(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 705 101 A1**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
09.09.2020 Bulletin 2020/37

(51) Int Cl.:
A61G 5/10 *(2006.01)* ***A61G 5/04*** *(2013.01)*
B62B 5/00 *(2006.01)*

(21) Application number: **20000098.2**

(22) Date of filing: **06.03.2020**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **08.03.2019 NL 1043183**

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(54) WHEELED TRANSPORTER

(57) A transporter has wheels for transporting at least one person (U). The transporter comprises a self-balancing wheelchair (200; 300) comprising a platform (110), a seat (120; 320) for a human occupant (U) mounted on the platform, two wheels (101) at opposite sides of the platform with coinciding wheel axes, respective motors (102) for driving the wheels with respect to the platform. The transporter is configured to be controlled by a person (P) positioned behind the seat.

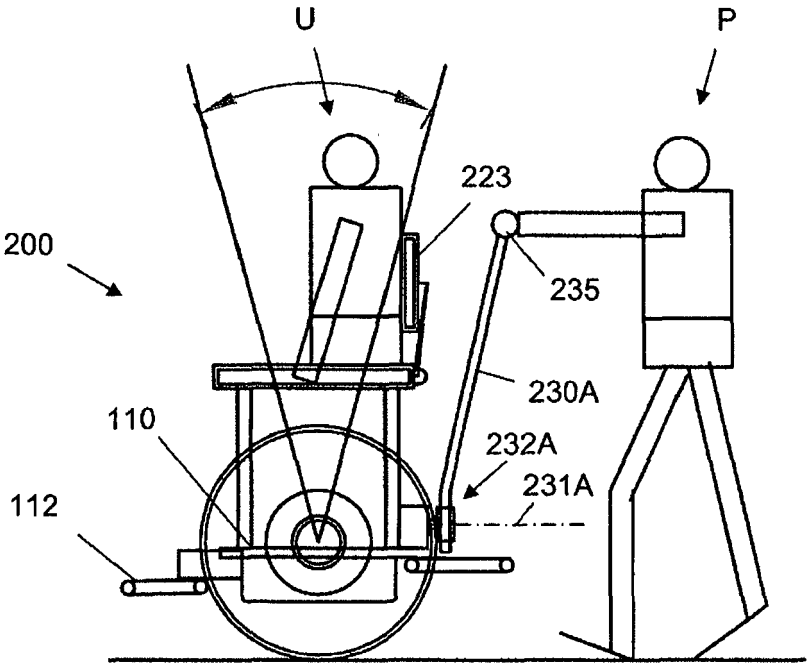

FIG. 2A

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Description

FIELD OF THE INVENTION

[0001] The present invention relates in general to a wheeled transporter. In one range of embodiments, the transporter is for transporting persons, while in another range of embodiments, the transporter is for transporting goods.

[0002] In the following, the invention will be specifically described and explained for the case of a transporter for transporting persons.

BACKGROUND OF THE INVENTION

[0003] The transporter of the present invention is of a type comprising a self-balancing body provided with two driven wheels driven by electric motors controlled by a drive controller. A transporter of this type is well-known as "Segway", and a description can be kept brief. It is intended to carry a person ("driver") standing upright. In an equilibrium state, the centre of gravity of the transporter with the person is positioned precisely above the common axis of the wheels. If the driver moves his weight slightly, the body tends to tilt, which is detected by one or more sensors providing a signal to the drive controller, and in response the drive controller drives the wheels in a direction such as to reduce the tilt and to place the common axis of the wheels under the centre of gravity of the body again: the transporter is riding.

[0004] At the front of the transporter, a driving stick is provided, typically equipped with a display. The driving stick can be displaced in transverse direction, causing command signals to the drive controller, which in response drives the wheels at different rotational speed so that the driver can let the transporter make a turn.

[0005] Based on this balancing technology, the present inventor has already invented a transporter in which the body comprises a seat: a self-balancing wheelchair. Again, driving forward / stopping / reverse is controlled by shifting the centre of gravity of the body, in this case shifting the upper body of the occupant, and steering is again done by manipulating the driving stick. Since the occupant is now sitting, his position with respect to the driving stick will be different; particularly, his feet will be at the front side of the driving stick, with the driving stick between his legs. But apart from such adaptations, the balancing technology is the same as the Segway mentioned already.

[0006] Such self-balancing wheelchair is a perfect godsend for persons with reduced mobility, whether just having difficulty walking or even being disabled, because it allows these persons to be mobile independently again. However, such self-balancing wheelchair is also quite suitable for being used by persons having adequate mobility, as an alternative to the "Segway" embodiment, for instance for guided tours, or for strolling to discover a city as a tourist, allowing the user to be seated in stead of standing.

[0007] In all of the above implementations and applications, the user is assumed to be able (physically and mentally) to control the wheelchair himself, i.e. particularly to be able to control the wheelchair by shifting his weight.

[0008] There is, however, a group of persons who are not able to control the wheelchair themselves. Such persons are dependent on using a standard wheelchair, and are always accompanied by a buddy to push the wheelchair. Depending on material and inclination of the ground, pushing a wheelchair can be quite difficult, and it may even prove to be impossible in case of sandy or muddy paths, beaches, etc.

SUMMARY OF THE INVENTION

[0009] The present invention is intended to alleviate or even eliminate these problems.

[0010] The present invention is based on the insight that the self-balancing technology also works in response to an influence from outside. The mechanism does not respond to a shift of the centre of gravity per se, but it responds to the detection of (a start of) a tilt, and it responds by rotating the wheels such as to reduce the tilt - whatever the cause of tilt. Thus, the inventor has recognized that the self-balancing wheelchair can be displaced by an accompanying person pushing the chair. As far as the self-balancing wheelchair is concerned, it will respond and behave in precisely the same manner as in the case of control by shifting centre of gravity. In contrast to a "normal" wheelchair being pushed, a self-balancing wheelchair is very easy to push, because the pushing force is not needed for overcoming friction in the actual displacement but only for inducing a slight tilt: the actual propelling force for riding is generated by the wheel drive.

[0011] It may be noted in this respect that the notion of "tilt" is expressed with respect to the vertical. While powered, the self-balancing wheelchair will at all times maintain an upright position, irrespective of an inclination of the floor on which it stands.

[0012] Thus, the self-balancing wheelchair proposed by the present invention distinguishes itself in that it is configured to be controlled by a person positioned behind the seat.

[0013] The configuration involves a handle bar for pushing and pulling mounted behind the seat, and a control stick for steering mounted behind the seat; handle bar and control stick may conveniently be embodied in one combined control member.

