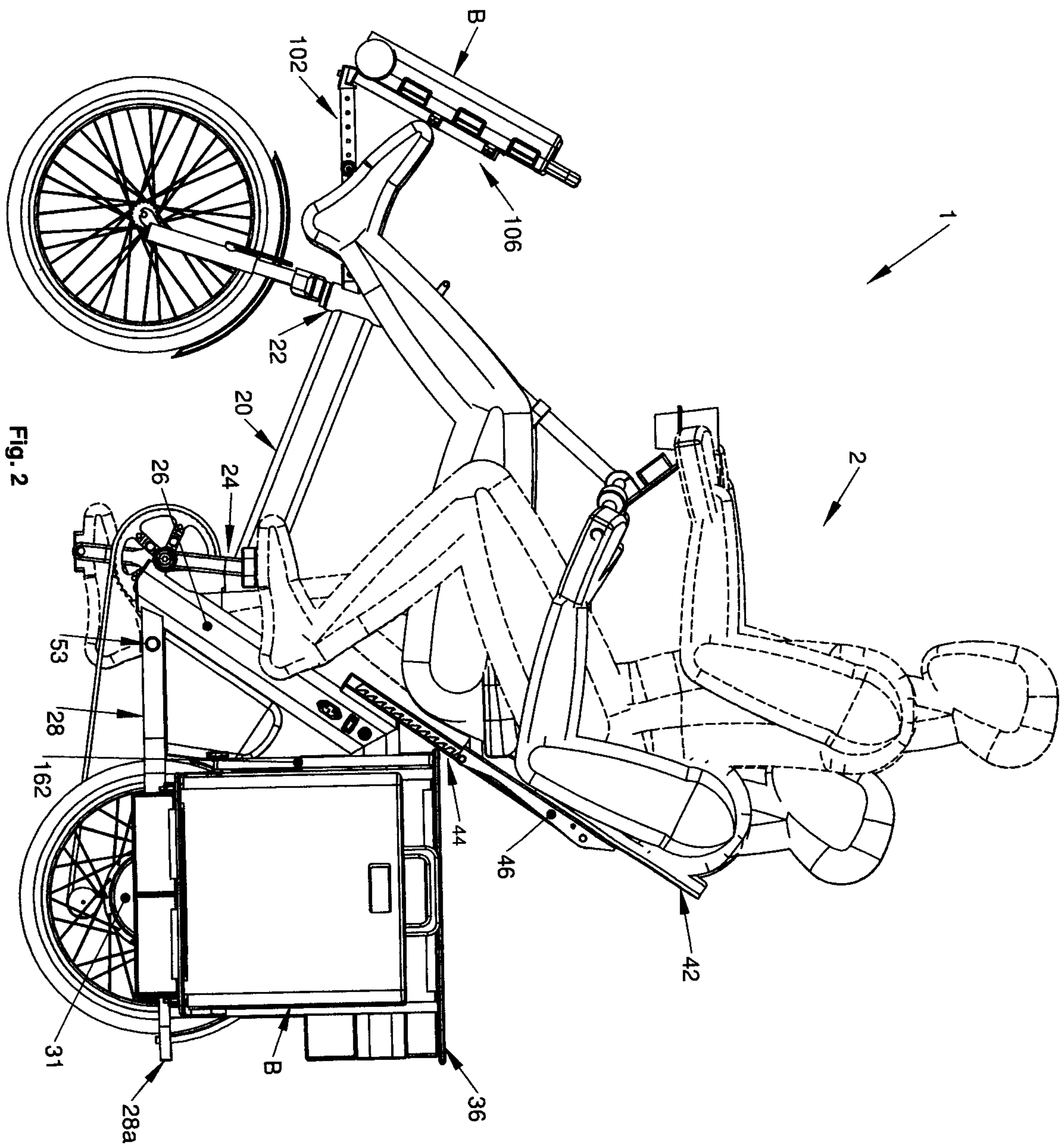
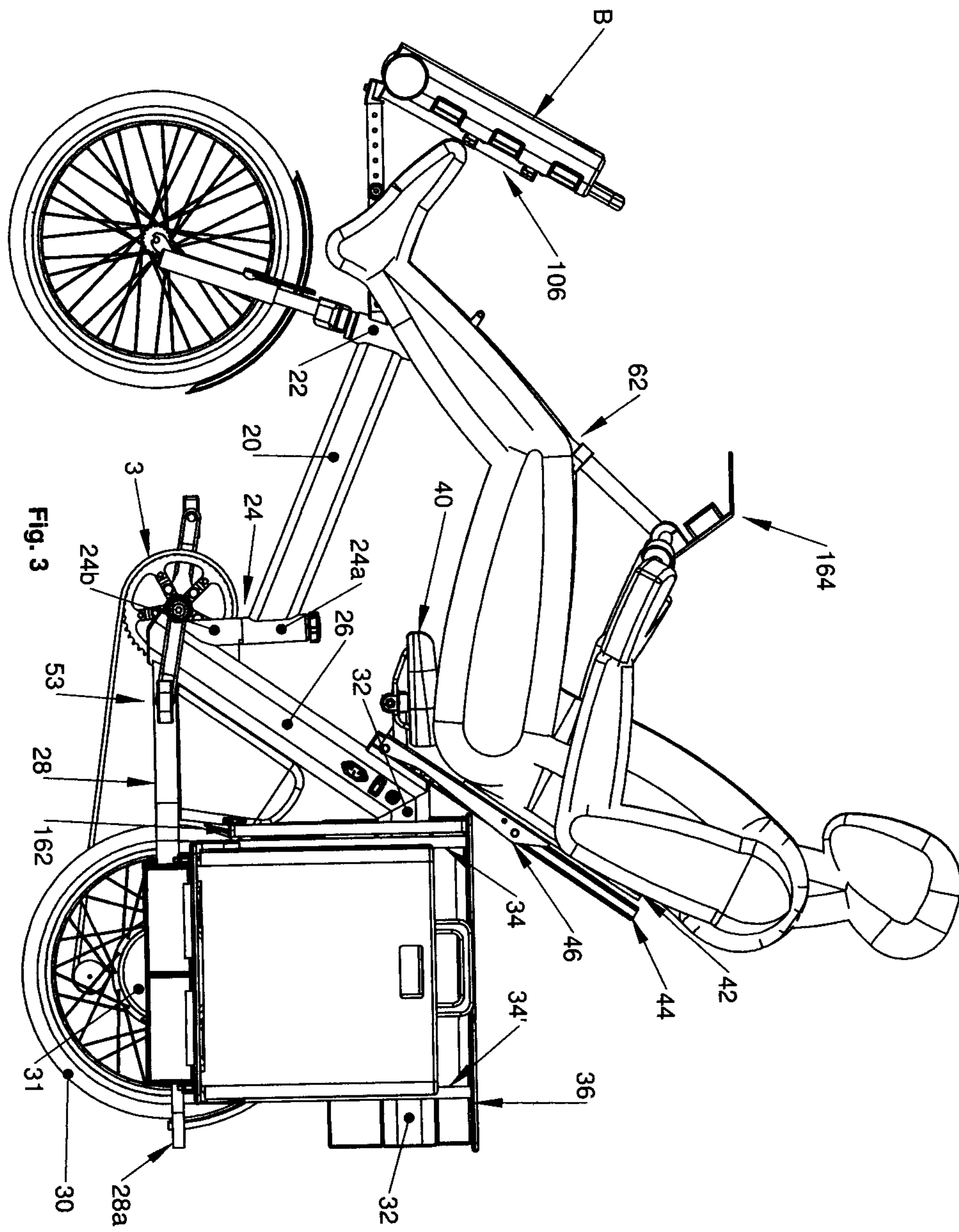
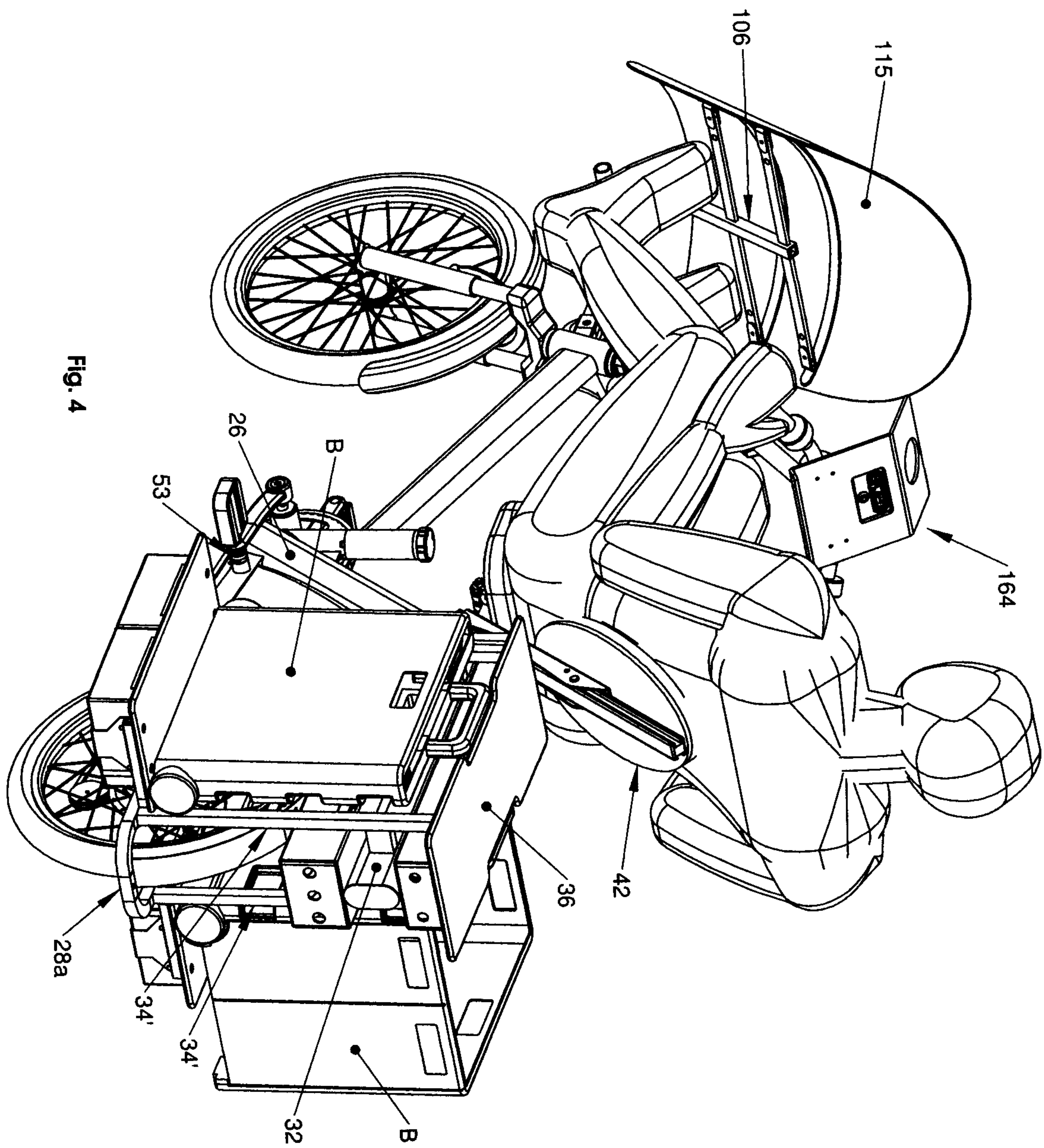
