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(54) Title: TWO-WHEEL BATTERY-POWERED VEHICLE

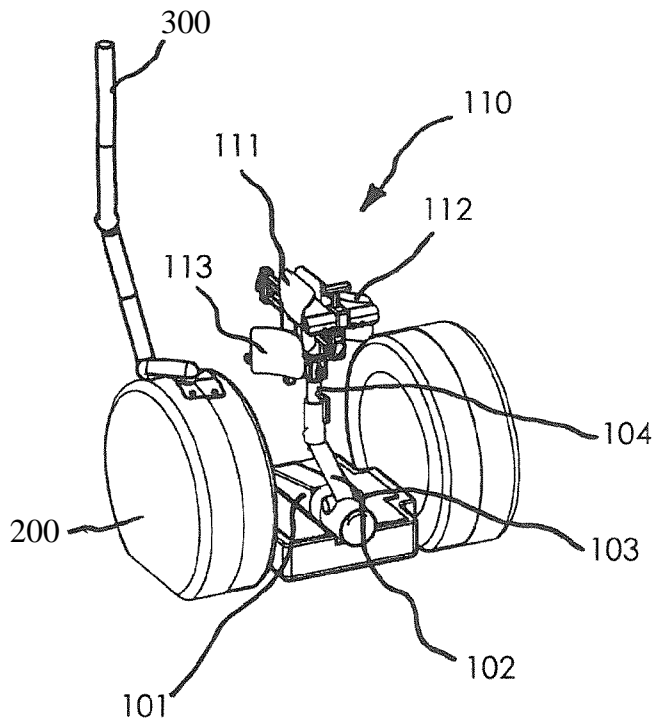


Fig. 3

(57) Abstract: The invention relates to a two-wheel battery-powered vehicle comprising: a platform; two wheels connected to the platform; a battery-powered wheel drive driving the two wheels; a n attachment connected to the platform; a sensor device arranged in the platform; wherein a person standing on the platform and engaging the attachment moves the platform into an angle position corresponding to a body position of the person, wherein, based on the angle position of the platform relative to a horizontal position, the sensor device controls the wheel drive such that the wheel drive, by acceleration or deceleration, keeps the vehicle and the person standing on the platform in a balanced position; wherein the attachment has a leg support device for at least one leg of the person standing on the platform in order to keep the platform at a desired angle position. The vehicle according to the invention is characterized in that the leg support device is adjustable. In a particularly preferred embodiment of the invention the leg support device is provided to lie on the lower leg of the person, wherein the leg support device preferably is provided to lie on the leg upon an area of a calf of the person. Expediently the leg support device provides separate shells for its front and its rear side and the front and the rear shell are arranged in differing heights.

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DESCRIPTION:5 „Two-wheel battery-powered vehicle”

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10 The invention generally relates to a two-wheel battery-powered vehicle comprising a platform, two wheels connected to the platform, a battery-powered wheel drive driving the two wheels, an attachment connected to the platform, a sensor device arranged in the platform, wherein a person standing on the platform and engaging the attachment moves the platform into an angle position corresponding to a body position of the person, wherein, based on the angle position of the platform relative to a horizontal position, the sensor device controls the wheel drive such that the wheel drive, by acceleration or  
15 deceleration, keeps the vehicle and the person standing on the platform in a balanced position.

Such a vehicle is in use and known under the name "Segway®". The platform of this known vehicle comprises a flat box in which the battery, the sensors, and the  
20 control equipment are arranged. The standing surface is positioned at the comfortable height of a usual stair step. The person steps from the rear onto the platform and reaches for two handles that, similar to a bicycle handlebar, are arranged on a column arranged on the platform. In one embodiment of the vehicle, one side of the handlebar contains a rotary handle with which the  
25 control right/left steering is achieved. In another, right/left steering is achieved by leaning the entire handlebar to right and left. Speed control is achieved by a special type of balance control: The more the person and the column supporting the handles leans forward, the faster the vehicle moves forward. When leaning to the rear, the vehicle moves backwards, or decelerates. When the vehicle stands  
30 still and the person is not moving, the balance is maintained by acceleration and counter acceleration in which the vehicle moves continuously back and forth within small fractions of a second.

The „Segway®" vehicle is subject to U.S. patents 5,701,965; 5,971,091 ; 6,302,230; 6,367,817; 6,408,240; 6,561,294; 6,575,539; 6,581,714; 6,598,941 ; 6,651,766; 6,779,621 ; 6,789,640; 6,796,396; 6,799,649; 6,815,919; and 6,827,163 which are incorporated herein by reference. While the „Segway®" vehicle provided simple  
5 transportation, controlling such a vehicle while carrying objects, especially while operating a camera, is not well supported.

EP 1695896 and US 7,303,132 describe a further development of the two-wheel battery-powered vehicle. Instead of the handles of the „Segway®" vehicle, an  
10 attachment that has a leg support device for at least one leg of the person standing on the platform for keeping the platform at a desired angle position is connected to the platform. To drive the vehicle, the person standing on the platform leans his body forwards or backwards, thereby engaging the attachment and inclining the platform. Based on the angle of inclination of the  
15 platform, the sensor device controls the wheel drive such that, by acceleration or deceleration, the vehicle and the person standing on it are kept in a balanced position. A right/left control equipment providing foot pedals controls turning of the vehicle in a traveling direction by driving the wheels at different speeds. The vehicle requires that the person leans, tilts or otherwise compromises the body in  
20 order to maneuver the transport.

Furthermore the above mentioned patents disclose a bow-shaped support, which is provided for an object to be carried on the vehicle; the support is arranged to be pivotable to the front and to the rear of the vehicle, preferably on or near the wheel axle, and can be connected to the body, preferably by a  
25 bracket laterally engaging the body. The support that extends approximately to the waist of the person is provided as a hard mount of a camera.

While the developments disclosed in EP 1695896 and US 7,303,132 improve the possibilities to use the two-wheel battery-powered vehicle, several shortfalls when  
30 operating remain. For example, the vehicle shows a leg-saddle comprising two concave control shells placed between a user's legs at a height above the knees. With this vehicle braking requires a person to incline the body rearwards from above the knees, in particular from above the hips, which leads to unnatural body positions.

35 Furthermore the vehicle is vulnerable to accidents and mishaps. A common accident occurs when one or both wheels of the vehicle run into an object too high for the vehicle to negotiate, e.g. a wall, kerb, leg, or any other obstacle. This often results in the vehicle attempting to climb the object, thus throwing the

person off the machine, and causing the vehicle to perform an emergency shut down, whereby it loses power and falls over. A person that does not carry or operate any equipment may be injured, but a person who does may also be forced to abandon the equipment, causing damage to it or to people or objects  
5 in the vicinity.

Thus it is an object of the invention to facilitate the operation of the vehicle and to make the use of the vehicle safer.

10 This object is achieved in that the attachment has a leg support device for at least one leg of the person standing on the platform in order to keep the platform at a desired angle position.

In a particularly preferred embodiment of the invention, the leg support device is  
15 provided to lie on the lower leg of the person. Advantageously the person is able to bend his knees when operating the vehicle. For accelerating, the person can engage the machine by pushing forward with the leg. When decelerating, stopping, or going backwards, the person can transfer his weight back without bending his torso backwards, but by making a movement which is similar to a  
20 movement sequence that one conducts when sitting down on a chair. This allows the centre of gravity of the person to be moved backwards by a greater degree, causing greater deceleration.

Thus it is created a more ergonomic, versatile and safe control system to make possible a better body control and as a result better control of supported loads or  
25 tools.

In a particularly preferred embodiment of the invention the leg support device is provided to lie on the leg upon an area of a calf of the person. It rests comfortably on the bulk of the calf muscle, avoiding contact with the hamstring  
30 tendons. This position allows maximal braking potential, while optimizing comfort.

Expediently the leg support device provides separate shells for its front and its rear side and the front and the rear shell are arrangeable in differing heights.

In a further embodiment of the invention the shell of the front side is provided to  
35 sit on or above the knee of the person. Advantageously the person gains exact control of the acceleration or forward movement. Furthermore the person feels safe when accelerating by pushing his knees against the front shells.

In a further embodiment of the invention the, preferably cushioned, shells are curved or angled and preferably provide essentially the form of a quadrant so that they can comfortably sit on the persons' leg. Preferably, the shells contact  
5 the leg laterally, preferably at an inner side of the leg.

Expediently the positions of the shells are adjustable independently of one other, preferably adjustable in a vertical and/or horizontal direction and/or pivotable about a vertical and/or a horizontal axis. The shells may be individually adjusted  
10 left and right along the coronal plane to accommodate differing distances between persons' legs, and may be rotated about the sagittal plane to accommodate differing musculature. Furthermore, the person can vary the distance between the front and rear shells. Tightening brings an increased contact with the shells necessary for negotiating uneven terrain, and has the  
15 benefit of encouraging the person into a slight crouching position, analogous to skiing, that allows the legs to function as natural shock absorbers and to adjust to changing levels of left and right wheels that might pitch an erect operator sideways from the vehicle.

Furthermore the leg support device may provide an equipment to adjust the position of the shells, so that equilibrium may be obtained even when supporting a heavy load supported to the front of the machine. Expediently the adjusting equipment comprises a spindle drive which preferably comprises a spindle whose threaded rod is provided with a rotating means, preferably a crank handle or a  
25 rotary knob.

In a particularly advantageous embodiment of the invention the leg support device is provided for swiveling around a vertical axis. When the person rotates his or her body to face into the direction of a turn, he may turn his hips and  
30 naturally rotate his knees to effect a tight swivel turn, the body initiating the movement from the ankle joints up. This natural way to control the vehicle enables new turning movements and encourages the person to move economically on the vehicle. In contrast, when using the prior art leg-saddle which is rigid about the horizontal plane, the body rotates from the knee joint up  
35 only. This results in additional strain being placed on the knee joint, and a decrease in the person's ability to face into the direction of the turn.

Expediently the leg support device is provided with a spring which is arranged

such that it is loaded when the leg support device is swivelled. Due to the force of the spring, the leg support device is placed in its centred position when the rotational force of the legs is taken off. Accordingly the leg support device is of a self-centring nature. Furthermore the shells provide a counterpressure for the swivel movement to the persons' leg and thereby provide better control of the swivelling movement.

Preferably the spring is arranged on a support rod of the leg support device which is connected to the platform.

10 An expedient embodiment of the invention is characterized by a replacement part comprising the leg support device. The replacement part is connectable to the base column of a commercially available vehicle of the aforementioned kind in place of the usual commercially provided height-adjustable column having handles.

15

The replacement part enables retrofitting of the vehicle but also an economic variation within the production.

In particular for retrofitting, for the right/left control of the vehicle it is proposed to provide two foot pedals; furthermore, the replacement part is provided with a rocker device that is provided with the foot pedals; by means of at least one arm projecting upwardly from the rocker device, an electric control member mounted on the replacement part is actuated for the control right/left. Preferably, the electric control member is a control member that is removed from the rotary handle of a commercially available attachment of the vehicle.