[0014] The handle bar, to be manipulated by the accompanying person, will be positioned at a height suitable and convenient for the accompanying person, which will in general be at the upper end of the back rest of the seat. The height of the handle bar may be adjustable. The handle bar / control stick may be mounted to the lower frame of the self-balancing wheelchair, or to the

seat or to the back rest of the seat.

[0015] In a possible embodiment, the control stick may have a general inverted L-shaped configuration (or Γ-configuration), with a vertical leg attached to the chair and a horizontal manipulation arm attached to the upper end of the leg, the handle bar being attached to the (free end of the) horizontal manipulation arm and extending in transverse horizontal direction. The vertical leg only has rotational freedom with respect to the chair about a vertical axis. Thus, controlling the riding of the self-balancing wheelchair is done by the accompanying person lifting or lowering the horizontal manipulation arm. Steering the self-balancing wheelchair is done by the accompanying person rotating the vertical leg by displacing the horizontal manipulation arm in horizontal transverse direction.

[0016] In a possible embodiment, the control stick may have a general L-shaped configuration, with a horizontal leg attached to the chair and a vertical manipulation arm attached to the free end of the leg, the handle bar being attached to the (free end of the) vertical manipulation arm and extending in transverse horizontal direction. The horizontal leg only has rotational freedom with respect to the chair, about a horizontal axis extending in longitudinal direction of the self-balancing wheelchair. Thus, controlling the riding of the self-balancing wheelchair is done by the accompanying person pushing or pulling the vertical manipulation arm. Steering the self-balancing wheelchair is done by the accompanying person rotating the horizontal leg by displacing the upper end of the vertical arm in horizontal transverse direction.

[0017] It is noted that the control stick may have other shapes, i.e. straight, curved, having two or more angles, etc.

[0018] In all of these cases, the movements of the handle bar / control stick will be detected by suitable sensors, that will generate signals to the drive controller, which in turn will actuate the wheel motors to accommodate the commands from the accompanying person.

[0019] The accompanying person, who in fact controls the driving and steering of the self-balancing wheelchair, may in the simplest embodiment be walking behind the wheelchair. In a further elaboration, the self-balancing wheelchair is provided with a carrying platform for carrying the accompanying person. The platform may be for standing, but may also be provided with a second seat for allowing the accompanying person to sit.

[0020] The platform may be fixed to the self-balancing wheelchair, but this would have the consequence that weight shifts of the accompanying person would result in a riding response by the self-balancing wheelchair. In a preferred embodiment, the platform is provided with and supported by its own wheels, coupled to the self-balancing wheelchair, such as to be towed by the self-balancing wheelchair. The coupling structure preferably joins the self-balancing wheelchair at a position aligned with the wheelchair's wheel axis, rotatable around that wheel axis, such as not to influence driving response of the self-balancing wheelchair. Further, the coupling structure preferably allows for relative pivoting about a vertical pivot axis, which preferably is located at equal distances from the wheelchair's wheel axis and the wheel axis of the carrying platform for the accompanying person. A further advantage is provided if the track width of the carrying platform is equal to the track width of the self-balancing wheelchair, because this will cause the wheels of the carrying platform to always follow in the tracks of the wheels of the self-balancing wheelchair, which will increase manoeuvrability in narrow places (such as aisles of shops) and reduce friction in sandy conditions.

[0021] Further, the coupling structure preferably allows for pivoting about the longitudinal axis of the coupling structure.

[0022] A further aspect of the transporter involves safety. In case of an electronic failure, or in case of battery exhaustion, the system is no longer capable of responding to weight shifting and could tip over. If the occupant of the wheelchair has reduced ability, he might be hurt in the fall. It is possible to provide the said coupling structure with stops to limit the tilting angle of the wheelchair with respect to the carrying platform.

[0023] Further, during mounting and dismounting the wheelchair, it is important that the wheelchair stands still without falling over, with the electric system switched off. Therefore, the self-balancing wheelchair is preferably provided with support brackets for keeping the wheelchair upright while stationary. These support brackets are displaceable to engage or release. Control of these support brackets may be mechanical or electrical. In the case of the self-balancing wheelchair according to the present invention, user controls for these support brackets are located at the rear side of the wheelchair, be it electric control members located at the control stick or a mechanical lever mounted in a lower region of the wheelchair to be actuated by an accompanying person's foot.

[0024] While said support brackets in the released condition are free from the horizontal or inclined floor upon which the self-balancing wheelchair is riding, they may in that released condition act as a safety feature for limiting the tiling angle by contacting the floor and act as a tilt stop. It is conceivable that a control failure occurs while the self-balancing wheelchair is riding, causing the self-balancing wheelchair to lose balance and tilt till a support bracket comes into contact with the floor. This may result in an immediate halting of the riding wheelchair, causing it to fall over because of its inertia. According to the present invention, this problem can be reduced or eliminated by providing the support bracket with one or more wheels or rolls that can rotate with respect to the support bracket with substantial friction such as to bring the self-balancing wheelchair to a halt without falling over.

[0025] In another implementation of the inventive insight of the inventor, the present invention provides an improved transporter for transporting goods. The same or similar considerations as mentioned above apply, with the seat for a human occupant replaced by a container

for holding goods.

[0026] Considering that a self-balancing wheelchair as such is already known, details about its design and control need not be explained here, and the illustrating figures will be kept schematic.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] These and other aspects, features and advantages of the present invention will be further explained by the following description of one or more preferred embodiments with reference to the drawings, in which same reference numerals indicate same or similar parts, and in which:

Figure 1 schematically shows a self-balancing wheelchair according to prior art;
Figures 2A, 2B, 3A, 3B, 4A, 4B schematically show embodiments of a self-balancing wheelchair according to the present invention;
Figures 5A-5D schematically show embodiments of a self-balancing freight vehicle according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0028] Figure 1 schematically shows a self-balancing wheelchair 100 according to prior art, in side-view. The self-balancing wheelchair 100 comprises a platform 110 and wheels 101 (of which only one is visible in the figure). Electric motors for driving the wheels are schematically represented at 102, a battery for powering the motors is schematically represented at 103. A drive controller is not shown in the figure. Support brackets, also indicated as parking supports, mounted to the underside of the platform 110 for stabilizing the self-balancing wheelchair 100 when switched off, are schematically represented at 111, 112.