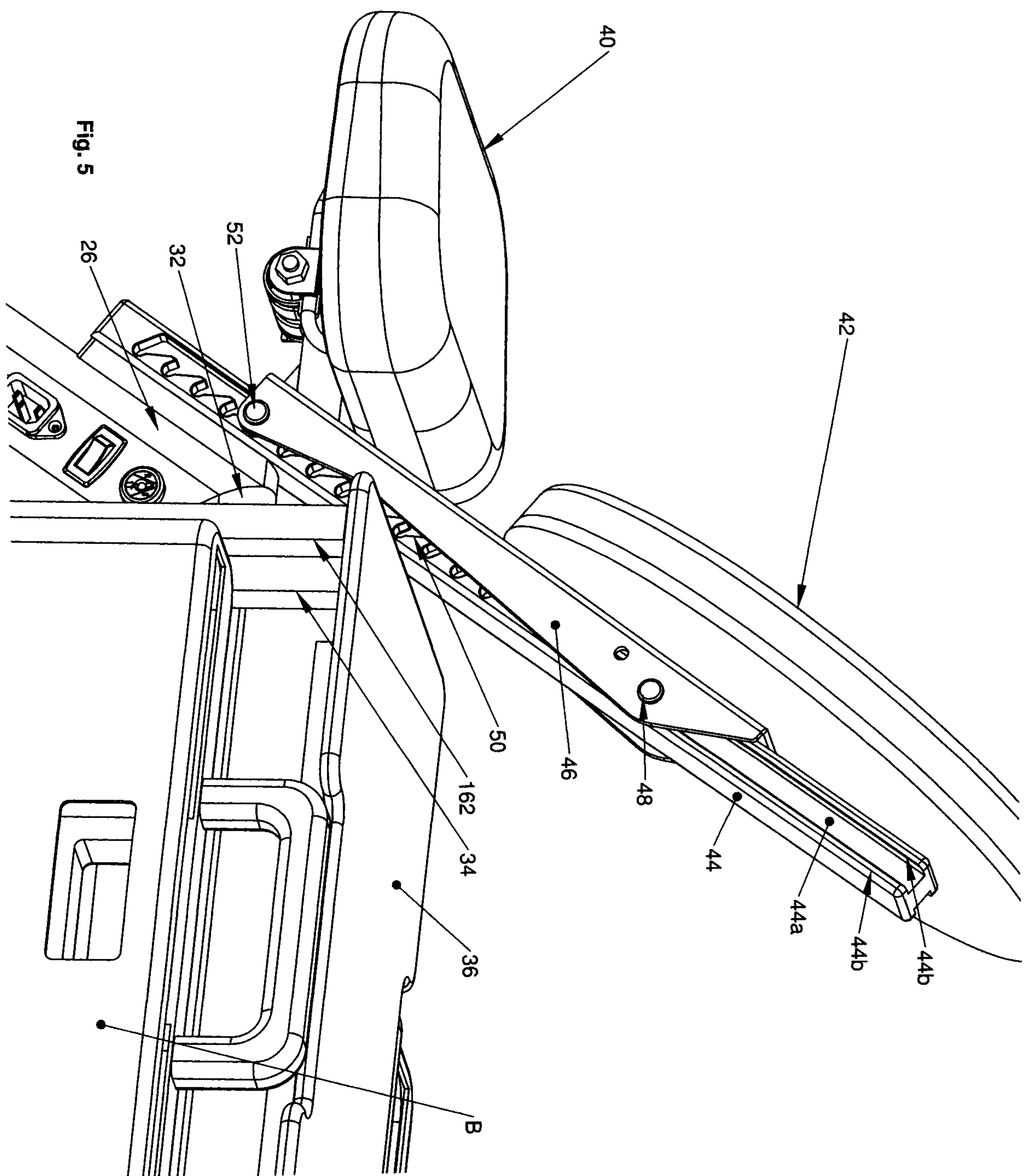
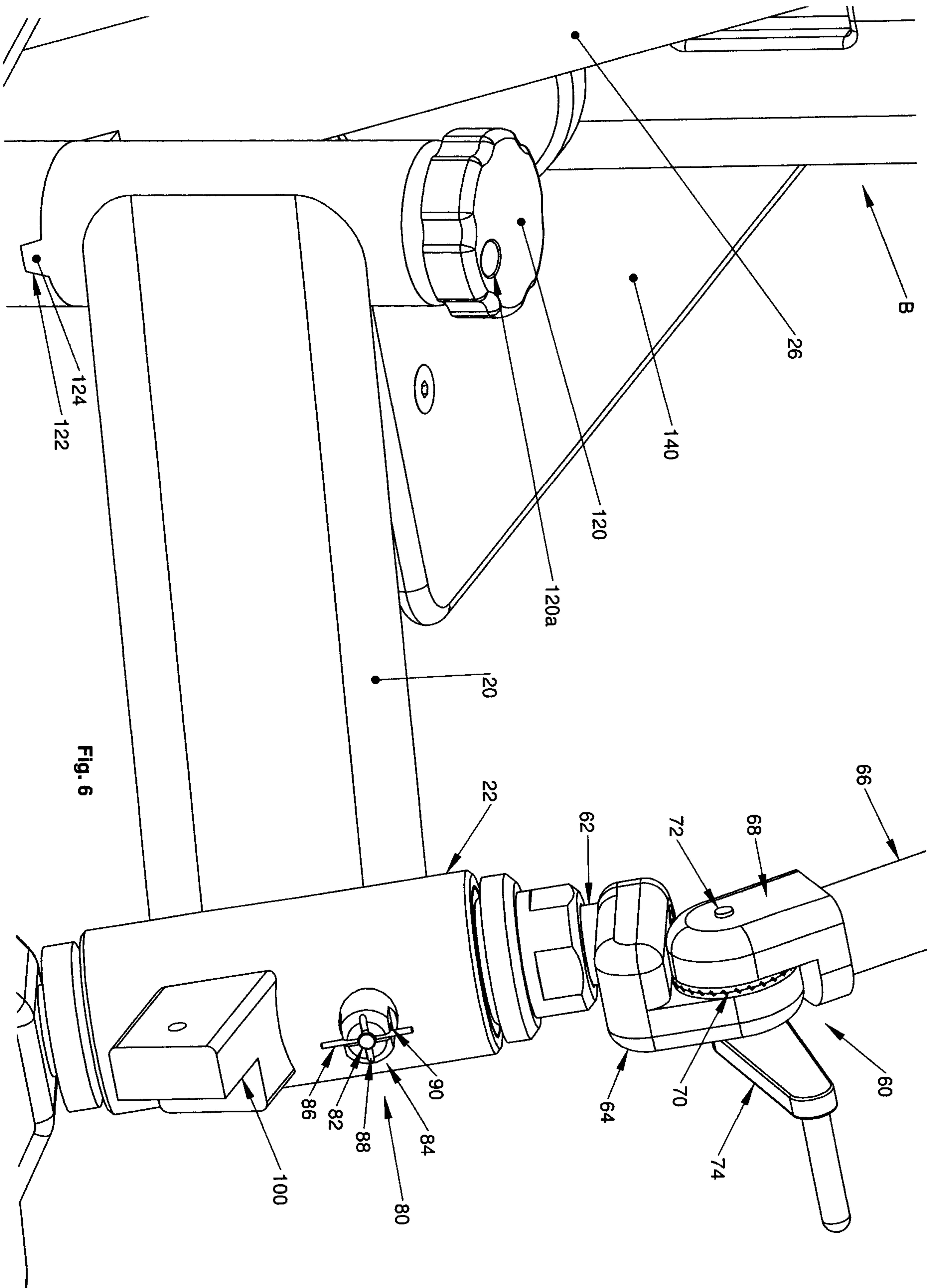