25

Moreover, the control member can be provided with a drive means cooperating with the arm, preferably a pin that is mounted on a rotary disk that engages a slotted hole or a bifurcation of the arm.

30

When the vehicle is produced from the start in accordance with the present invention, the control right/left will be realized preferably in a different way, for example, by pressure switches or by means of sensors in the platform that react to weight shifting from one foot to the other.

35

In a further embodiment of the invention which may be used as an alternative or additionally to the described right/left control the mentioned sensor device is

provided for determining the swivelling angle of the leg support device in relation to the platform, wherein the sensor device controls the driving direction of the vehicle by turning the wheels at different speeds based on the determined swivelling angle. The person can control steering of the machine by rotating his  
5 body towards the intended direction to initiate steering.

Alternatively or additionally the leg support device, preferably the attachment as a whole, may be tiltable in relation to the platform and the sensor device controls the driving direction of the vehicle by turning the wheels at different speeds based on the determined tilting angle. Driving direction of the vehicle can be controlled  
10 by leaning the body towards the intended direction to initiate steering.

In a further embodiment of the invention, the vehicle comprises a fender for each wheel a fender which partially encloses the wheel, wherein it preferably fully encloses at least the upper half of the wheel. The fender protects the person and the  
15 transported equipment against dirt which may be swirled up by the wheels. Furthermore it secures against unintended contact with environmental surroundings. In particular it prevents that clothes, e.g. long skirts or costumes that may be worn by actors using the vehicle in entertainment shows, from getting caught up in the wheels or the gears of the vehicle.

20 In a preferred embodiment of the invention the fender encloses the wheels to a height off the ground which corresponds to the height that the vehicle can climb. This height normally corresponds to approximately  $\frac{1}{4}$  of the wheel diameter but a climb up to  $\frac{1}{3}$  of the wheel diameter, as the case may be up to  $\frac{4}{9}$ , may be  
25 possible. When the vehicle comes into frontal contact with an object exceeding this height, the vehicle pushes it aside, or if the object is immovable, comes to rest against it. When the vehicle comes into glancing contact with an object, the blow deflects either the vehicle or the object. All these outcomes are preferable to the behavior of the known vehicle that attempts to climb any object it comes  
30 into contact with if it can obtain traction. This generally results in the vehicle performing an immediate emergency shut down and/or energetically ejecting the rider.

35 Expediently the fender comes down to different heights on the front and on its rear side. As the vehicle may safely descend a greater height that it may climb the fender systems may have a higher cut-off to the rear than to the front, allowing the vehicle to descend kerbs and drops. A rounded form of the rear cut-



off helps to prevent the fender from hanging-up on a surface the vehicle is descending from.

5 In a further embodiment of the invention the fender is provided for being directly connected to the chassis, in particular to a gear box, of the vehicle. Preferably it comprises an attachment flange that is provided for being fixed onto fixing

means of the gear box of the commercially available vehicle. Thereto the flange comprises mounting holes that fit with tapped holes of the chassis or gear box so that the flange can be bolted down onto it.

10

Furthermore the fender may solely present rounded contours at its outside so that it presents less danger to people and objects in the vicinity of the vehicle than sharp edges of the known vehicle.

15 In a particularly preferred embodiment of the invention the fender is provided for carrying a support for an object to be transported, in particular a "hard-mount" to support any tool, load, or supported equipment, e.g. a camera. In the art, the term "hard-mount" refers to a system of supporting equipment that does not use the physical strength of a person operating the equipment. Expediently the

20 support comprises an articulated bracket and preferably is provided to be pivotable to the front and the rear of the vehicle.

Though the fenders may be made of a single piece, in a preferred embodiment of the invention it is made of two half-shells, wherein preferably an inner half-shell is

25 connected to the gear box and an outer half-shell encloses the wheel's outer side.

The inner half-shell may be provided to solely carry the mentioned object support. Preferably it is made of a material, e.g. steel or aluminium, providing sufficient strength to bear the object support carrying the object.

30 Expediently the outer half-shell can be manufactured in a variety of sizes to fit different wheels. It may be made of a less heavy material, e.g. a plastic material that is malleable and therefore less like to cause damage to people or surroundings.

35 In a further development of the invention the vehicle comprises means for automatically stabilizing the vehicle against falling over forward or backward in case of a vehicle cut-off in order to maintain the vehicle in its erect orientation when it has shut down. During any instance of the vehicle's loosing power, either

by malfunction or initiated by the person, these supports may be rapidly deployed to prevent the transporter from falling over.

5 Preferably the stabilizing means comprises at least one extendible support wheel on the front side and at least one on the rear side of the vehicle. It descends to project below and away from the chassis of the vehicle to make contact with the ground at angles suitable to stabilizing the transporter when it is not under power.

10 In a preferred embodiment of the invention the support wheels are arranged on a telescopic rod which is provided with a spring, in particular a gas spring or a helical spring, by force of which the telescopic rod can be extended.

15 In a further development of the invention the vehicle comprises a means to manually shut down the power supply of the vehicle when the person is aboard. When carrying or operating equipment it may be desirable to shut off power to the vehicle in conjunction with the above-mentioned stabilizers. The shut down means operates by directly cutting power between the power supply and the motor and control systems of the vehicle by means of an electrical switch.

20 In a preferred embodiment the shut down means comprises power supply connector plug which is extensible out of a connector holder that preferably is arranged on the upper side of the vehicle so that the vehicle can be shut down by pulling the connector plug upwards out of the connector holder and thereby to operate the electrical switch.

25 Expediently the connector plug and the connector holder are provided such that the connector plug is extensible out of the connector holder in a vertical direction and in angles up to at least 15°, preferably up to at least 30°, to the vertical axis of the vehicle.

30 For easy use during driving the vehicle, the connector plug may comprise a control rope which is provided to be held in a hand of the person.

It is a matter of course that the leg support device, the fender, the stabilizers and the shut down means may be provided independently of each other and each in itself beneficial for the vehicle.

35 Furthermore the fender, the stabilizers and/or the shut down means may also be applied to any known embodiment of prior art vehicles, e.g. „Segway®“, which may comprise the above mentioned two handles instead of the leg support device, or other two-wheel battery-powered vehicles according to preamble of

claim 1.

These and other objects and advantages will be made apparent when considering the following detailed specification when taken in conjunction with  
5 the drawings.

- FIG. 1 shows a front view of a vehicle according to the invention,  
FIG. 2 shows a side view of the vehicle according to FIG. 1,  
FIG. 3 shows a perspective view of the vehicle according to FIG. 1,  
10 FIG. 4 shows a top view of the vehicle according to FIG. 1,  
FIG. 5 shows a perspective view of a detail of the vehicle according to FIG. 1,  
FIG. 6 shows another perspective view of a detail of the vehicle according to FIG. 1,  
15 FIG. 7 shows a side view of a detail the vehicle according to FIG. 1,  
FIG. 8 shows a top view of a detail the vehicle according to FIG. 1,  
FIG. 9 shows a perspective view of a detail of the vehicle according to FIG. 1,  
FIG. 10 shows another perspective view of a detail of the vehicle according to FIG. 1,  
20 FIG. 11 shows a n exploded perspective view of a detail of the vehicle according to FIG. 1,  
FIG. 12 shows a n exploded perspective view of a detail of the vehicle according to FIG. 1,  
25 FIG. 13 shows a perspective view of the vehicle according to FIG. 1 when used by a person,  
FIG. 14 shows a perspective view of a detail of the vehicle according to FIG. 1 when used by a person,  
FIG. 15 shows a part of a fender according to the invention in different views,  
30 FIG. 16 shows another part of a fender according to the invention in different views,  
FIG. 17 shows another part of a fender according to the invention in different views,  
FIG. 18 shows a n arm of a n object support according to the invention in different views,  
35 FIG. 19 shows a front view of another vehicle according to the invention,  
FIG. 20 shows a side view of the vehicle according to FIG. 19,  
FIG. 21 shows a perspective view of the vehicle according to FIG. 19,

- FIG. 22 shows a perspective view of another vehicle according to the invention when used by a person,
- FIG. 23 shows a perspective view of a component part of the vehicle according to FIG. 19,
- 5 FIG. 24 shows the component part according to FIG. 23 in a lateral view,
- FIG. 25 shows a perspective view of the component part according to FIG. 23 in another functional position,
- FIG. 26 shows a lateral view of the component part according to FIG. 23 in another functional position,
- 10 FIG. 27 shows a lateral view of a detail of the component part according to FIGS. 23 - 26,
- FIG. 28 shows a lateral view of the component part according to FIG. 23 in different functional positions,
- FIG. 29 shows another perspective view of a component part of the vehicle according to FIG. 19,
- 15 FIG. 30 shows a perspective and a lateral view of an element of the vehicle according to FIG. 19,
- FIG. 31 shows lateral views of the component part according to FIGS. 23 - 29 and the element of the vehicle according to FIG. 30, and
- 20 FIG. 32 shows a part of another fender according to the invention in different views,
- FIG. 33 schematically shows different functional positions of a vehicle according to the invention in top views,
- FIG. 34 shows different functional positions of a vehicle according to the invention in front views, and
- 25 FIG. 35 shows schematically details of the vehicle according to FIG. 19 - 22.

The following detailed description is directed to certain specific embodiments of the invention. However, the invention can be embodied in a multitude of different ways as defined and covered by the claims and their equivalents. In 30 this description, reference is made to the drawings wherein like parts are designated with like numerals throughout.

Unless otherwise noted in this specification or in the claims, all of the terms used in the specification and the claims will have the meanings normally ascribed to 35 these terms by workers in the art.

Unless the context clearly requires otherwise, throughout the description and the claims, the words "comprise," "comprising" and the like are to be construed in an inclusive sense as opposed to an exclusive or exhaustive sense; that is to say, in a

sense of "including, but not limited to." Words using the singular or plural number also include the plural or singular number, respectively. Additionally, the words "herein," "above," "below," and words of similar import, when used in this application, shall refer to this application as a whole and not to any particular portions of this application.

The above detailed description of embodiments of the invention is not intended to be exhaustive or to limit the invention to the precise form disclosed above. While specific embodiments of, and examples for, the invention are described above for illustrative purposes, various equivalent modifications are possible within the scope of the invention, as those skilled in the relevant art will recognize. For example, while steps are presented in a given order, alternative embodiments may perform routines having steps in a different order. The teachings of the invention provided herein can be applied to other systems, not only the systems described herein. The various embodiments described herein can be combined to provide further embodiments. These and other changes can be made to the invention in light of the detailed description.

Any and all the above references and U.S. patents and applications are incorporated herein by reference. Aspects of the invention can be modified, if necessary, to employ the systems, functions and concepts of the various patents and applications described above to provide yet further embodiments of the invention.