[0029] A chair 120 is mounted on the platform 110. The chair comprises a support structure 121, a seat 122, and a backrest 123. In front of the chair 120, a substantially vertical driving stick 130 is mounted to the platform 110 for steering the wheelchair 100. More precisely, the wheelchair 100 comprises control circuitry (not shown for sake of convenience) for controlling the operation of the electric motors 102, and this control circuitry is provided with a control input device 132 mounted to the platform 110. This input device 132 has a rotatable input member, that is rotatable about a horizontal axis 131 directed in lengthwise direction of the wheelchair, i.e. perpendicular to the axes of the wheels and lying in the plane of drawing, as shown. Said control circuitry controls the electric motors 102 to have differential rotation, wherein the direction of the rotation difference and the magnitude of the rotation difference depends on the direction to which said rotatable input member is rotated and on the rotation angle, respectively. Said substantially vertical driving stick 130 has its lower end attached to this rotatable input member. User input for making a turn to the right or to the left is done by displacing the free upper end of the driving stick 130 sideways (perpendicular to the plane of drawing) so that the driving stick 130 moves in a vertical plane while rotating about said horizontal axis 131. In this respect, a displacement to the right corresponds to a turn to the right.

[0030] An occupant user U is schematically shown seated on the chair 120. The figure shows that the user U can reach out to hold the driving stick 130 and move the stick to the right and to the left for steering, and that he can move his upper body forward / rearward to control the driving forward / rearward behaviour of the wheelchair 100.

[0031] Figures 2A and 2B are views comparable to figure 1, showing embodiments of a self-balancing wheelchair 200 according to the present invention. With respect to figure 1, it can be seen that the driving stick 130 in front of the chair 120 has been removed. Instead, the self-balancing wheelchair 200 according to the present invention is provided with a handle bar 235 / control stick 230A, 230B mounted at the rear of the chair 120. The control input device to which the control stick 230A, 230B connects, is indicated at 232A, 232B. This control input device can have the same design and operation as the prior art control input device 132 described above, therefore a more detailed description may be omitted here. The corresponding rotation axis of the rotatable input member is indicated at 231A, 231B.

[0032] In figure 2A, the control input device 232A is shown to be mounted to the platform 110 directly, whereas in figure 2B the control input device 232B is shown to be mounted to the chair 120. Each figure illustrates that the user U is sitting with relaxed arms, while an accompanying person P positioned behind the self-balancing wheelchair 200 is controlling the forward / rearward movements of the wheelchair 200 by adequately pushing or pulling the handle bar 235 attached to the free end of control stick 230A, 230B to cause an initiation of a tilt of the platform 110 and chair 120. For steering the self-balancing wheelchair 200, the control stick 230A, 230B is rotated about said axis 231A, 231B, which again is directed horizontally in the forward/rearward direction of the wheelchair. Thus, the upper end of the control stick 230A, 230B is moved sideways, making the handle bar 235 / control stick 230A, 230B displace in a vertical plane perpendicular to said axis 231A, 231B.

[0033] Support brackets 112 are shown in a released or inactive condition, in which they do not touch the ground.

[0034] Figures 3A and 3B illustrate variations for the implementation of the handle bar / control stick.

[0035] The control stick may be substantially vertical, such that its upper end is relatively close to the backrest 223, as shown in figures 2A and 2B. However, the horizontal distance from the upper end of the handle bar / control stick 230 to the backrest 223 may be more substantial. A reason for such larger horizontal distance may

for instance be for the accompanying person P to have more space for his legs.

[0036] In an exemplary embodiment illustrated in figure 3A, the control stick 230 has a general inverted L-shaped configuration (or Γ-configuration), with a vertical leg 233 coupled to the control input device 232 and a horizontal manipulation arm 234 attached to the upper end of the leg 233, and a transverse horizontal handle bar 235 attached to the free end of the horizontal manipulation arm 234. The angle between leg 233 and arm 234 does not have to be 90°. The control stick 230 may have two or more bends, and may even be contiguously curved. The control stick 230 may even be a straight bar arranged at an angle.

[0037] In such configuration, controlling the riding of the self-balancing wheelchair by the accompanying person P can not only be done by pushing/pulling the horizontal handle bar 235 but can also be done by lifting/lowering the handle bar 235 and hence horizontal manipulation arm 234. After all, lifting and pushing tend to initiate a forward tilt while lowering and pulling tend to initiate a rearward tilt.

[0038] As mentioned before, steering the self-balancing wheelchair is done by the accompanying person P rotating the free end of the handle bar / control stick in horizontal transverse direction about the horizontal longitudinal rotation axis 231. It is now a particular effect of the wheelchair that, if it is steering to the right, the free end of the handle bar / control stick 230 is moving to the left. This effect is stronger with larger horizontal distance between the upper end of the control stick 230 and the backrest 223 (actually, the horizontal distance between the upper end of the control stick 230 and the axis of the wheels 101 is decisive). If, as in prior art, steering to the right is actuated by rotating the free end of the control stick 230 to the right, the resulting displacement of the control stick 230 to the left as resulting from the steering movement of the wheelchair causes the control stick 230 to push harder to the hand(s) of the accompanying person P. Consequently, because of this positive feedback, steering is more difficult to control. In order to avoid this problem, in a preferred embodiment in accordance with the present invention, a displacement of the handle bar 235 to the right corresponds to a steering response to the left, and vice versa.

[0039] In an alternative exemplary embodiment illustrated in figure 3B, the control input device 232 has a vertical rotation axis 231, and said vertical leg 233 coincides with this vertical rotation axis 231. Actuating this control input device 232 for steering is done by rotating the vertical leg 233 about the vertical rotation axis 231, by moving the handle bar 235 sideways so that the horizontal manipulation arm 234 is displaced in a horizontal plane.

[0040] As in the case of figure 3A, controlling the riding of the self-balancing wheelchair by the accompanying person P can be done by pushing/pulling the horizontal manipulation arm 234 and/or by lifting/lowering the horizontal manipulation arm 234. As for steering, the same applies as in the case of figure 3A: in accordance with the present invention, it is preferred that a displacement of the free end of the control stick 230 to the right corresponds to a steering response to the left, and vice versa.

[0041] In the exemplary embodiment of figure 3C, the control input device 232 is positioned at a higher level. It may be attached to the structure of the wheelchair itself, but in the embodiment shown the wheelchair comprises a fixed control stick 230 directed substantially vertically, with or without bends, fixed to the chair's platform or seat or frame, with the control input device 232 mounted at the upper end of this stick 230. This control input device 332 has a rotatable input member, that is rotatable about a horizontal longitudinal axis 231. A transverse handle bar 235, extending horizontally perpendicularly to said horizontal rotation axis 231, i.e. perpendicular to the plane of drawing, is attached to said input member, substantially centrally. This embodiment can be described as being similar to the embodiment of figure 3A, in which the length of the vertical leg 233 would be zero. This embodiment provides the most convenient steering response for the accompanying person P.

[0042] Again, riding is controlled by the accompanying person P pushing/pulling and/or lifting/lowering the handle bar 235. Steering is controlled by the accompanying person P rotating the transverse handle bar 235 about the horizontal rotation axis 231, i.e. displacing the transverse handle bar 235 in a vertical plane. It is preferred that rotation clockwise corresponds to steering to the right.