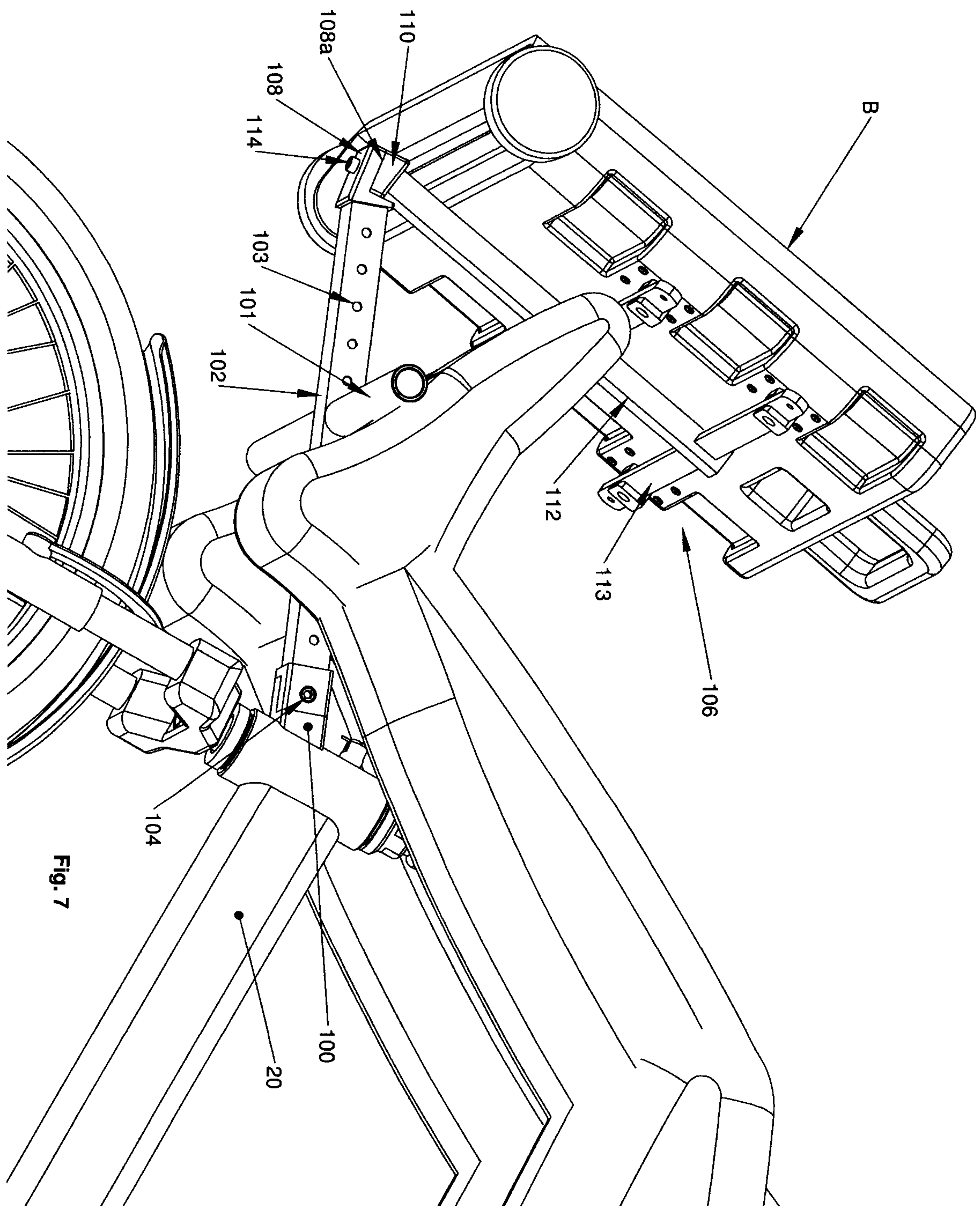
Fig. 2