FIG. 1-4 show a vehicle 1 according to the present invention which provides a platform 2 configured as a flat box, two wheels 3 connected to the platform 2 and enfolded by fenders 200, a battery-powered wheel drive driving the two wheels 3, an attachment 100 connected to the platform 2 and a sensor device arranged in the platform 2. On one of the fenders 200 is mounted a support 300 for an object to be transported.

The attachment 100 at the front end of the vehicle 1 extends upwardly from the platform 2. It is comprised of a rigid base support 101 fixedly connected to the platform 2 and a support column 102 which is positioned with a socket 103 to the base support 101. The support column 102 extends at a slant upwardly and is connected to a support rod 104 of a leg support device 110 comprising front shells 111, 112 and rear shells 113, 114. The front and rear shells 111-114 are provided with lay-on surfaces 115-118 for the legs of a person which provide approximately the form of a quadrant.

As it can be seen in FIG. 1 and 3 the front shells 111, 112 are arranged in a higher position than the rear shells 113, 114.

As presented in FIGS. 5 - 10, the leg support device 110 comprises an adjustable rod system 120 carrying the shells 111- 114. FIGS. 9 and 10 show the rod system 120 with the front and rear shells 111 - 114 removed.

The rod system 120 comprises a middle support rod 124 which is connected to the support rod 104, a front support member 133 carrying the front shells 111, 112, a further middle support rod 129 connected to the rear shells 113, 114, and a rear adjustment member 137.

The middle support rod 124, the front support member 133, the middle support rod 129, and the rear adjustment member 137 are connected with each other by sliding rods 160, 161.

The leg support 110 as a whole is height-adjustable by moving and subsequently fixing the rod system 120 along the rigid base column 104.

The rear shells 113, 114 are mounted on a rear support member 131 which is arranged slidable on a support bar 132 in order to adjust the height of the rear shells 113, 114 in respect to the front shells 111, 112.

The front shells 111, 112 are mounted on the front support member 133 which comprises a horizontal bar 134 and a support block 135. Together with the further middle support block 129 and the rear adjustment member 137 the front support member 133 is horizontally adjustable by means of a spindle drive 121 comprising a threaded rod 122. The threaded rod 122 is fed through a tapped bore 123 of middle support rod 124 and provided with a crank handle 125.

Analogously a spindle drive 126 with a threaded rod 127, a tapped bore 128 of the further middle support rod 129 and a crank handle 130 is provided for the rear support member 131 in order to adjust the rear support member's horizontal position in respect to the front support member 133.

While the transverse horizontal space between the respective left and right shells 111 - 114 is adjustable to comport to variations in space between different person's legs, the position of the leg support device 110 as a whole is adjustable to move the person's 400 center of gravity which may include camera gear forwards and backwards to achieve equilibrium in the stopped position. The position may be adjusted by use of the spindle drives 121, 126 and the handle 125, 130 which may be adjusted while in use.

The front shells 111, 112 are fixed on the horizontal bar 134 which is arranged pivotable around a horizontal axis in a support bore of a carrier block 135. The position of the horizontal bar 134 can be fixed with bolts 136 which are arranged  
5 in threaded bores that lead to the support bore.

The position of the front shells 111, 112 can individually be adjusted against each other by loosening bolts 136, pivoting the front shells 111, 112 around the horizontal bar 133 and/or move them along it and fixing the bolts 136 again.

10 In the same manner the position of the rear shells 113, 114 can be adjusted by loosening and bolts 139, pivoting/moving the rear shells 113, 114 around/along a horizontal bar 138 of the rear support member 131, and subsequently fixing the bolts 139 again.

15 The front and rear shells 111 - 114 may be rotated about the transverse horizontal axis of the horizontal bars 133, 138 to accommodate persons of varying bone structure and muscular development. Thus the disclosed leg support device 110 can accommodate persons presenting differing leg angles in both the vertical and horizontal axis.

20 As FIG. 11 and 12 show detailed in exploded perspective views, the leg support device 110 is mounted on a swivel assembly 140 which connects the support rod 104 and the leg support device 110. The leg support 110 device can be pivoted around the longitudinal axis of the support rod 104 by means of the swivel  
25 assembly 140.

The swivel assembly 140 comprises a spring compartment which is made of a base plate 142 firmly fixed on the support rod 104, a U-shaped sidewall member 143 and a clamp 149 that sits on the sidewall member 143. The base plate 142 is  
30 connected to the support rod 104 by means of plug connection comprising a connecting bar 141 which fits into the support rod 104 and a cut-out of the base plate 142. While a superior part of a rotary bar 148 is arranged within the middle carrier rod 124 of the leg support device 110, a lower part sits in the spring compartment. A wedge 150 with two perpendicularly protruding pins 145 is  
35 arranged on the lower part of the rotary bar 148. On each lateral side of the pins 145, i.e. between the pins 145 and even parts 151 of the U-shaped sidewall member 143, a resilient silicone pad 146 acting like a spring is arranged. On the

front side of the spring compartment, a spring load adjusting plate 144 that is provided with a recess is arranged. The closing plate 144 is fastened to rotary bar 148 by an adjusting bolt 147 that presses the adjusting plate 144 against the silicone pads 146.

- 5 The leg support device 110 can be swiveled against the force that is necessary to deform the silicone pads 146. When the force is taken off, the silicone pads 146 push the leg support device 110 back in a centred position.

The spring load provided by the silicone pads 146 can be adjusted with the aid of the adjusting bolt 147. If the adjusting bolt 147 is tightened strongly the adjusting plate 144 presses on the silicone pads 146. As a result the silicone pads 146 are compacted in the spring compartment and a greater force is necessary to deform them. Accordingly the leg support device 110 exerts more counterpressure against the legs of the person when his legs abut against the front or the rear shells 15 111 - 114. Correspondingly, if the adjusting bolt 147 sits only loosely on the closing plate 144, swiveling the leg support device 110 is easier.

Referring to FIG. 13, the vehicle 1 is shown when used by a person 400. The person 400 stands with his feet 404 on the platform 2 and his legs 401 lay on the lay-on 20 surfaces 115 - 118 of the shells 111 - 114.

As it is shown more detailed in FIG. 14 which shows a section of the leg support device 110 and one of the legs 401 of the person 400 when standing on the vehicle 1 the front shells 111, 112 lay above and on the knees 402 on the fore side of the legs 401 and the rear shells 113, 114 lay on the person's 400 calfs 403.

25 As it is illustrated in Fig. 14, when accelerating the vehicle 1 the person 400 can lean forward and thereby abut his knees 402 and/or his upper legs 401 against the front shells 111, 112 (see arrow F). To decelerate or to reverse he can lean backwards by bending his knees 402 (see arrow K) and moving into a sitting 30 position wherein calfs 403 back against the rear shells 113, 114 (see arrow R). When the person 400 wants to turn the vehicle and thereto twists his upper body in the turning direction the leg support device 110 follows the corresponding movement of person's legs and swivels by means of the swivel assembly 140 (see arrow S on Fig. 13). FIG. 33 shows in a top view the positions of the leg support device 110 in 35 relation to the platform when it is swivelled to the right (FIG. 33 (a)) or to the left side (FIG. 33 (b)). When swivelling the leg support device 110, the rotary bar 148 pivots about its longitudinal axis and the pins 145 are pressed against the resilient



silicone pads 146. Once no swivelling force acts on the leg support device 110, the silicone pads 146 push it back into a centred position.

The swivel assembly may comprise sensor equipment for detecting the swivel angle of the leg support device 110 in relation to the support rod 104 or/and the platform 2. The sensor equipment is arranged in the support rod 104 and measures the degree of rotation of the rotary bar 148 in relation to the support rod 104 or the spring compartment. It is connected to the sensor device so that the determined degree of rotation can be used as steering information for the right/left control of the vehicle. The driving direction of the vehicle 1 can be controlled in function of the swivel angle by driving the wheels at different speeds so that the person 400 can steer the vehicle by pivoting the leg support device 110.

Another possibility is to arrange the attachment 100 as a whole such that it is tiltable on the platform wherein the attachment is self-centring by force of a spring. If the vehicle comprises a sensor equipment for detecting tilting angle of the attachment 100 in relation to the platform 2, the person 400 can control the driving direction of the vehicle by leaning his body to the left or to the right and thereby pushing the attachment in the corresponding direction. Right/left tilting positions of the attachment 100 are shown in Fig. 34 (a) and (b).

Furthermore the sensor equipment for detecting the swivel angle of the leg support device and the sensor equipment for detecting tilting angle of the attachment 100 can be combined so that the person can steer the vehicle by tilting as well as by swivelling.

As it can be seen in FIG. 1 to 4, the fenders 200 are made of two half-shells 201, 202. FIG. 15 shows in different views the inner half shell 201 which may be made of steel in order to be able to withstand heavy loads. On its closed side 203 it has a rectangular cut-out 204 with which it overlaps the platform 2. A semi-fordial flange 205 is connected to the inner side of the half shell 201. As presented in FIG. 15 (e) the flange 205 is provided to sit over and partially enclose a part of the gear box 4 connecting the wheels 3 and is fixed on the gear 4 box by means of bolts that are led through bores 206. The bores 206 are arranged such that they fit with threaded bores that are provided on the gear box 4 of a commercially available vehicle („Segway®”).

FIGS. 16 and 17 show slimmer and broader embodiments of the outer fender half-

shells 202 which may be chosen in function of the wheel's 3 size.

The outside of the fenders 200 present solely rounded contours with no sharp edges, so that it offers less possibility of injuring or causing damage to any person or  
5 object the vehicle 1 may come into collision with.

As shown in FIG. 32 fender half shells 211,212 can be provided such that they enclose the wheels 3 to a smaller degree than the fenders 200 shown in FIG. 1 - 4.

On the front side 213 the fenders 210 fully enclose the wheels 3 to a height off the  
10 ground that is consistent with the vehicles 1 climbing and descending capabilities. At their front ends, the fenders 210 descend to a height above the ground approximately equal to that of the height above the ground of the lower casing of a battery enclosure. This corresponds to the height that the vehicle 1 can safely climb. When the vehicle 1 comes into frontal contact with an object  
15 exceeding this height, the vehicle pushes it aside, or if the object is immovable, comes to rest against it.

On their rear side 214 the fenders 210 fully enclose the wheels 3 to a height off the ground such that it can descend a greater height that it may climb, allowing the vehicle to descend kerbs and drops. Furthermore a rounded nature of the fenders  
20 210 helps to prevent them from hanging-up on a surface the vehicle 1 is descending from.

FIGS. 1 to 4 show how a hard-mount assembly 300 that may be attached to the fenders 200. The hard-mount assembly 300 comprises an articulated arm 301  
25 which is fixed onto the fender 200 by means of a metal mount 302. As it is shown more detailed in FIG. 18 the hard-mount assembly 300 has three rotary joints 303 - 306 which allow exact adjustment of the arm 301.