[0043] This embodiment, where the handle bar is directly connected to the rotatable input member of the control input device 332, does not have the problem of positive feedback described above, or in any case to a much lesser extent.

[0044] In the above, the inventive wheelchair has been discussed in the context of an accompanying person P walking behind the chair for pushing/pulling. In a further elaboration of the present invention, the accompanying person P does not have to walk/stand on the ground. Figure 4 illustrates schematically a self-balancing wheelchair 300 provided with a platform 301 extending to the rear, attached to or integral with the wheelchair's platform 110 or frame. The platform 301 may be fixed or detachable. As shown, an accompanying person P can stand on the platform 301. The platform 301 can even be provided with a seat for the accompanying person P. This is advantageous, for instance in the case of rough and/or dirty terrain, such as sand or mud, and/or in the case that the accompanying person P has difficulty walking. Riding this self-balancing wheelchair 300 can be controlled by the accompanying person P shifting weight.

[0045] This self-balancing wheelchair 300 can be provided with any of the steering control mechanisms as discussed in the above and illustrated in figures 3A-3C. It is noteworthy that, with the accompanying person P standing on the platform 301 attached at the rear of the

wheelchair, on making a steering movement, the handle bar / control stick extending at the rear does not displace with respect to the accompanying person P.

[0046] Figure 5A shows that, instead of the accompanying person P walking behind the self-balancing wheelchair 200, a trailer 400 towed by the wheelchair 200 can be provided, upon which person P can stand or, as shown in figure 5B, sit. The trailer 400 may for instance have a 4-wheeled or 2-wheeled structure. A coupling bar 410 connects the trailer 400 to the wheelchair 200. The steering control mechanism may be any of the steering control mechanisms as discussed in the above and illustrated in figures 3A-3C.

[0047] At its front end, the coupling bar 410 has a hinge 411 connecting to the wheelchair 200 at a position preferably vertically aligned with, more preferably coaxial with, the wheel axis of its wheels 101. As a result of this position, although a shift of the person P's weight may result in a change of downpressure caused by the coupling bar 410 on the wheelchair 200, such downpressure is aligned with the wheel axis of the wheels 101 and will not result in a tilting action and will hence not result in a driving response. Oppositely, since the hinge 411 has a horizontal and transverse hinge axis coinciding with the wheelchair's wheel axis, any vertical movement of the trailer 400 (be it by uneven support surfaces, or inclined surface, or whatever cause) will not result in a tilting action and will hence not result in a driving response. In this respect it is further noted that, on an inclined surface, the wheelchair 200 will remain vertical but the orientation of the coupling bar 410 will vary in accordance with the inclination without tilting the wheelchair.

[0048] If on the other hand it is desirable that a shift of the person P's weight does result in a driving response, the hinge 411 should be connected to the wheelchair 200 at a position in front of the wheel axis of its wheels 101.

[0049] For better manoeuvrability, the coupling bar 410 further comprises a hinge 412 with a vertical hinge axis. Preferably, the horizontal distance D2 from the hinge 412 axis to the wheelchair's wheel axis is equal to the horizontal distance D4 from the hinge 412 axis to the trailer's wheel axis, to ensure that the trailer's wheels always follow in the track of the wheelchair's wheels.

[0050] In rough terrain, the wheelchair 200 and/or the trailer 400 may tend to sway in transverse direction with respect to each other. To accommodate these swaying movements, the coupling bar 410 is preferably provided with a rotation play coupling between two bar sections, allowing for relative rotational movements about a longitudinal axis without longitudinal play. As an example, such coupling may comprise a disc attached to one bar section and longitudinally confined in a disc rotation chamber attached to the other bar section.

[0051] Such coupling may be integrated with the hinge 412, or be separate.

[0052] In another range of embodiments, illustrated in figures 6A-6D, the invention provides a self-balancing freight vehicle 500. The basic difference with respect to the self-balancing wheelchair as described above is that the chair 120 has been removed and has been replaced by a platform or container or cabinet 520 for holding goods. Apart from these adaptations, the description given above can remain the same. The handle bar / control stick for driving and steering may involve any of the steering control mechanisms as discussed in the above and illustrated in figures 3A-3C, and may be mounted to the platform (figure 6B) or may be mounted at a higher level to the cabinet 520 (figure 6C).

[0053] In the case of a self-balancing wheelchair, the directions of front/forward and rear/backward will be defined by the wheelchair in an obvious manner, and the handle bar / control stick will be at the rear side. The accompanying person P will be positioned behind the wheelchair, typically facing it, and he will push for moving the wheelchair forward and pull for moving the wheelchair backward. Likewise, the operator P of the self-balancing freight vehicle can be behind the vehicle facing it, pushing for forward and pulling for backward, but he can also be in front of the vehicle, pulling it behind him for forward motion, as illustrated. In this case, the "forward" direction is defined by the orientation of the operator P.

[0054] The advantages described in the above will also be attained in this case. The vehicle is easy to manoeuvre, even when heavily loaded, because the operator does not need to provide the driving force. Figure 6D illustrates a safety feature, also applying to the self-balancing wheelchair: the vehicle is intrinsically safe, as it tends to remain stationary and upright, even on inclined surfaces, without the operator needing to exert high forces to keep the vehicle under control. Particularly, the operator P does not need to provide force for preventing the vehicle from rolling down an inclination, and he does not need to provide the force for climbing an inclination, he only needs force to induce the beginning of a tilt.

[0055] As a further safety feature, the parking supports may also serve as catches to catch the vehicle and prevent it from tumbling over completely in the unlikely event of a failure such as battery exhaustion. At their free ends, the parking supports may be provided by friction rollers and/or friction wheels, rotating with friction with respect to the supports, to prevent the vehicle from "biting" into the ground but allowing it to roll some distance and braking it to a halt.

[0056] It should be clear to a person skilled in the art that the present invention is not limited to the exemplary embodiments discussed above, but that several variations and modifications are possible within the protective scope of the invention as defined in the appending claims.

[0057] Even if certain features are recited in different dependent claims, the present invention also relates to an embodiment comprising these features in common. Even if certain features have been described in combination with each other, the present invention also relates to an embodiment in which one or more of these features are omitted. Features which have not been explicitly described as being essential may also be omitted. Any ref-

erence signs in a claim should not be construed as limiting the scope of that claim.

Claims

1. Transporter with wheels for transporting at least one person (U), the transporter comprising a self-balancing wheelchair (200; 300) comprising a platform (110), a seat (120; 320) for a human occupant (U) mounted on the platform, two wheels (101) at opposite sides of the platform with coinciding wheel axes, respective motors (102) for driving the wheels with respect to the platform, **characterized in that** the transporter is configured to be controlled by a person (P) positioned behind the seat.