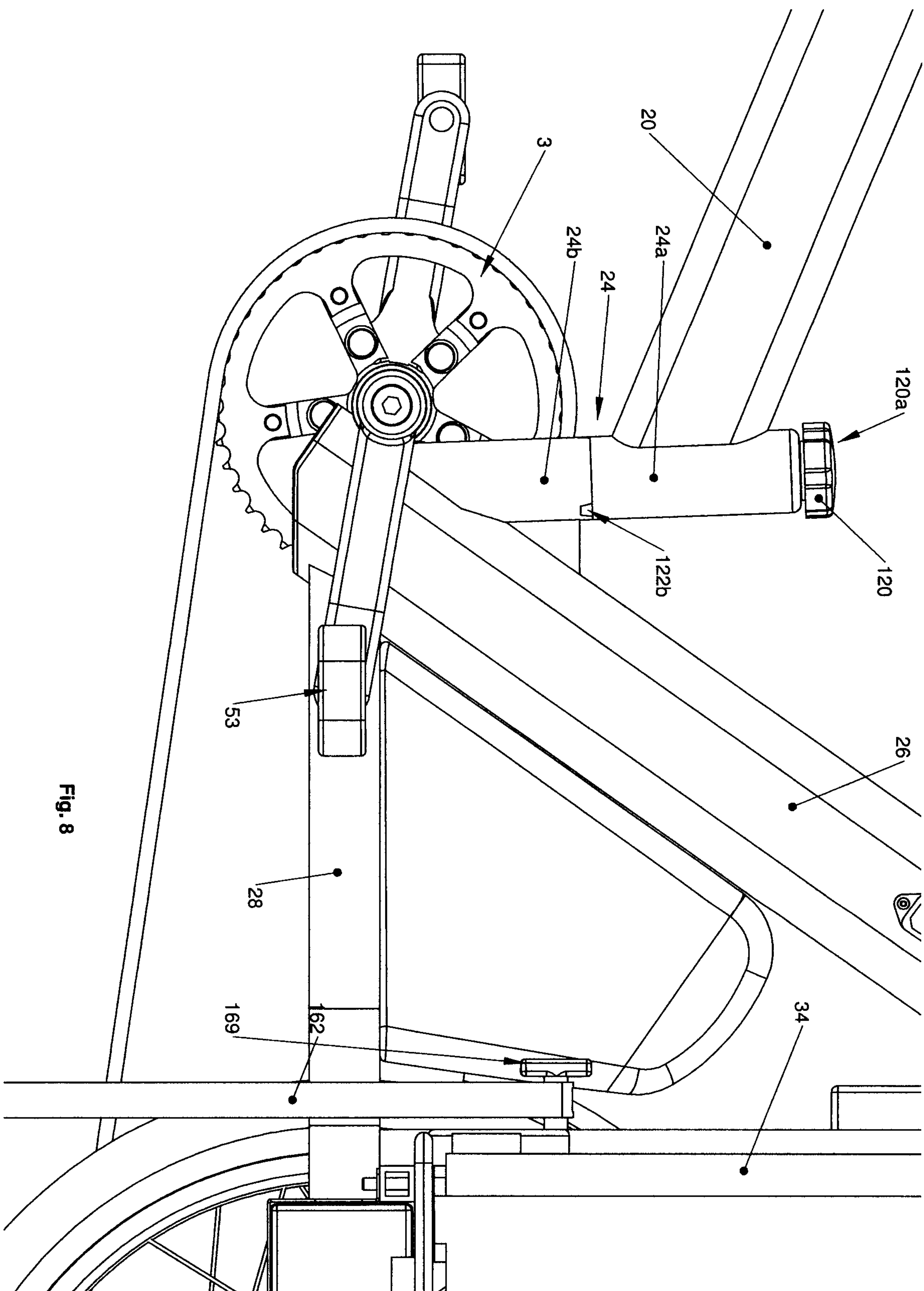
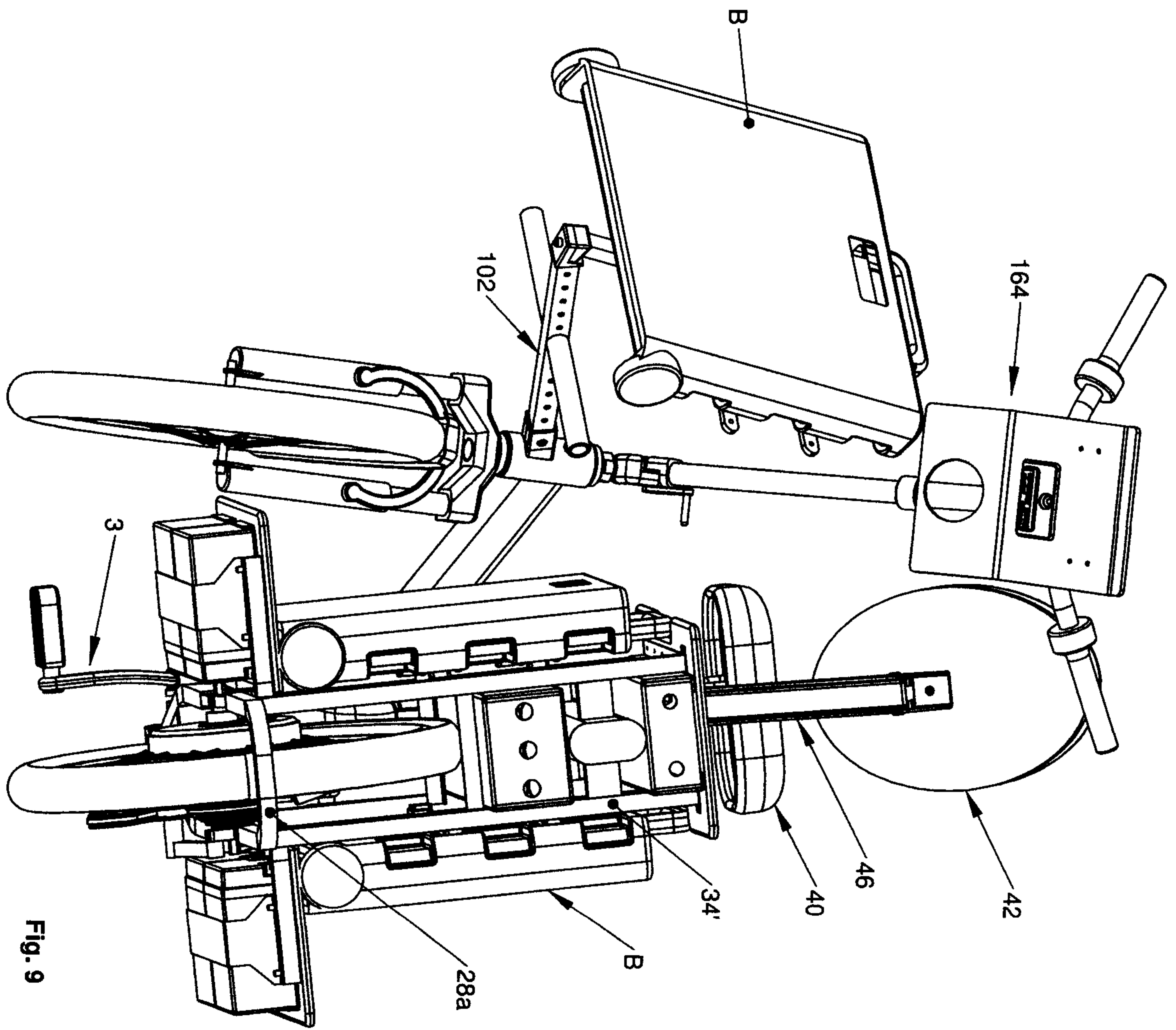