Though the metal mount 302 of the vehicle 1 as shown in FIGS. 1 to 4 sits on the  
30 inner 201 as well as on the outer fender half shell 202, in particular for supporting heavy payloads it may be advantageous to mount it only on the inner half shell 201 that is made of steel, is connected directly to the gear box and is provided to carry heavy payloads.

A further embodiment of the inventive vehicle is shown in FIGS. 19 - 21. The  
35 vehicle 10 differs from the vehicle 1 outlined above in that it is provided with stabilizers 501, 502 on its front and its rear side. Each stabilizer 501, 502 comprises a telescopic rod 503, 504 which is mounted to a chassis 505 that vertically protrudes

form the platform 20 of the vehicle 10. Support wheels 505, 506 are arranged on ends of each of the telescopic rods 503,504.

The telescopic rods 503,504 are provided with a gas spring 510. As presented in FIG. 35 one part 511 of gas spring 510 is connected to an upper rod 507 of the telescopic rods 503,504 and a movable part 512 of the gas spring 510 is fixed to a lower rod 508 of the telescopic rods 503,504. When activated the gas spring 510 extends the telescopic rods 503,504 to make contact with the ground at angles suitable to stabilizing the vehicle 10.

The gas spring is automatically activated when the vehicle's 10 power supply is shut down. Then the stabilizers 501,502 maintain it in its erect position.

It is a matter of course that, alternatively, the telescopic rods 503,504 could be provided with helical springs for pulling them out.

As it is shown in FIG. 22 the inventive vehicle 10 can be provided with a shut down means to manually shut down the power supply of the vehicle 10 when the person 400 is aboard. The shut down means comprises power supply connector plug 601 which can be extended out of a connector holder 602 that is arranged on the upper side of the chassis 505. Thereto the connector plug 601 is provided with a rope 603 which the person 400 driving the vehicle 10 holds in one of its hands.

When the person 400 pulls the connector plug 601 out of the connector holder 602 the power supply of the vehicle 10 is interrupted, the stabilizers 501,502 extend and the vehicle 10 stops.

Component parts of the connector holder 602 are shown more detailed in FIGS. 23 - 29 and in FIG. 31. FIG. 30 and 31 show the connector plug 601.

As presented in FIGS. 23 - 26 a casing of the connector holder 602 is provided with a reception recess 604 for the connector plug 601. The connector holder 602 comprises a rotary switch element 610 (FIG. 27) that is provided with an outer recess 611, a central aperture 612, a connecting tab 613 and a contacting tab 614. The central aperture 612 of the switch element 610 is arranged on an axle pin which forms the axis of rotation of the switch element 610. The axle pin is provided with a pin head 606 which can be engaged with a corresponding tool. The connecting tab 613 is connected to a spring 607 that is fixed to the casing. Using the tool the switch element 610 can be rotated against the force of the

spring 607 such that the outer recess 611 is aligned with the reception recess 604 as shown in FIG. 23 and 24 and the connector plug 601 can be put into the reception recess 604. As presented in FIG. 28 (a), in this position the contacting tab 614 holds a button 621 of an electrical switch 620 of the power supply of the vehicle in a switch-on position in which the vehicle is supplied with electrical energy.

As soon as the connector plug 602 is pulled out of the reception recess 604, the spring 607 contracts and thereby turns the switch element 610 so that the contacting tab 614 turns in the position shown in FIGS. 25 and 26. The contacting tab 614 releases the button 621 and the electrical switch 620 gets in a switch-off position in which the power supply of the vehicle is interrupted.

Moreover, as it is presented in FIG. 29 and 35, the connector holder 602 comprises a bracket 620 for a hydraulic cylinder 621. The hydraulic cylinder 621 is hydraulically connected to another hydraulic cylinder 622 a flexible tube 623. The hydraulic cylinder 622 can release an actuator 624 of the gas springs 510 of the telescopic rods 503,504. When the switch element 610 turns in the switch-off position which is shown in FIG 35 (b) it impinges on the hydraulic cylinder 621 and as a result the hydraulic cylinder 622 releases the actuator 624 so that the gas springs 510 are released and the telescopic rods 503,504 pull out as described above.

Alternatively instead of the hydraulic connection, a electrical connection between the shut down device could be provided so that the gas springs 510 could be released electronically as well.

As shown in FIG. 30 (a) a plug-in-side of the connector plug 601 is bevelled on its ends 631,632 in order to fit in a complementary form of the reception recess 604 as shown in FIG. 23 (b). Furthermore the connector plug 601 is provided with a connecting recess 633 for fixing the rope 603.

Due to the bevelled ends the connector plug 601 can easily pulled out of the reception recess 604 in directions which are parallel to the longitudinal axis of the reception recess 604 and which are inclined to the perpendicular of the top of the casing (see arrows † in Fig. 31 (a)).

Moreover the connector plug 601 is thinner than the width of the reception recess 604 so that the connector plug 601 can easily pulled out of the reception recess 604 in directions which are perpendicular to the longitudinal axis of the reception recess 604 and are inclined to the perpendicular of the top of the casing (see arrows p in Fig. 31 (b)).

CLAIMS:

1. A two-wheel battery-powered vehicle comprising: a platform; two wheels  
5 connected to the platform; a battery-powered wheel drive driving the two  
wheels; an attachment connected to the platform; a sensor device  
arranged in the platform; wherein a person standing on the platform and  
engaging the attachment moves the platform into an angle position  
corresponding to a body position of the person, wherein, based on the  
10 angle position of the platform relative to a horizontal position, the sensor  
device controls the wheel drive such that the wheel drive, by acceleration  
or deceleration, keeps the vehicle and the person standing on the platform  
in a balanced position;  
wherein the attachment has a leg support device for at least one leg of the  
15 person standing on the platform in order to keep the platform at a desired  
angle position.
2. The vehicle according to claim 1, wherein the leg support device is  
provided to lie on the lower leg of the person.
- 20 3. The vehicle according to claim 1 or 2, wherein the leg support device is  
provided to lie on the leg upon an area of a calf of the person.
4. The vehicle according to one of claims 1 to 3, wherein the leg support  
25 device provides separate shells for its front and its rear side and the front  
and the rear shell are arranged in differing heights.
5. The vehicle according to one of claims 1 to 4, wherein the shell of the rear  
side is provided to sit on the calf and the shell of the front side is provided to  
30 sit on or above the knee of the person.
6. The vehicle according to one of claims 1 to 5, wherein the positions of the  
shells are adjustable independently of one another, preferably adjustable in  
a vertical and/or horizontal direction and/or pivotable about a vertical  
35 and/or a horizontal axis.
7. The vehicle according to one of claims 1 to 6, wherein an equipment to  
adjust the position of the shells comprises a spindle drive.

8. The vehicle according to one of claims 1 to 7 wherein the leg support device comprises a shell that is curved or angled and preferably essentially provides the form of a quadrant.
- 5
9. The vehicle according to claim 8, wherein the shell contacts the leg laterally.
10. The vehicle according to claim 8 or 9, wherein the shell contacts an inner side of the leg.
- 10
11. The vehicle according to one of claims 8 to 10, wherein the shell is cushioned.
12. The vehicle according to one of claims 1 to 11, wherein the leg support device is provided for swiveling around a vertical axis, in particular against the force of a spring.
- 15
13. The vehicle according to claim 12, wherein the spring is arranged on a support rod of the leg support device which is connected to the platform and on which the shells are fixed.
- 20
14. The vehicle according to one of claims 1 to 13, comprising a replacement part comprising the leg support device for the at least one leg, wherein the replacement part is adapted to connect to a base column of a commercially available vehicle and to replace a height-adjustable column provided with handles of the commercially available vehicle.
- 25
15. The vehicle according to claim 14, wherein the replacement part comprises a box-shaped column and a height-adjustable holder connected to the column, wherein the leg support device is connected to the holder, wherein the replacement part further comprises a slantedly positioned socket connected to the column and connected to the base column.
- 30
16. The vehicle according to one of claims 1 to 15, comprising a right/left control.
- 35
17. The vehicle according to claim 16, wherein the right/left control controls turning of the vehicle to the left or to the right in a traveling direction by driving the wheels at different speed.

18. The vehicle according to claim 16 or 17, wherein the right/left control is foot-operated.
- 5 19. The vehicle according to one of claims 16 to 18, wherein the right/left control comprises two pedals.
- 10 20. The vehicle according to one of claims 1 to 19, comprising a replacement part comprising the leg support device for the at least one leg, wherein the replacement part is adapted to connect to a base column of a commercially available vehicle and to replace a height-adjustable column provided with handles of the commercially available vehicle, wherein on the replacement part a rocker device with pedals is mounted, wherein the rocker device has an arm that projects upwardly and operates an electric control member of the right/left control, which control member is mounted on the replacement part.
- 15 21. The vehicle according to claim 20, wherein the control member is taken from a rotary handle of the attachment of a commercially available vehicle.
- 20 22. The vehicle according to one of claims 16 and 17, wherein the right/left control is operated by a movement of the attachment in relation to the platform.
- 25 23. The vehicle according to claim 22, wherein the right left control is operated by swivelling the leg support device.
- 30 24. The vehicle according to claim 22, wherein the right left control is operated by tilting the attachment and/or the leg support device in relation to the platform.
25. The vehicle according to one of claims 1 to 24, further comprising for each wheel a fender which partially encloses the wheel
- 35 26. The vehicle according to claim 25, wherein the fender fully encloses at least the upper half of the wheel.
27. The vehicle according to claim 25 or 26, wherein encloses the wheels to a

height off the ground which corresponds to the height that the vehicle can climb.

- 5 28. The vehicle according to one of claims 25 to 27, wherein on the front and on its rear side, the fender comes down to different heights.
- 10 29. The vehicle according to one of claims 25 to 28, wherein the fender is provided for being connected to the chassis and/or a gear box of the vehicle.
30. The vehicle according to one of claims 25 to 29, wherein the fender solely presents rounded contours at its outside.
- 15 31. The vehicle according to one of claims 25 to 30, wherein the fender is provided for carrying a support for an object to be transported, especially for a camera.
- 20 32. The vehicle according to claim 31, wherein the support comprises an articulated bracket.
33. The vehicle according to claim 31 or 32, wherein the support is connectable to the body of the person.
- 25 34. The vehicle according to one of claims 1 to 33, comprising means for automatically stabilizing the vehicle in case of a vehicle cut-off.
- 30 35. The vehicle according to claim 34, wherein the stabilizing means comprises at least one extendible support wheel on the front side and at least one on the rear side of the vehicle.
- 35 36. The vehicle according to claim 34 or 35, wherein the support wheels are arranged on a telescopic rod.
37. The vehicle according to claim 36, wherein the telescopic rod is provided with a spring, in particular a gas spring or a helical spring, by force of which the telescopic rod can be extended.
38. The vehicle according to one of claims 1 to 37, wherein the vehicle



comprises a means to manually shut down the power supply of the vehicle when a person is aboard.