2. Transporter according to claim 1, further comprising:

   control circuitry for controlling the motors (102), the control circuitry being provided with a control input device (232) comprising a rotary control input member that is adapted to generate control input signals for the control circuitry;
   a control stick (230) positioned behind the seat, having its lower end attached to said rotary control input member and having a free upper end adapted for manipulation by an accompanying person (P), preferably provided with a transverse horizontal handle bar (235).

3. Transporter according to claim 2, wherein the control input device (232A) is mounted to the lower frame of the self-balancing wheelchair.

4. Transporter according to claim 2, wherein the control input device (232B) is mounted to the seat of the self-balancing wheelchair.

5. Transporter according to any of claims 2-4, wherein the control circuitry, in response to receiving a control input signal resulting from the control stick's free end being displaced to the right, is adapted to control the motors (102) such that the transporter turns to the left, and in response to receiving a control input signal resulting from the control stick's free end being displaced to the left, is adapted to control the motors (102) such that the transporter turns to the right.

6. Transporter according to any of the claims 2-5, wherein the rotary control input member has a horizontal rotation axis (231).

7. Transporter according to claim 1, further comprising:

   a control stick (230) positioned behind the seat, having a free upper end and a lower end, wherein the lower end is fixedly attached with respect to a frame of the self-balancing wheelchair or with respect to the seat of the self-balancing wheelchair;
   control circuitry for controlling the motors (102), the control circuitry being provided with a control input device (232) comprising a rotary control input member that is adapted to generate control input signals for the control circuitry, said control input device (232) being mounted at said free upper end of the control stick;
   a handle bar (235) adapted for manipulation by an accompanying person (P), the handle bar being attached to said rotary control input member.

8. Transporter according to claim 7, wherein the control circuitry, in response to receiving a control input signal resulting from the handle bar being rotated clockwise, is adapted to control the motors (102) such that the transporter turns to the right, and in response to receiving a control input signal resulting from the handle bar being rotated counter-clockwise, is adapted to control the motors (102) such that the transporter turns to the left.

9. Transporter according to any of the claims 7-8, wherein the rotary control input member has a horizontal rotation axis (231).

10. Transporter according to any of the previous claim, further comprising a platform (301) attached to the wheelchair (300), the platform (301) being adapted for allowing an accompanying person (P) to stand on.

11. Transporter according to claim 10, wherein the platform (301) is provided with a second seat for the accompanying person (P) to sit on.

12. Transporter according to any of the previous claims 1-9, further comprising a trailer (400) towed by the wheelchair (200), for carrying an accompanying person (P).

13. Transporter according to claim 12, wherein the trailer is arranged for standing, or is provided with a second seat for allowing the accompanying person to sit.

14. Transporter according to claim 12 or 13, further comprising a coupling bar (410) that connects the trailer (400) to the wheelchair (200), the coupling bar (410) having a hinge (411) connecting to the wheelchair (200), wherein said hinge (411) has a hinge axis coinciding with the wheelchair's wheel axis.

15. Transporter according to claim 14, provided with a stop to limit the hinging angle of said coupling bar (410) with respect to the wheelchair (200).

16. Transporter according to claim 14 or 15, wherein the

coupling bar (410) comprises a hinge (412) with a vertical hinge axis.

17. Transporter according to claim 16, wherein the horizontal distance (D2) from the hinge (412) axis to the wheelchair's wheel axis is equal to the horizontal distance (D4) from the hinge (412) axis to the trailer's wheel axis.

18. Transporter according to claim 17, wherein the track width of the trailer (400) is equal to the track width of the self-balancing wheelchair.

19. Transporter according to any of claims 14-18, wherein the coupling bar (410) is provided with a rotation play coupling between two bar sections, allowing for relative rotational movements about a longitudinal axis without longitudinal play.

20. Transporter according to any of the previous claims, wherein the self-balancing wheelchair is further provided with support brackets for keeping the wheelchair upright while stationary, wherein user controls for these support brackets are located at the rear side of the wheelchair to be actuated by the accompanying person.

21. Transporter according to claim 20, wherein each support bracket is provided with one or more wheels or rolls that can rotate with respect to the support bracket with substantial friction.

22. Self-balancing transporter (500) according to any of the previous claims, adapted for transporting goods, wherein the seat for a human occupant is replaced by a platform or container or cabinet (520) for holding goods.