Fig. 8



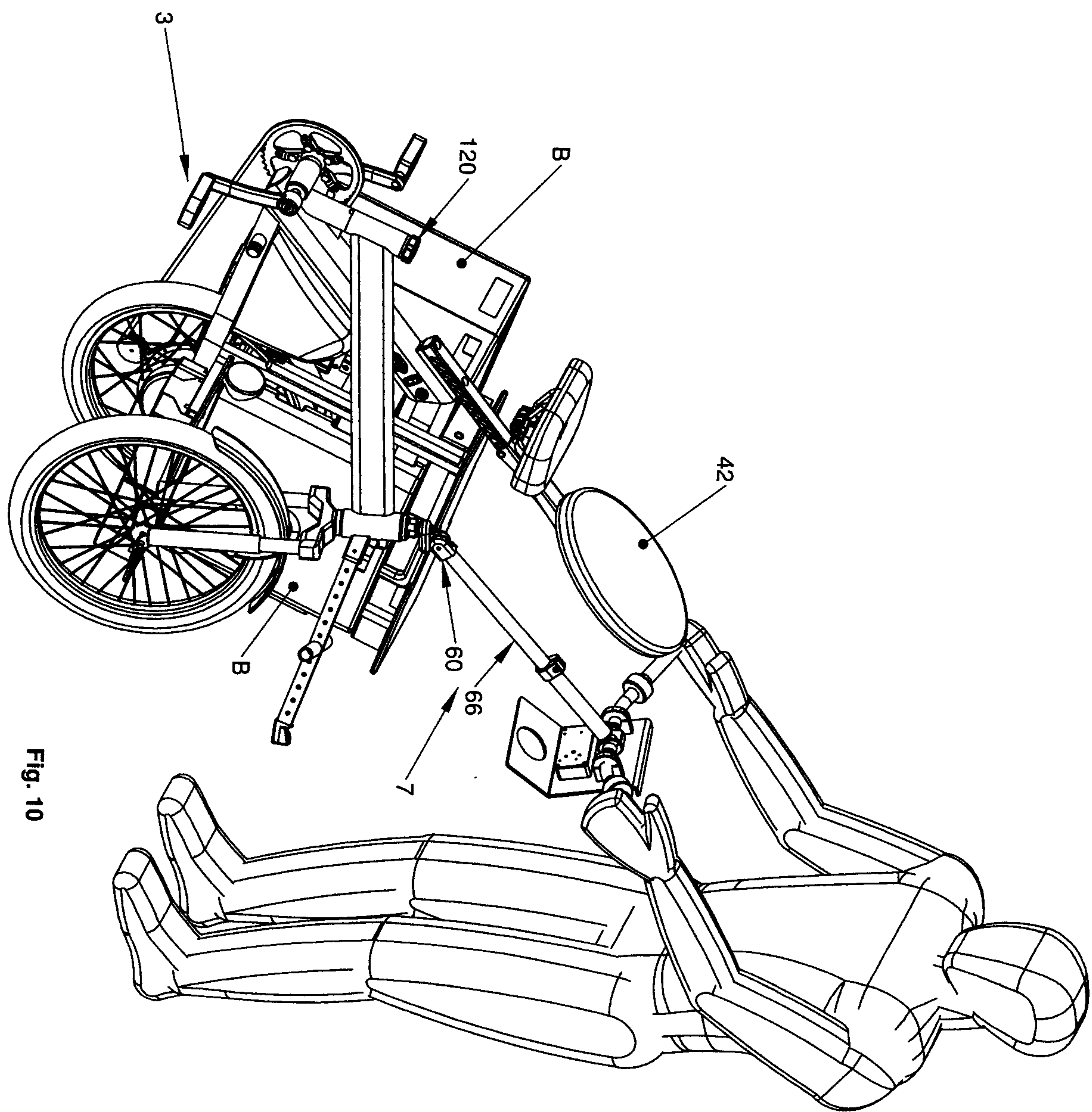


Fig. 10

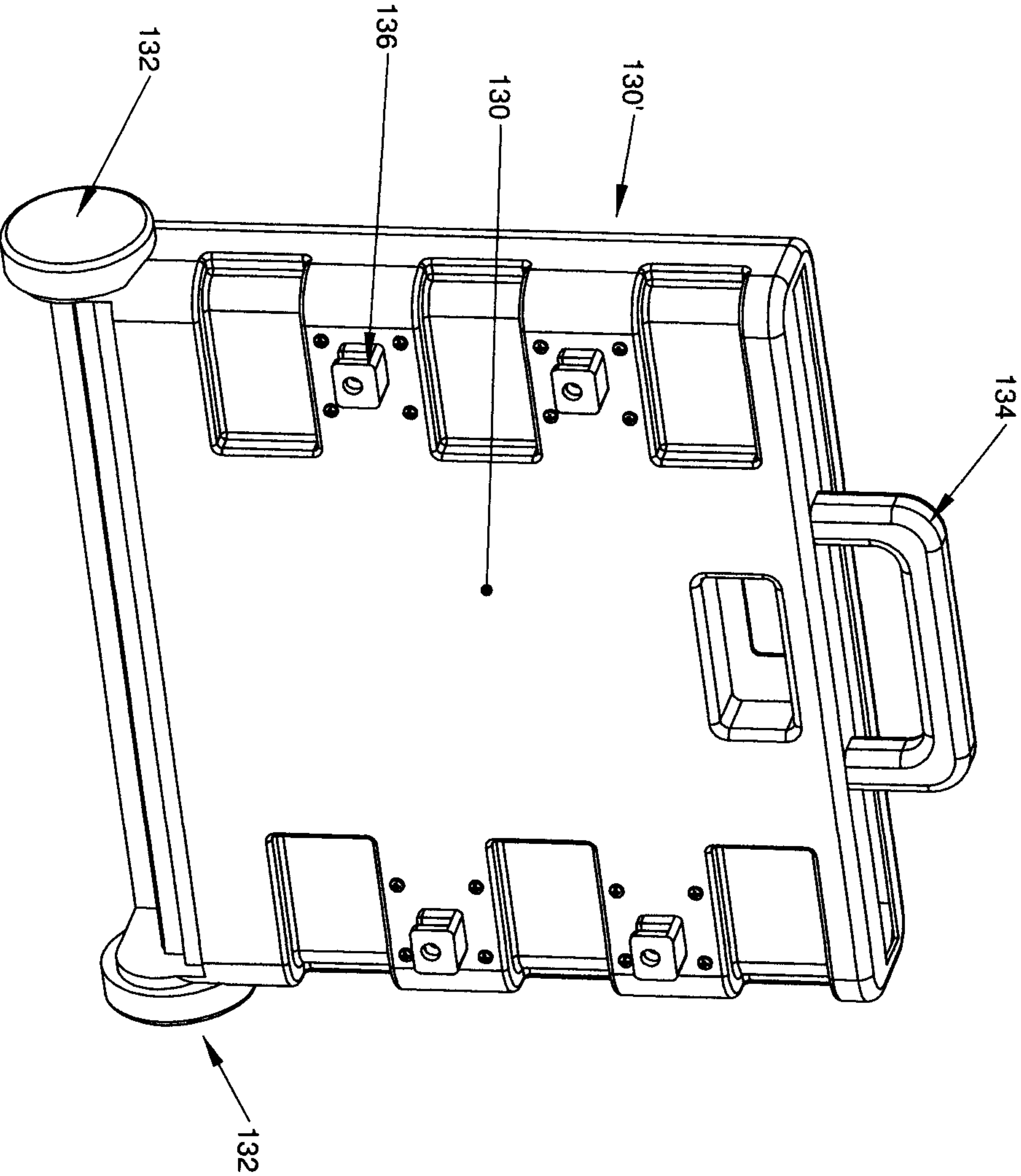


Fig. 11