- 5 39. The vehicle according to claim 38, wherein the shut down means comprises power supply connector plug which is extensible out of a connector holder.
40. The vehicle according to claim 39, wherein the connector holder is arranged on the upper side of the vehicle.
- 10 41. The vehicle according to claim 39 or 40, wherein the connector plug is extensible out of the connector holder in a vertical direction and in angles up to at least 15 °, preferably up to at least 30 °, to the vertical axis of the vehicle.
- 15 42. The vehicle according to one of claims 39 to 41, wherein the connector plug comprises a control rope which is provided to be hold in a hand of the person.

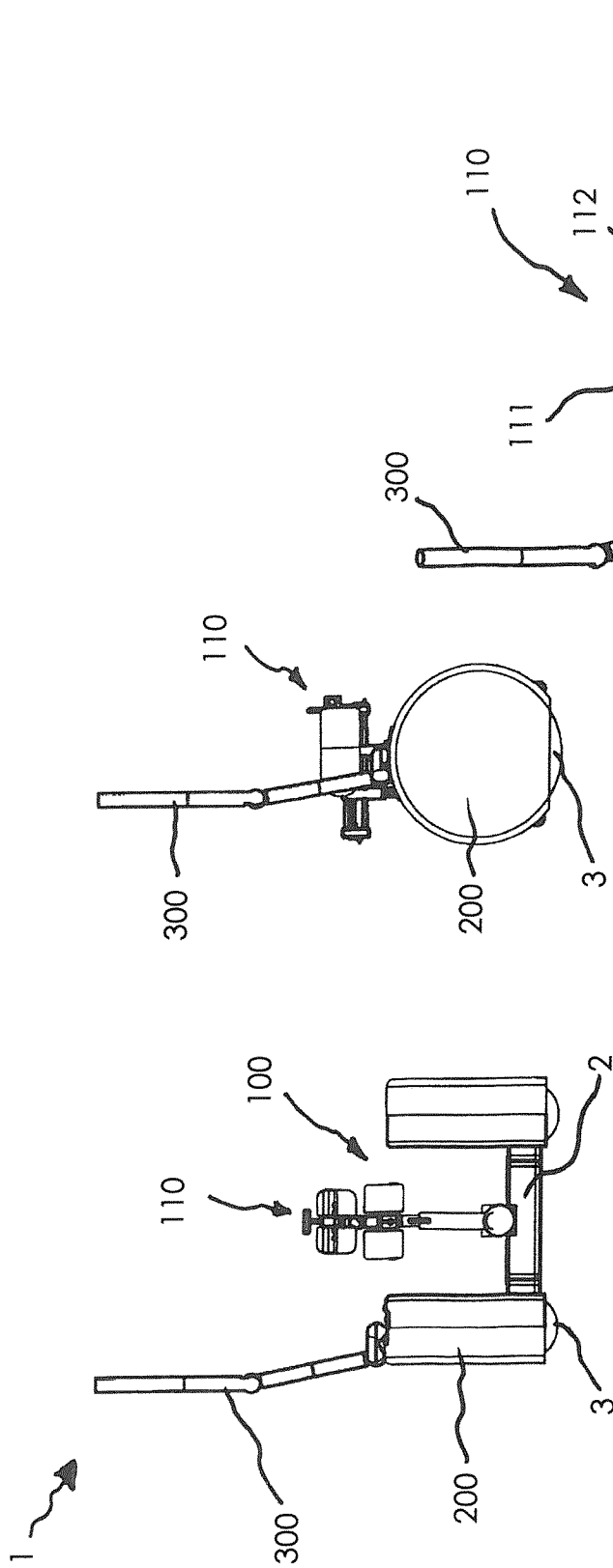


Fig. 2

Fig. 1

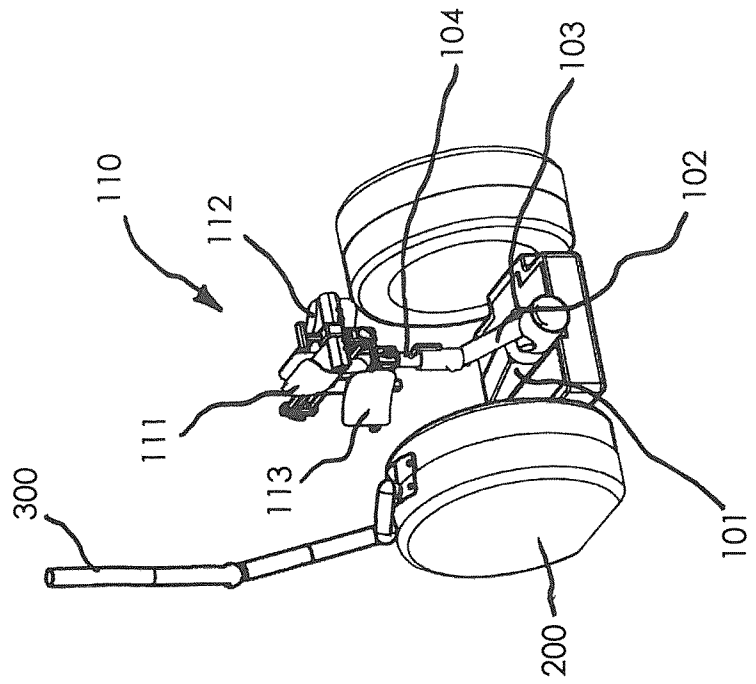


Fig. 3

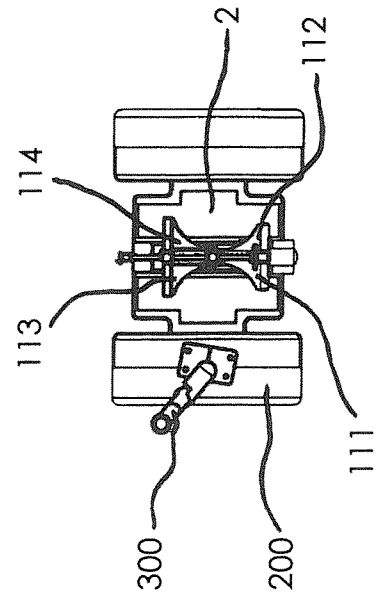


Fig. 4

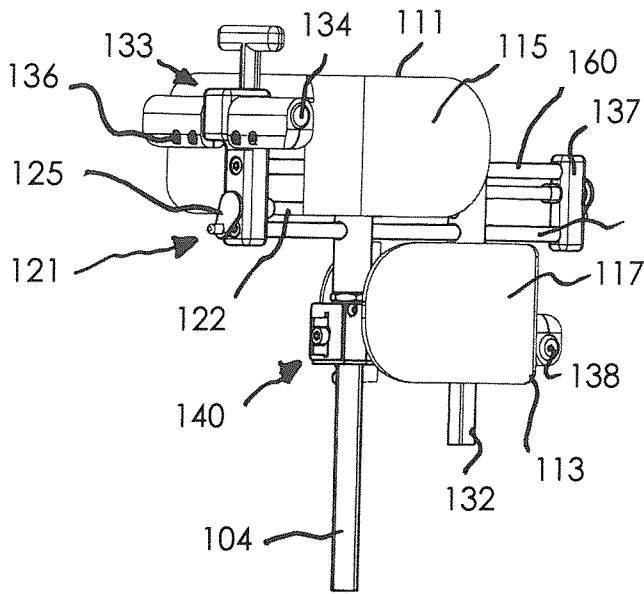


Fig. 5

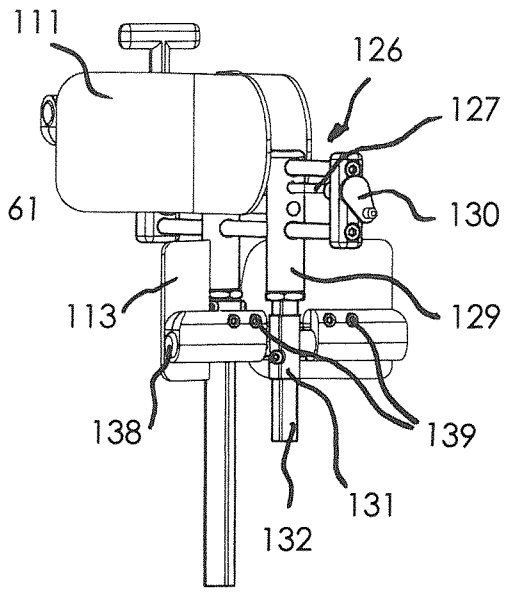


Fig. 6

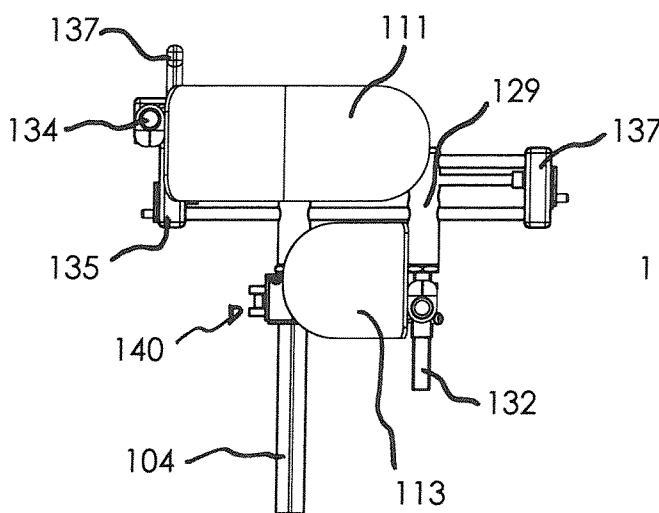


Fig. 7