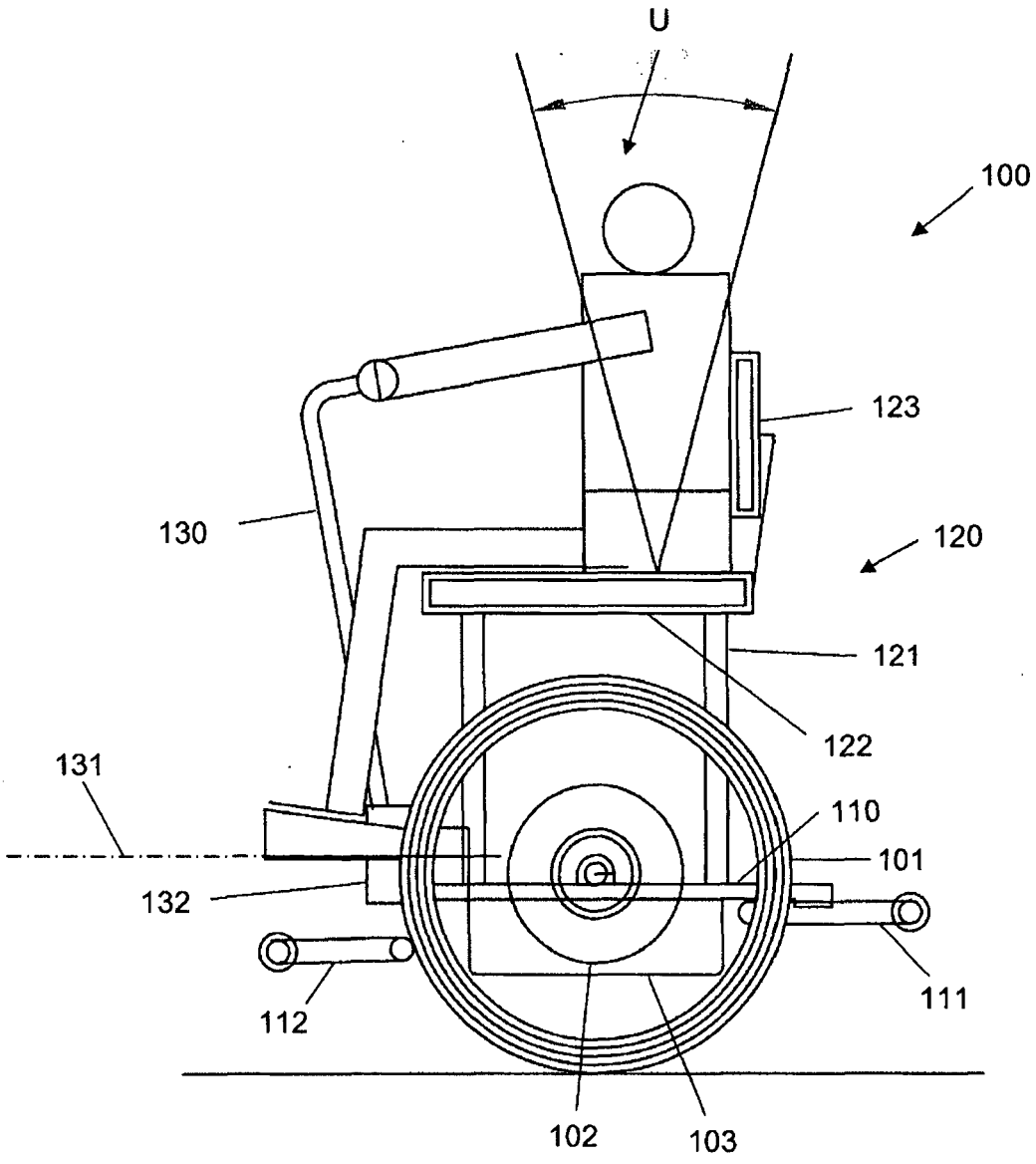
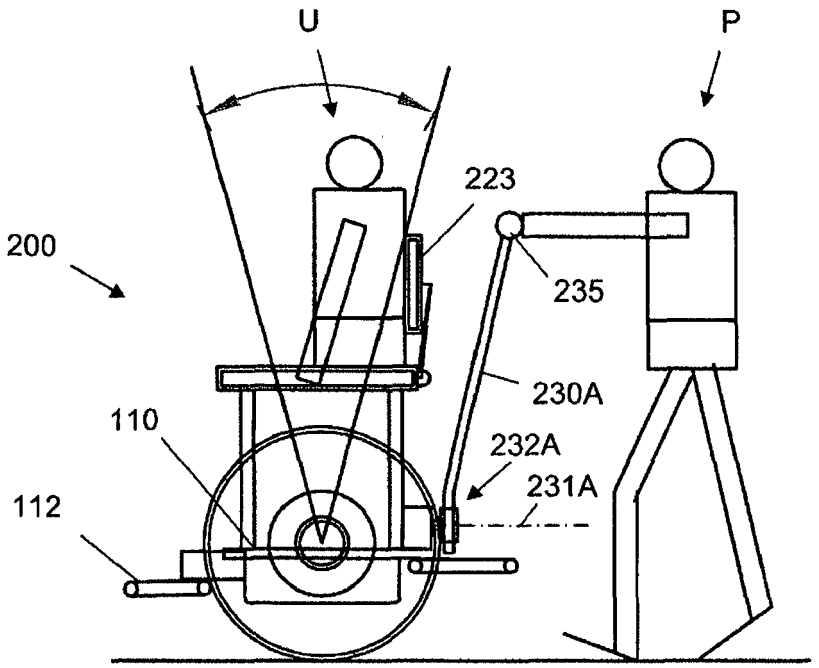


FIG. 1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231A
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FIG. 2A

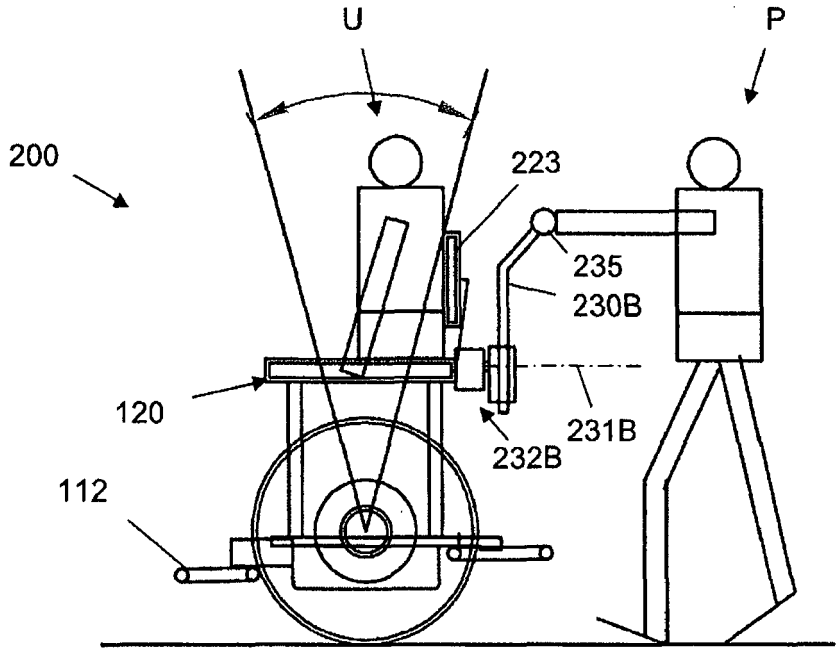
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FIG. 2B