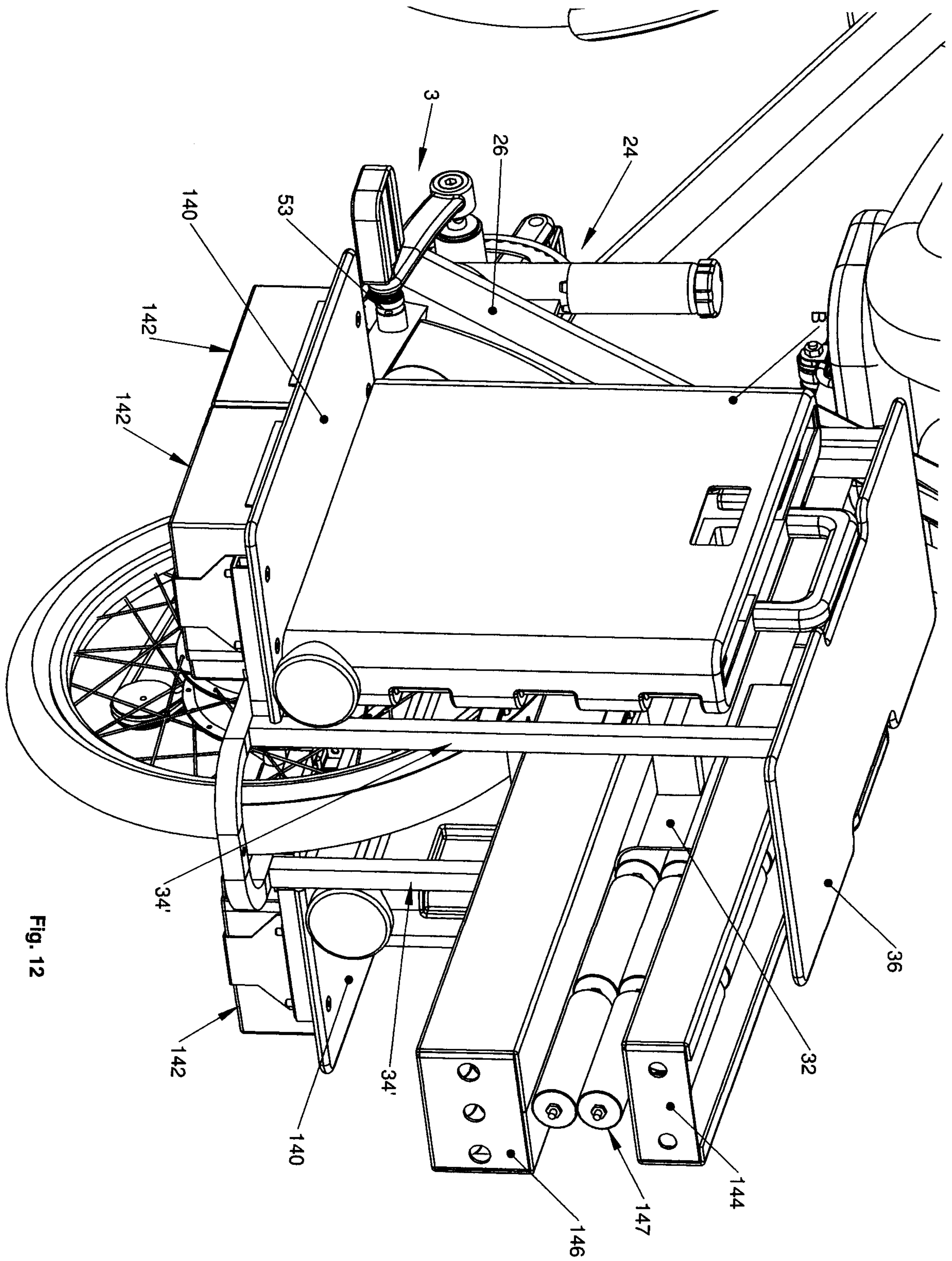
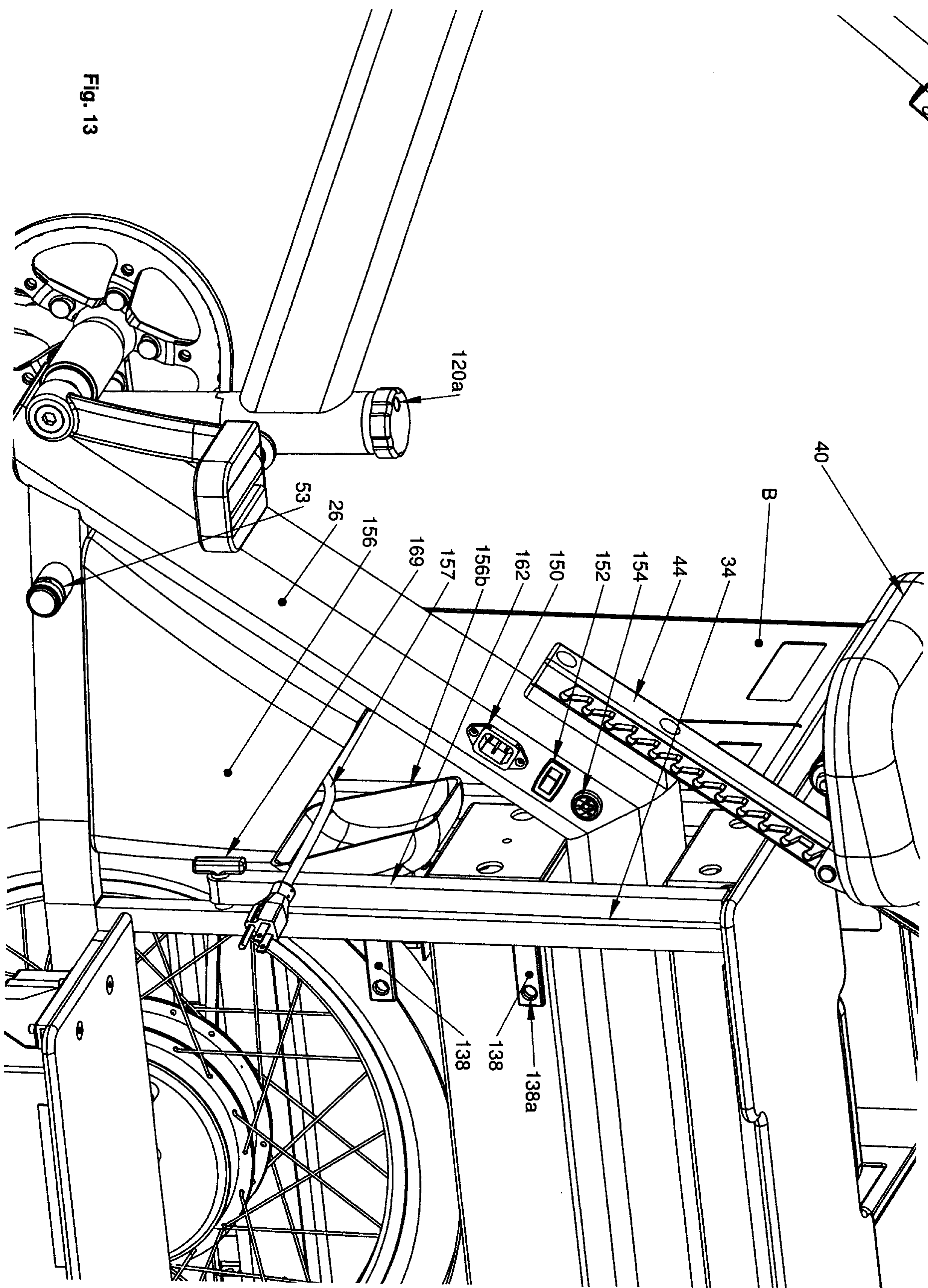
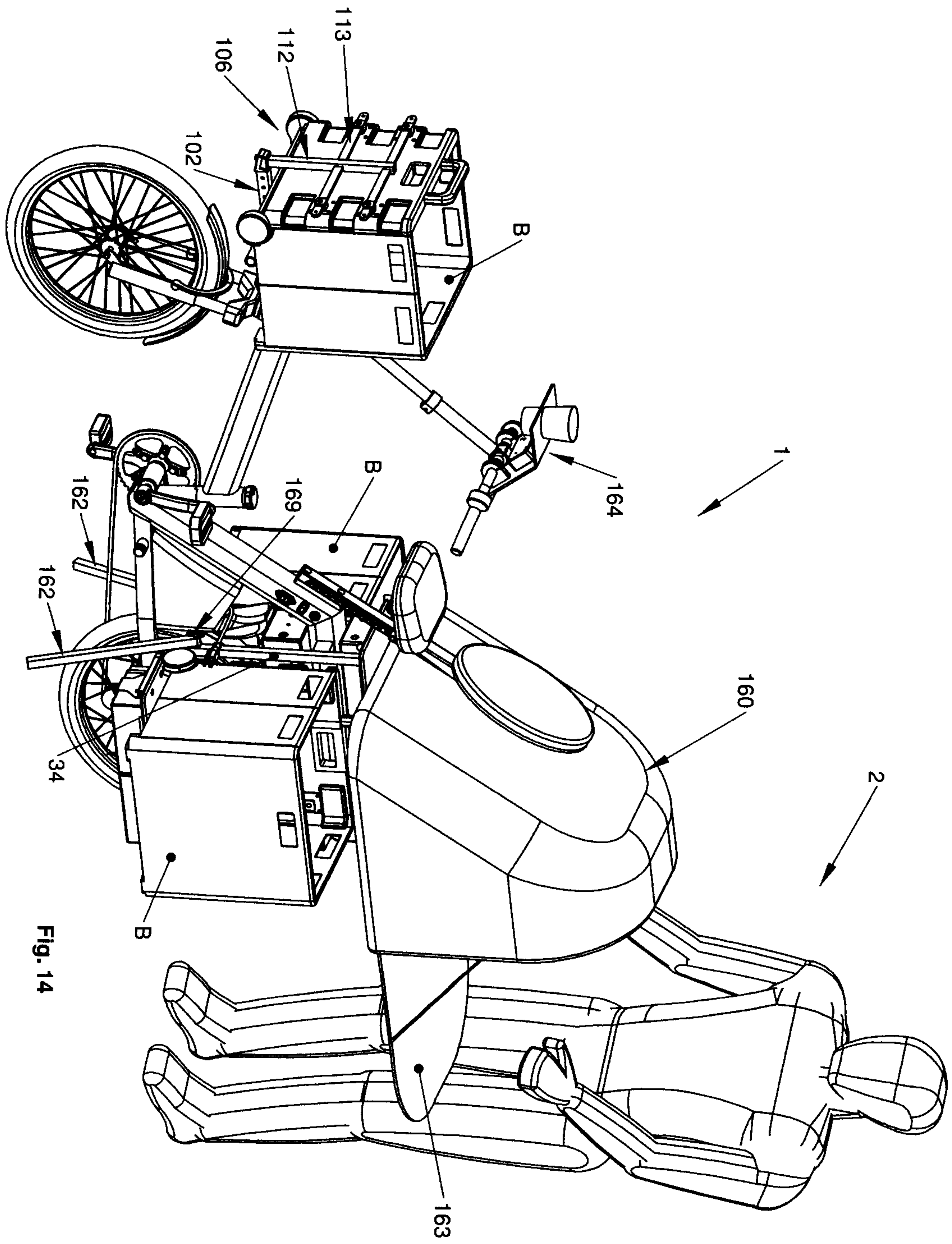