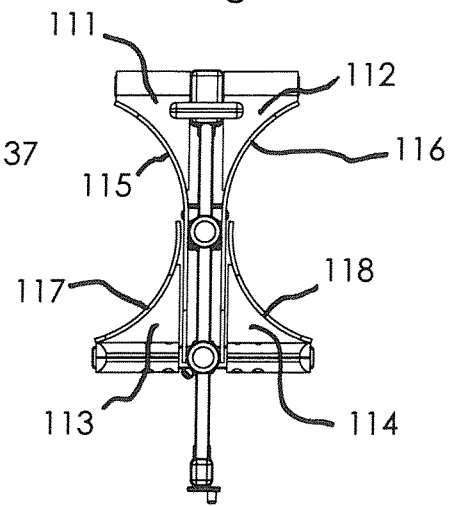


Fig. 8

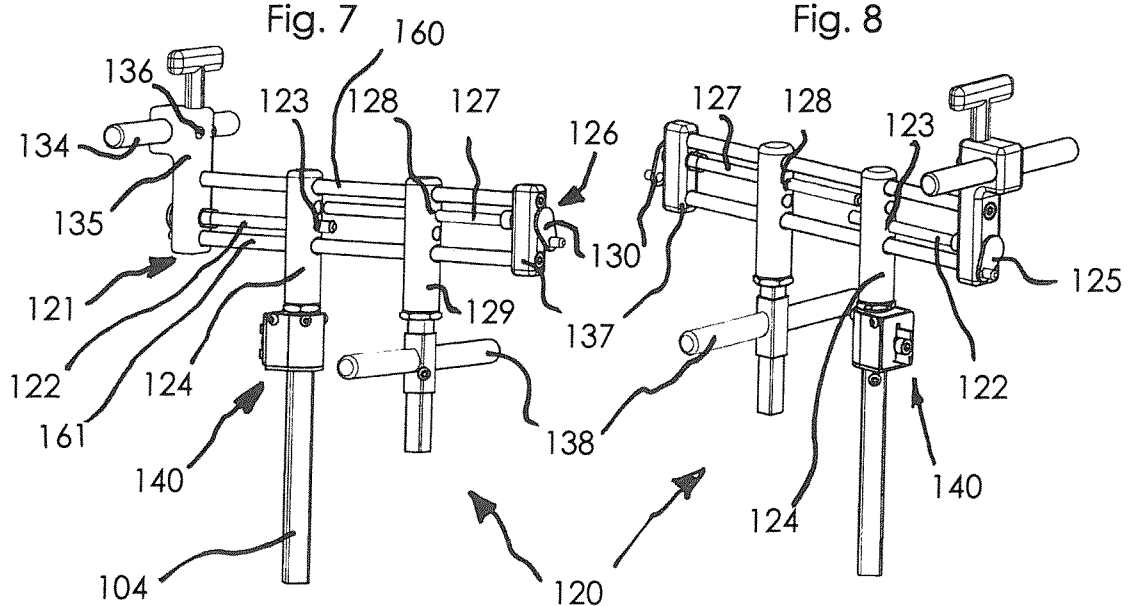


Fig. 9

Fig. 10

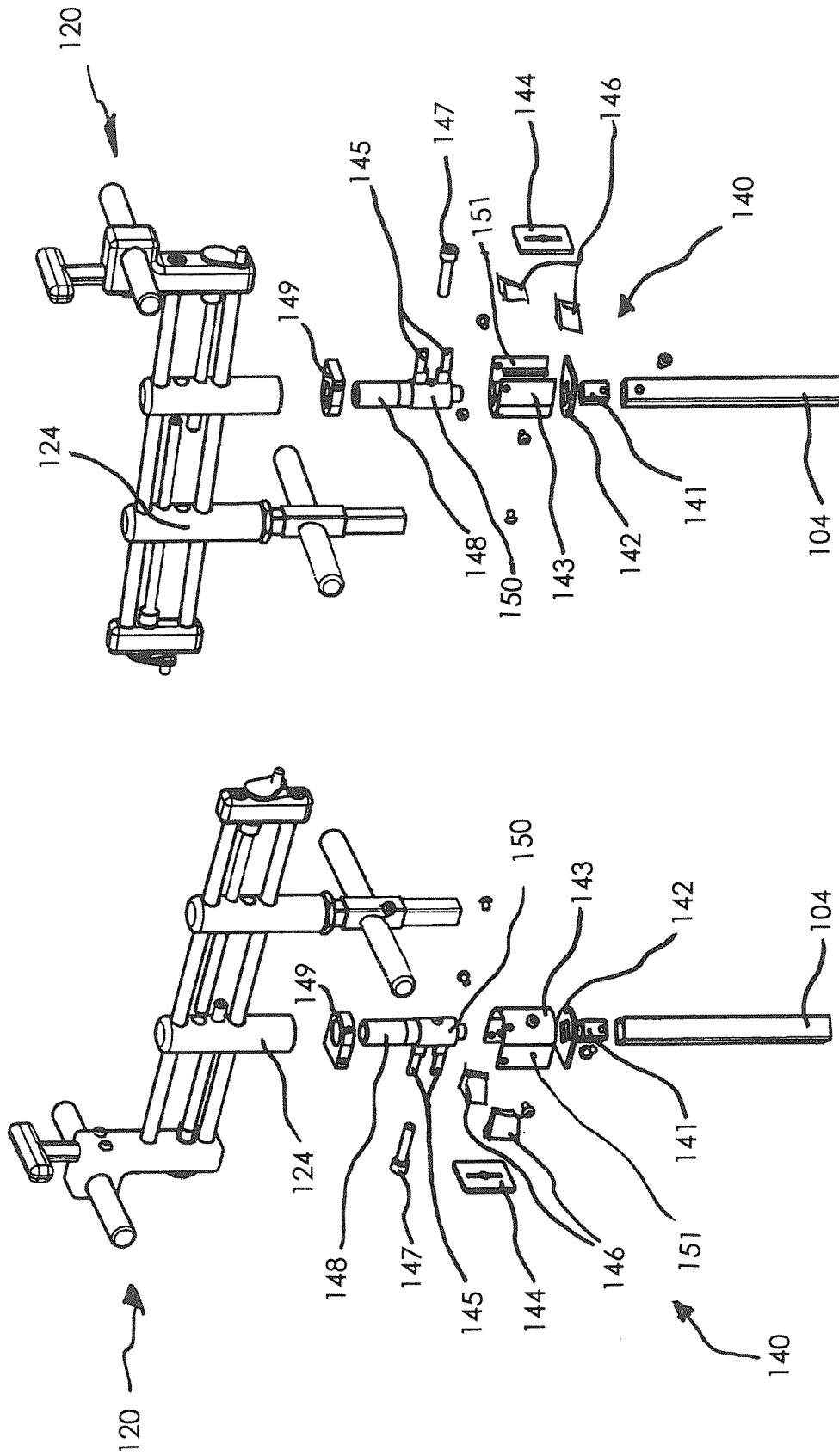


Fig. 12

Fig. 11

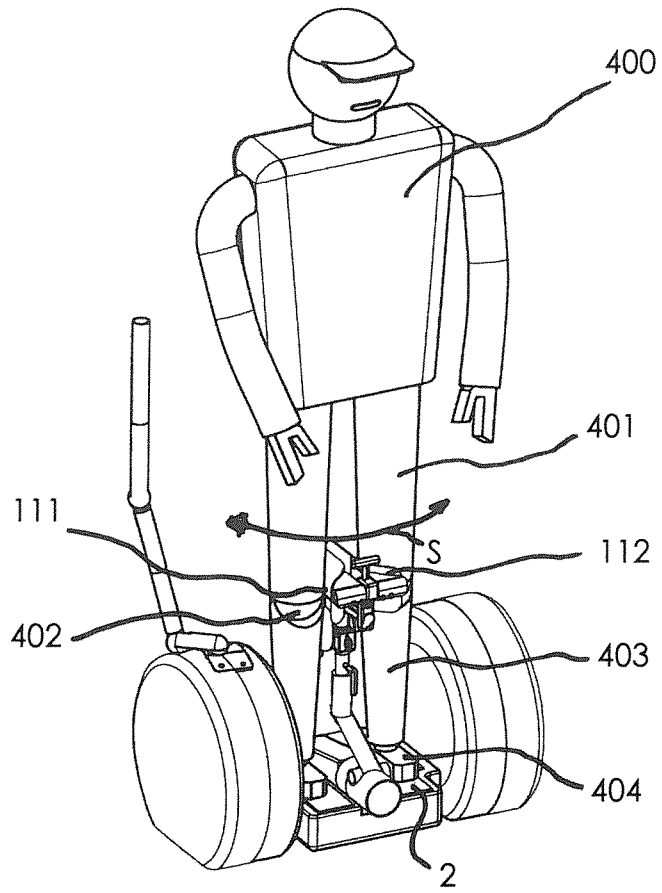


Fig. 13

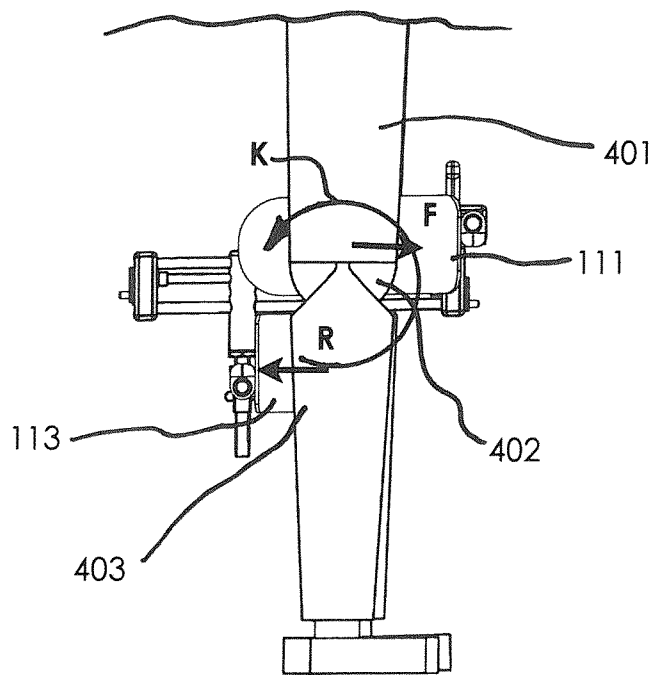


Fig. 14

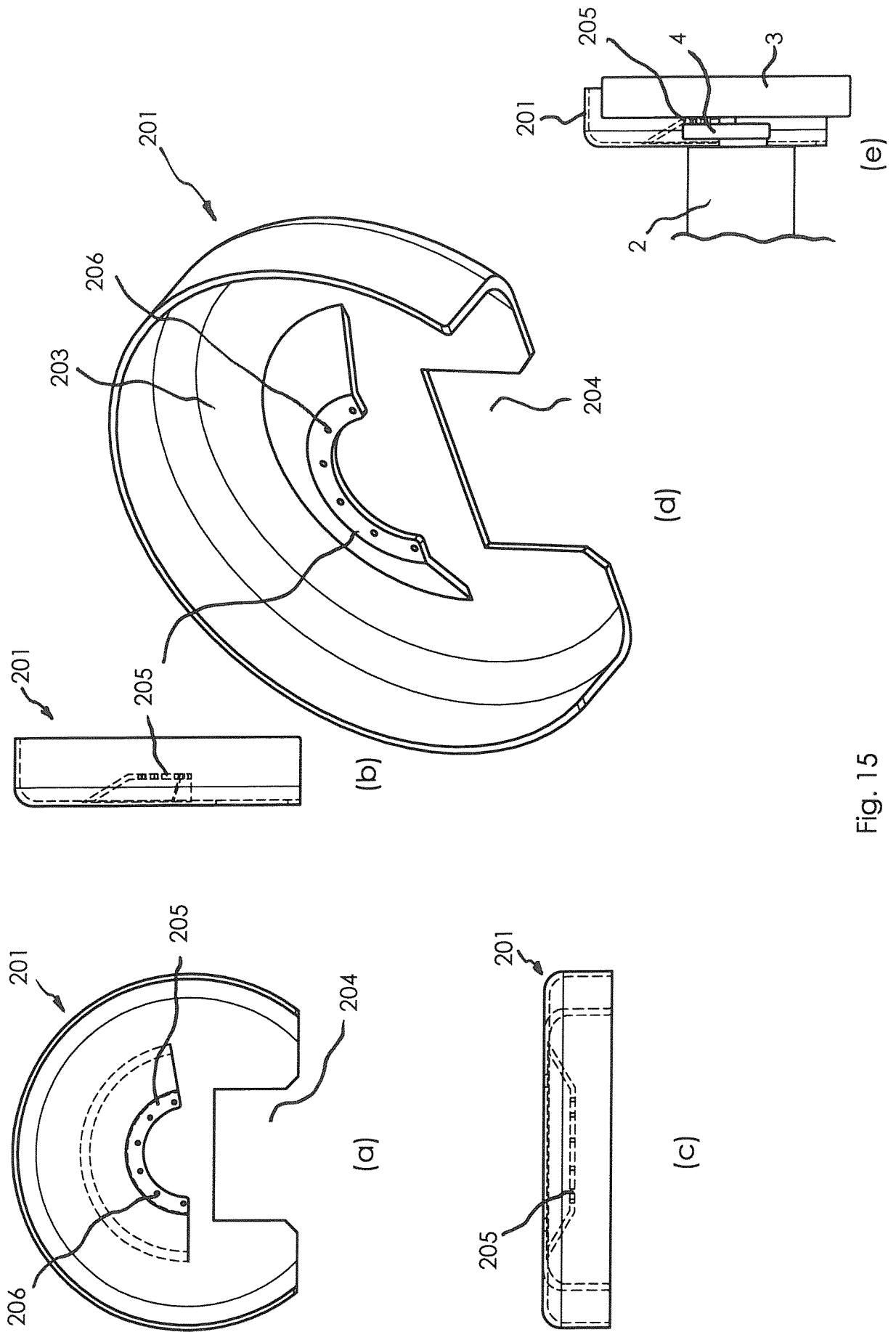


Fig. 15

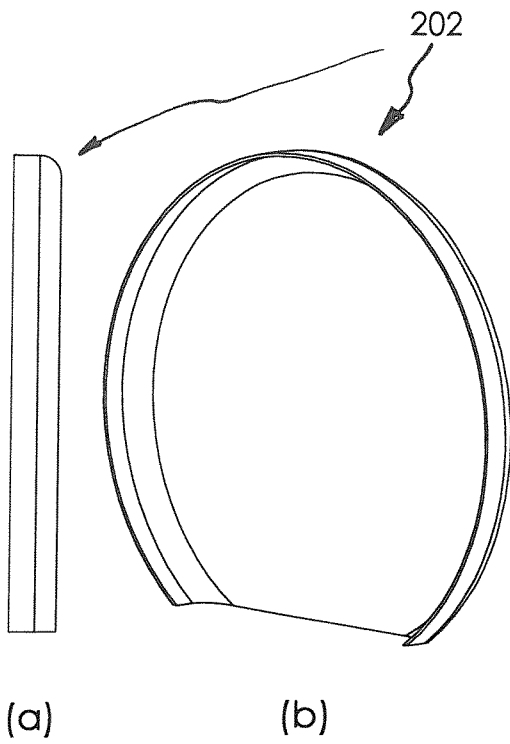


Fig. 16

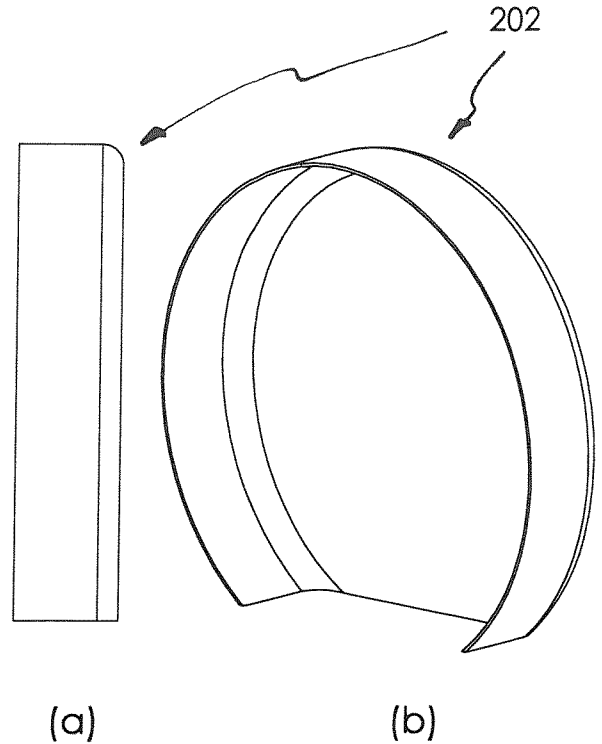


Fig. 17

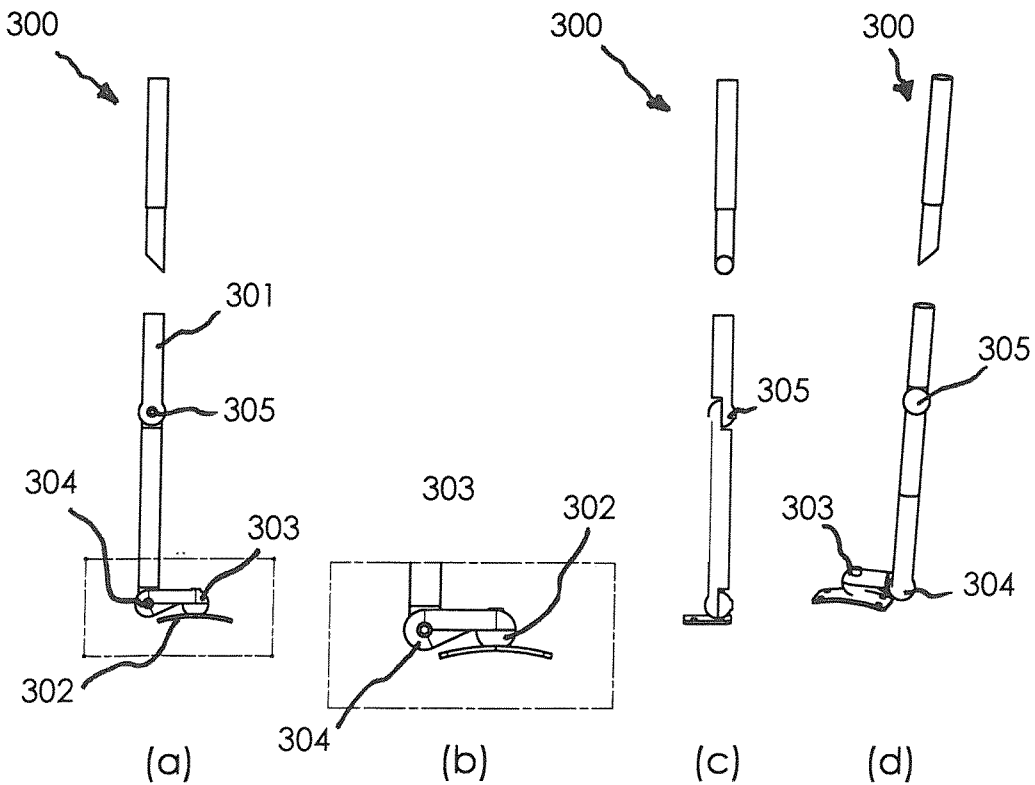


Fig. 18

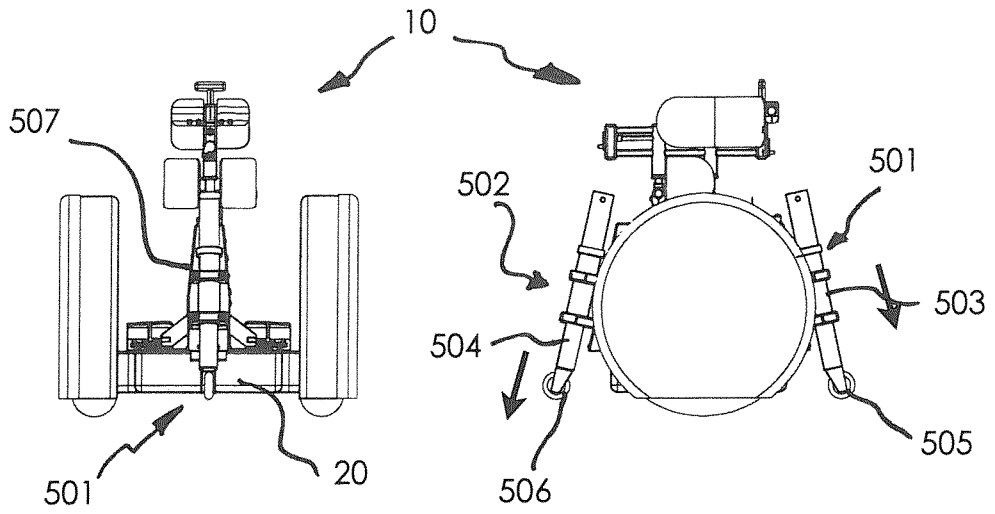