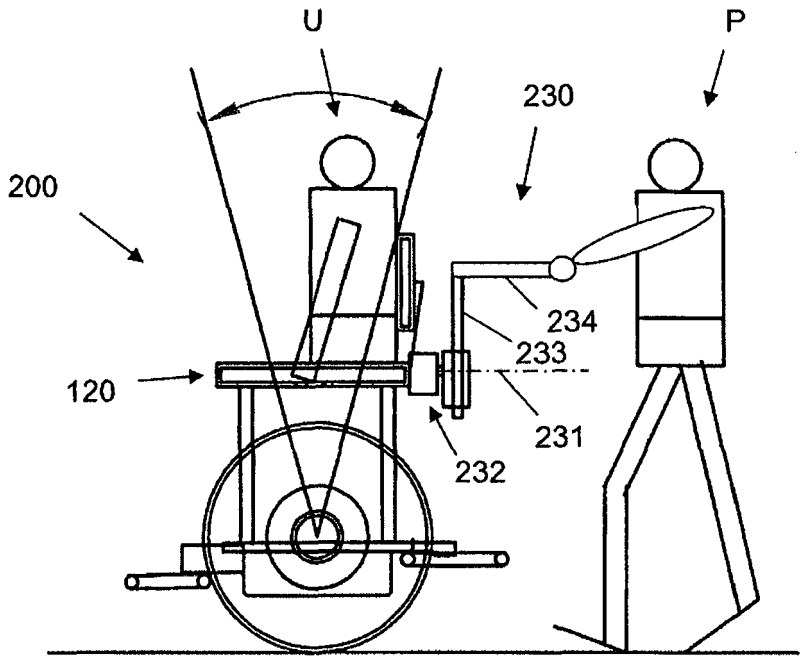

FIG. 3A

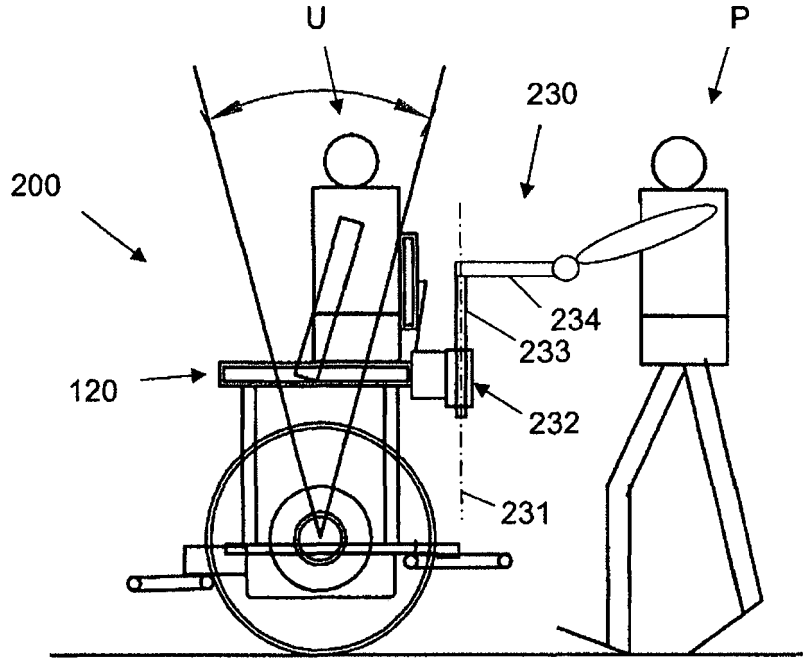

FIG. 3B

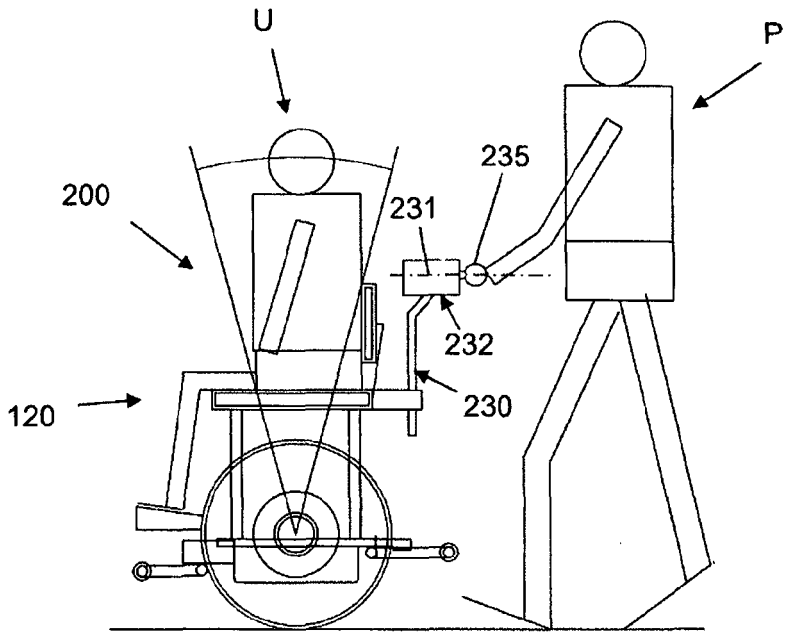

FIG. 3C

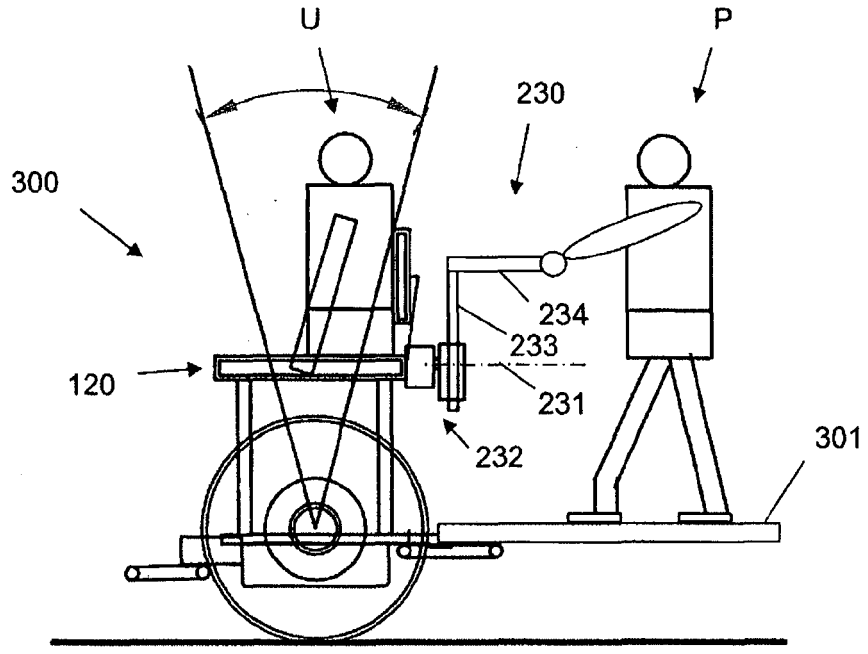

FIG. 4

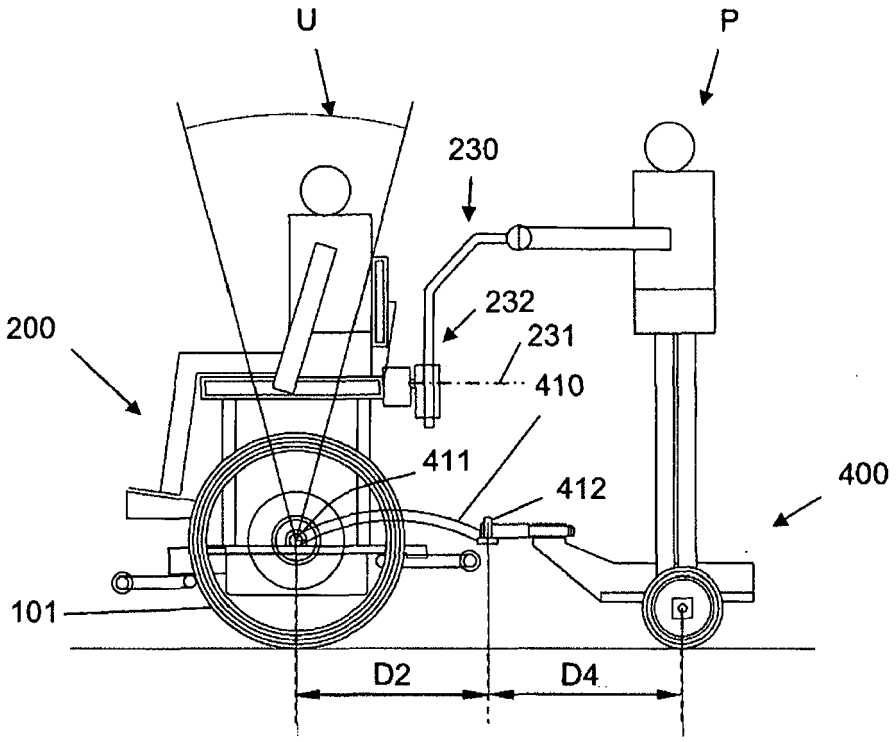
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FIG. 5A

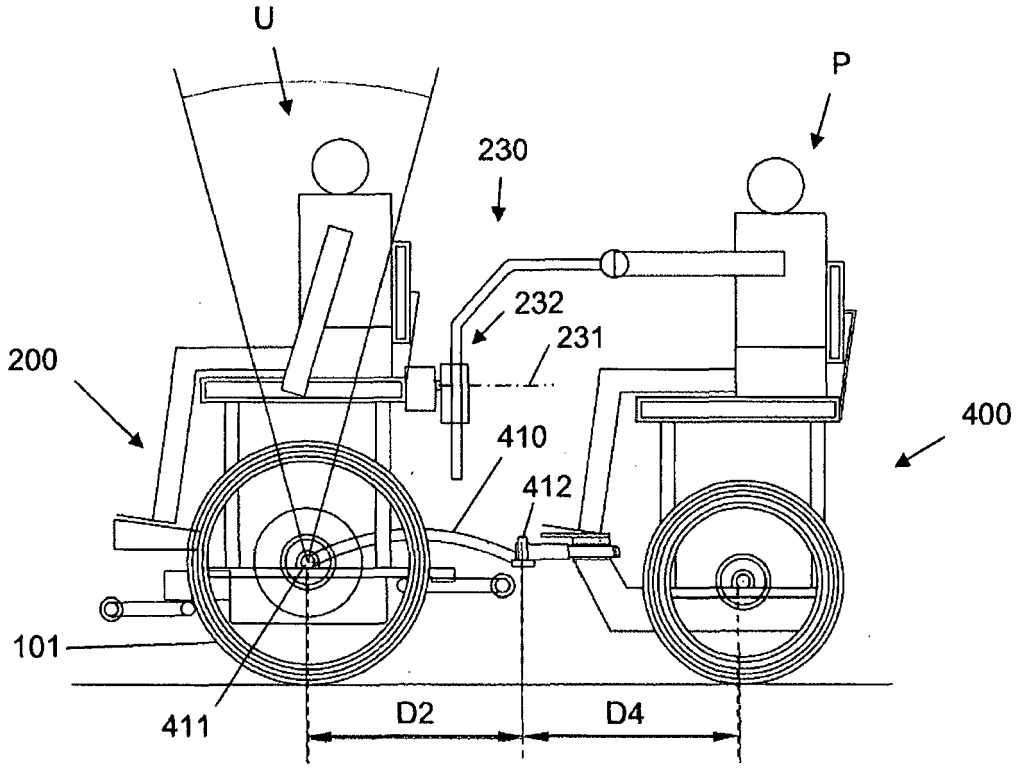
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FIG. 5B

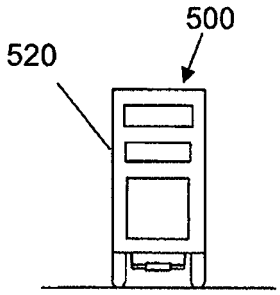

FIG. 6A