Fig. 12





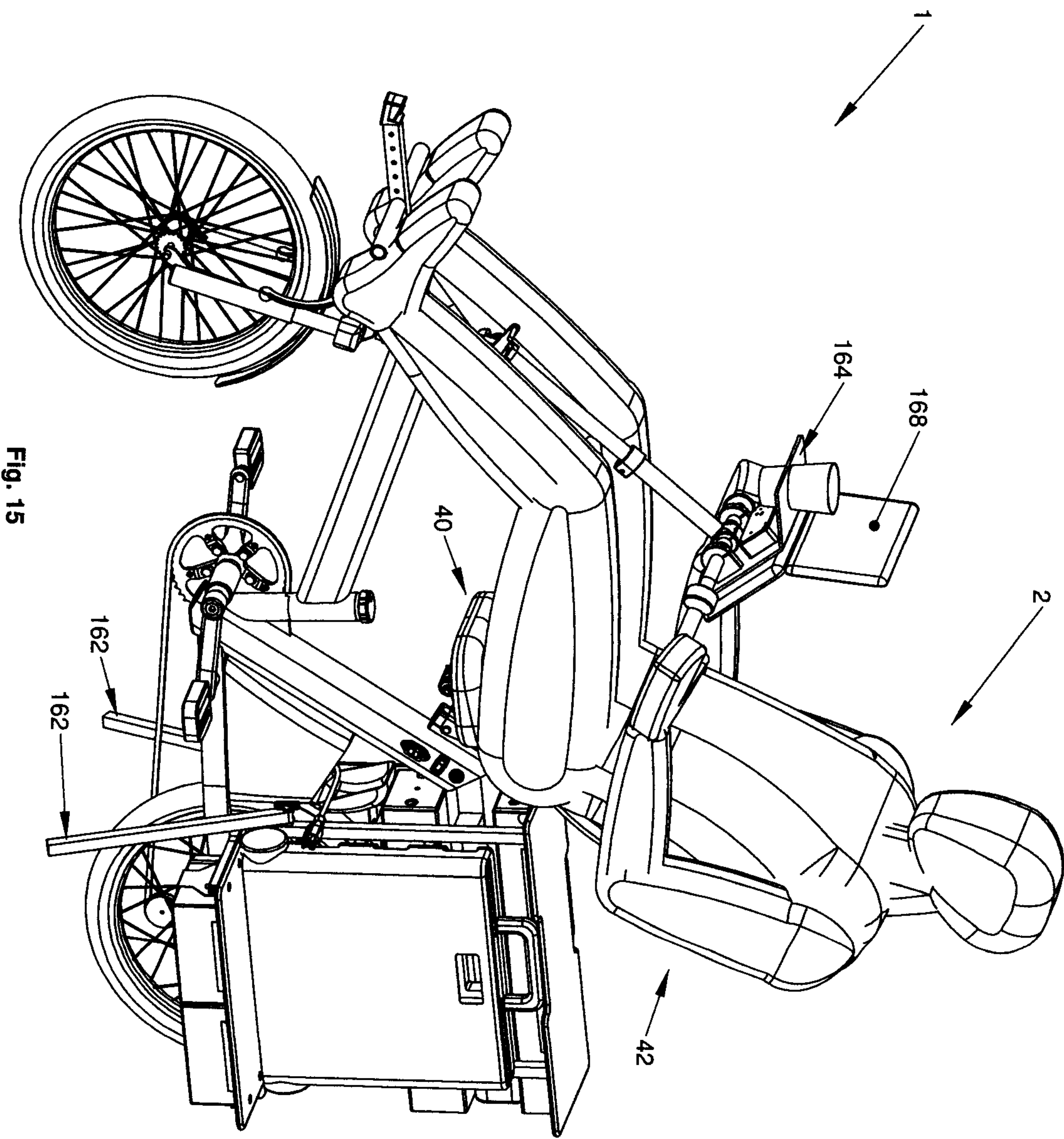


Fig. 15

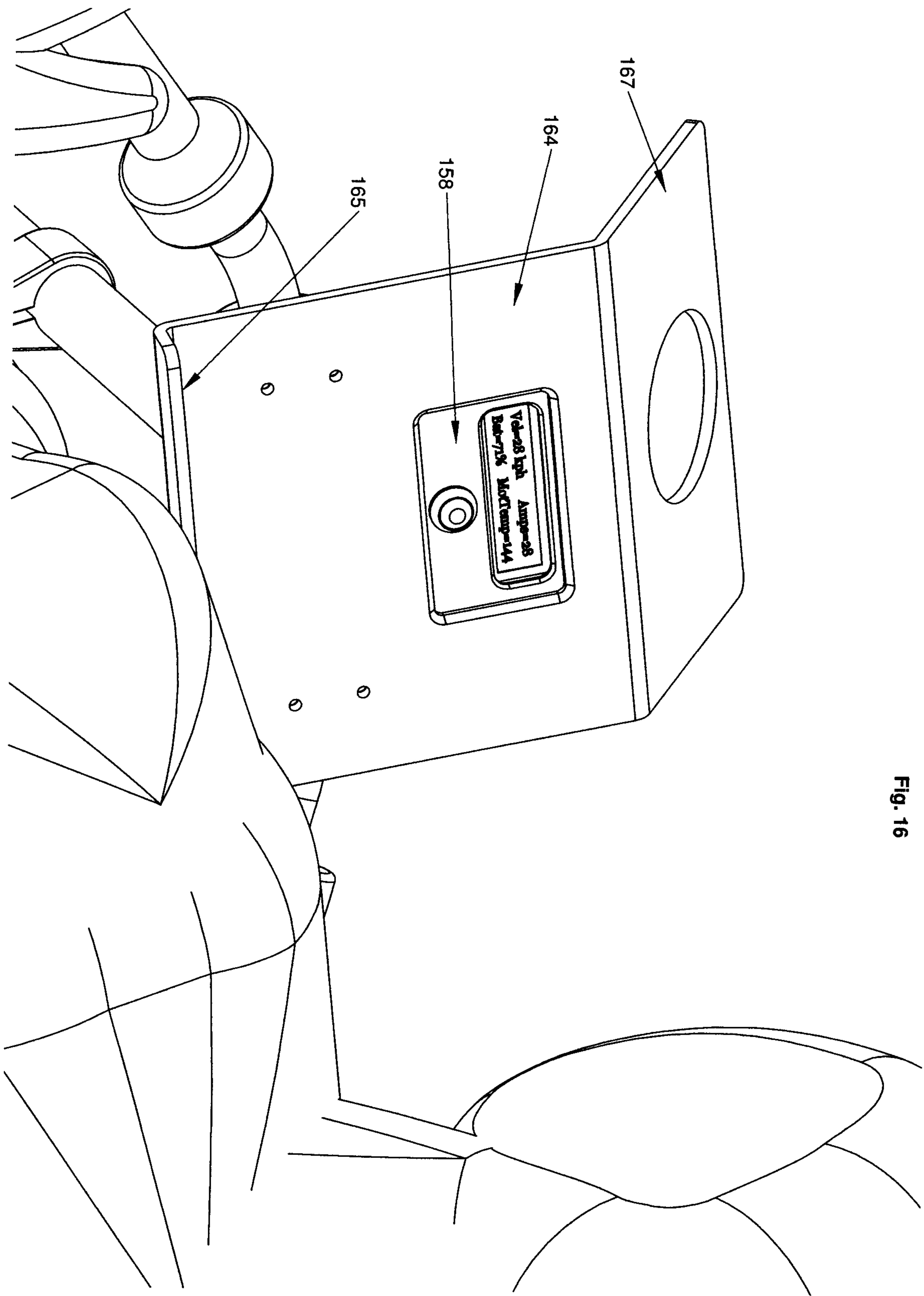