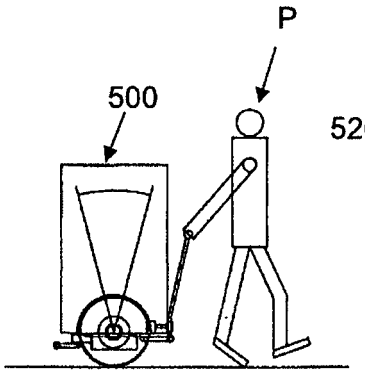

FIG. 6B

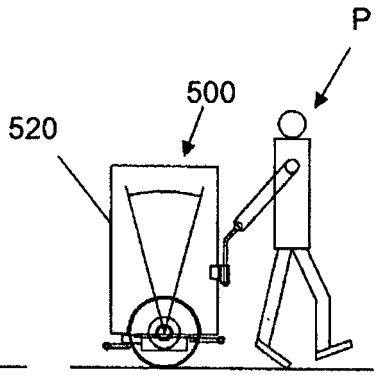

FIG. 6C

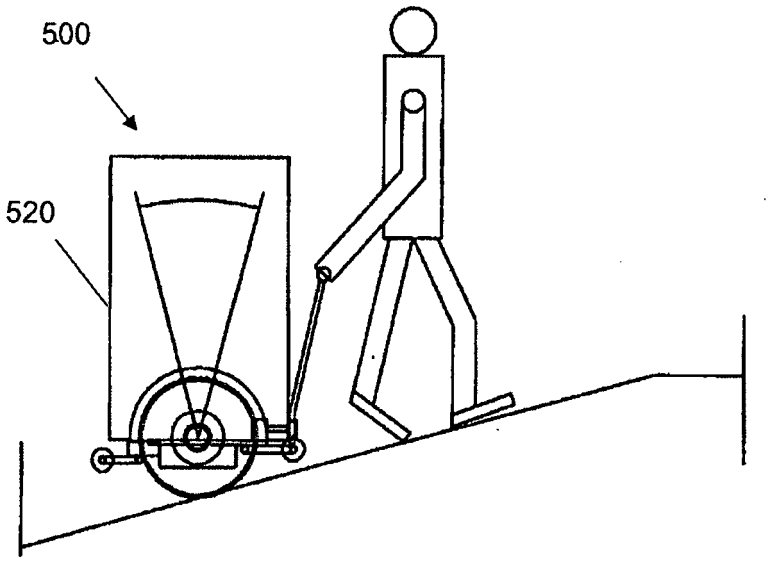

FIG. 6D

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EUROPEAN SEARCH REPORT

Application Number
EP 20 00 0098

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	24 July 2020	Gkama, Alexandra

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24-07-2020

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