Fig. 16

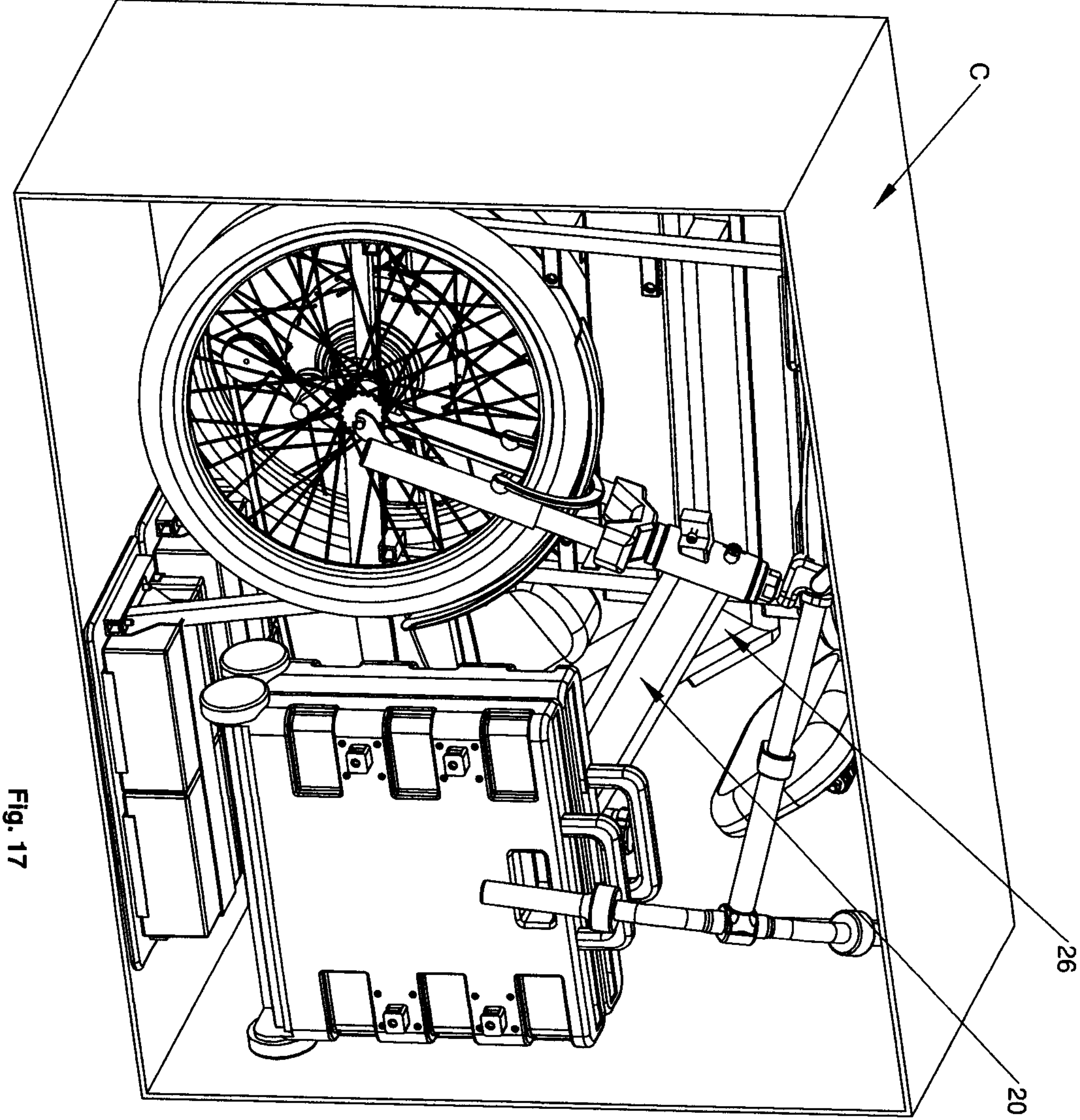


Fig. 17

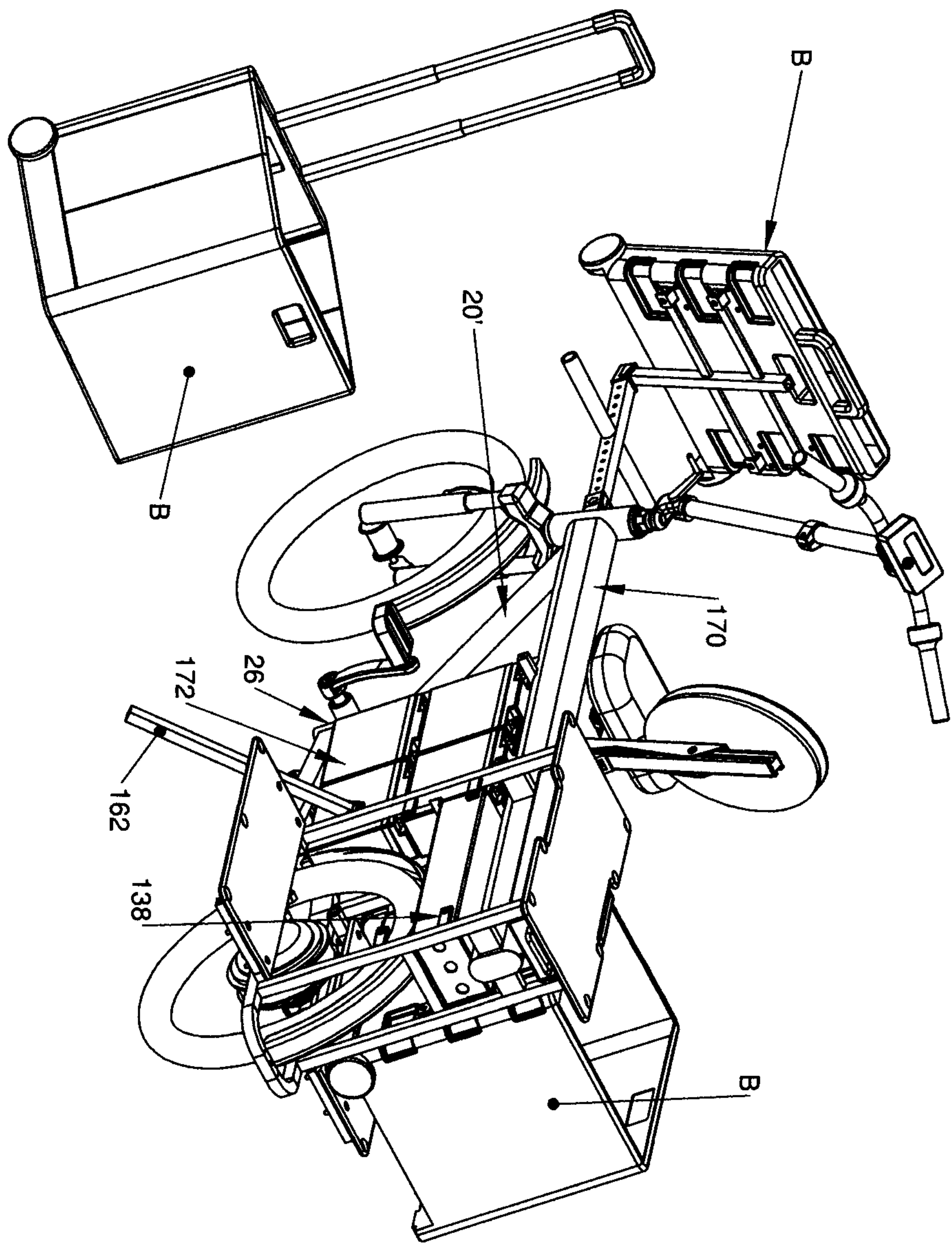


Fig. 18