Fig. 19

Fig. 20

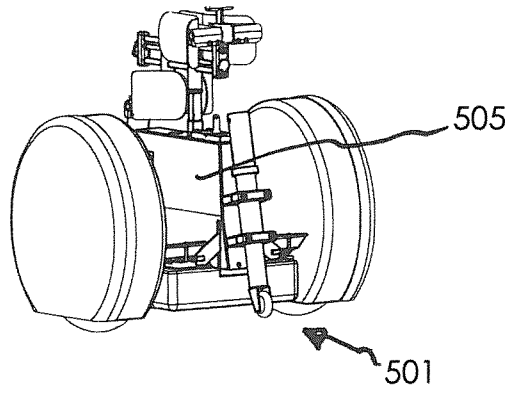


Fig. 21

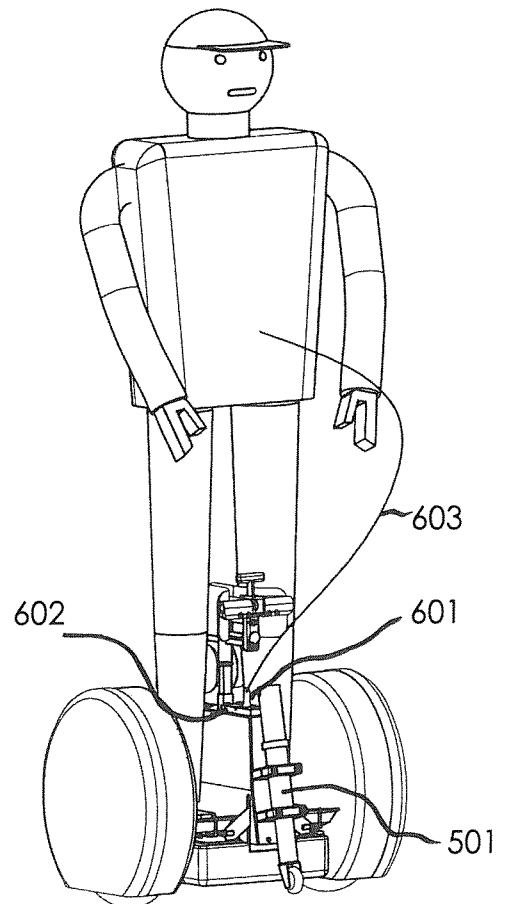


Fig. 22



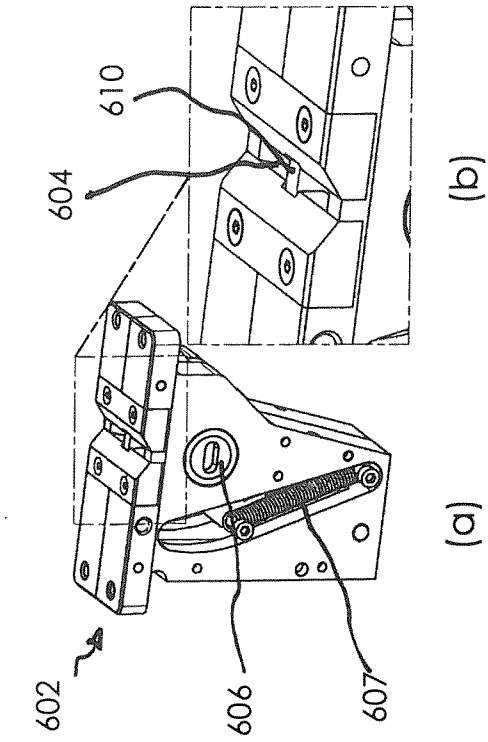


Fig. 23

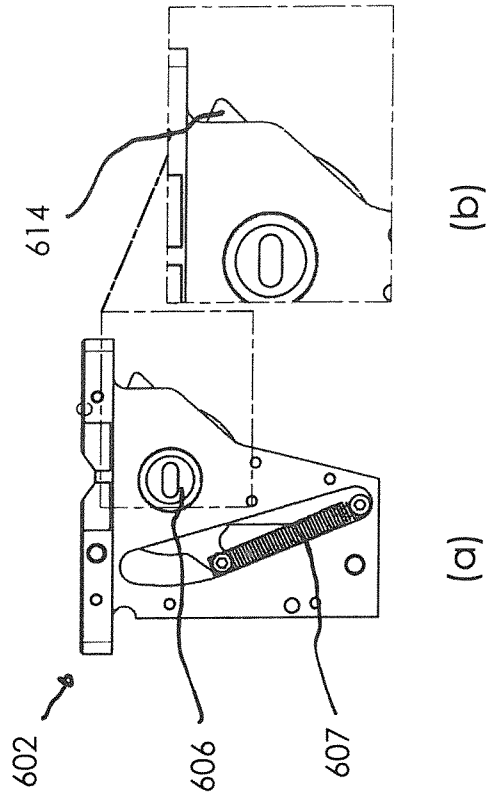


Fig. 24

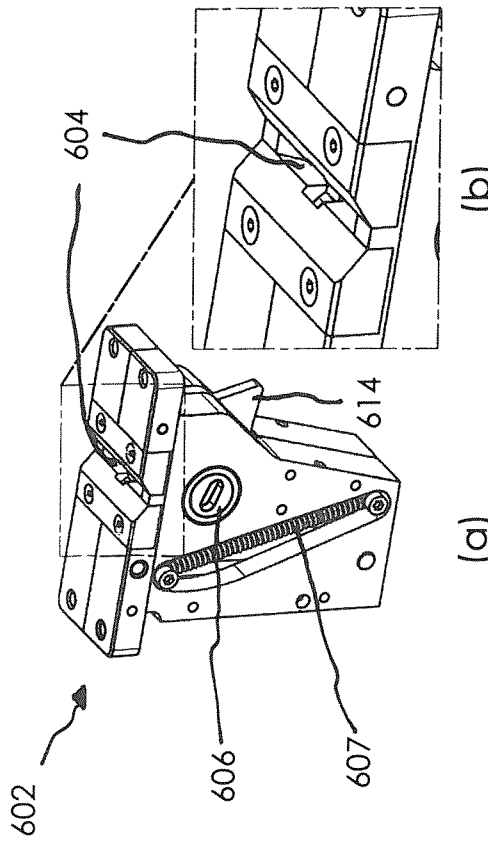


Fig. 25

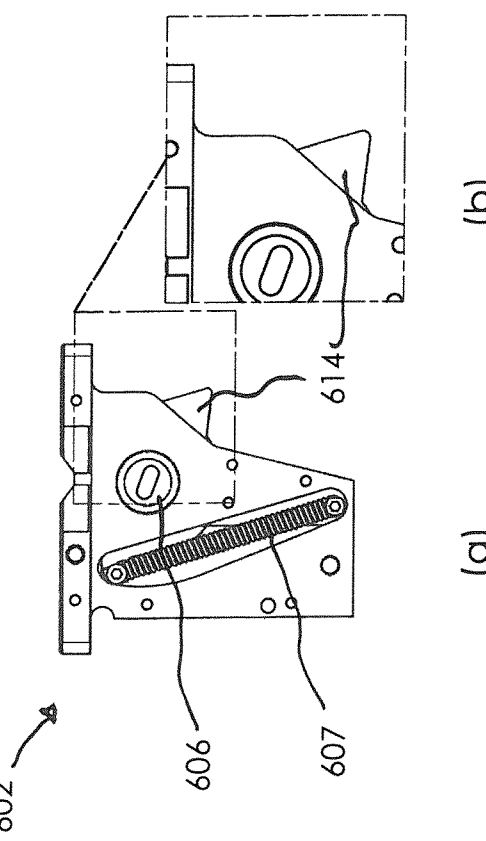


Fig. 26

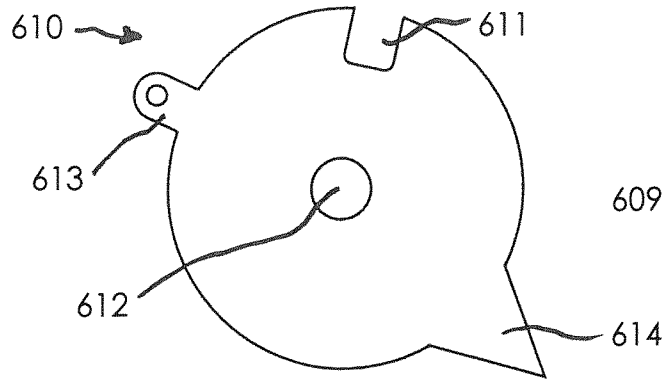


Fig. 27

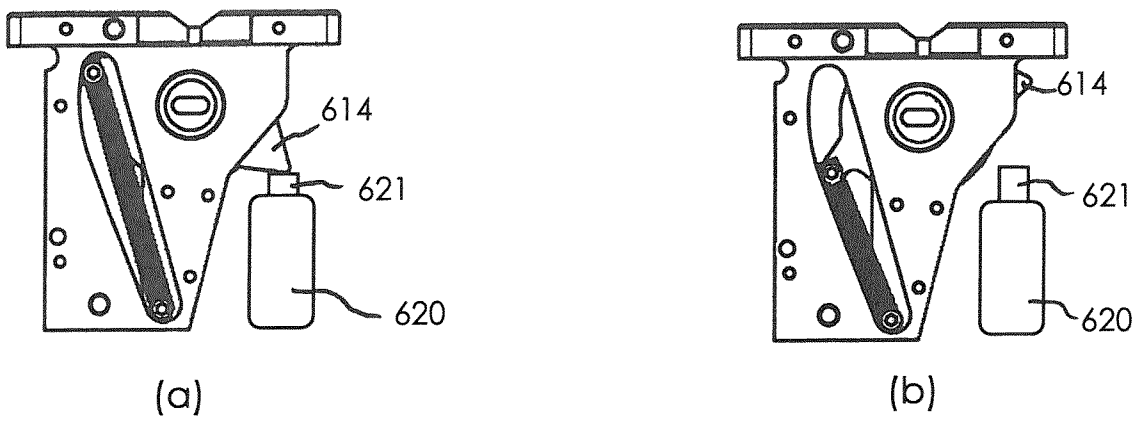


Fig. 28

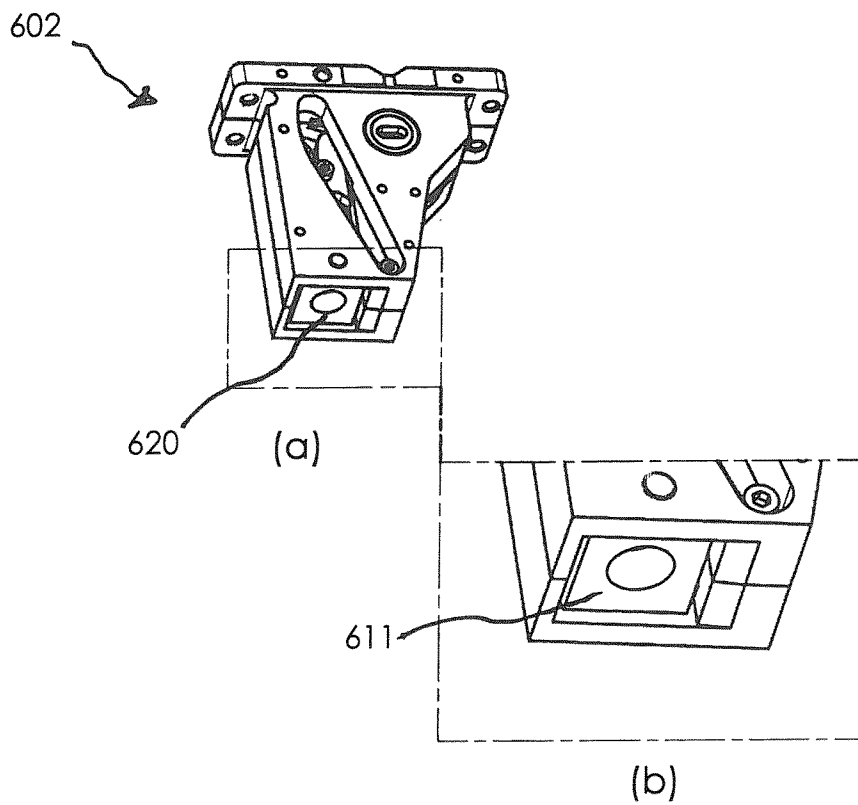


Fig. 29

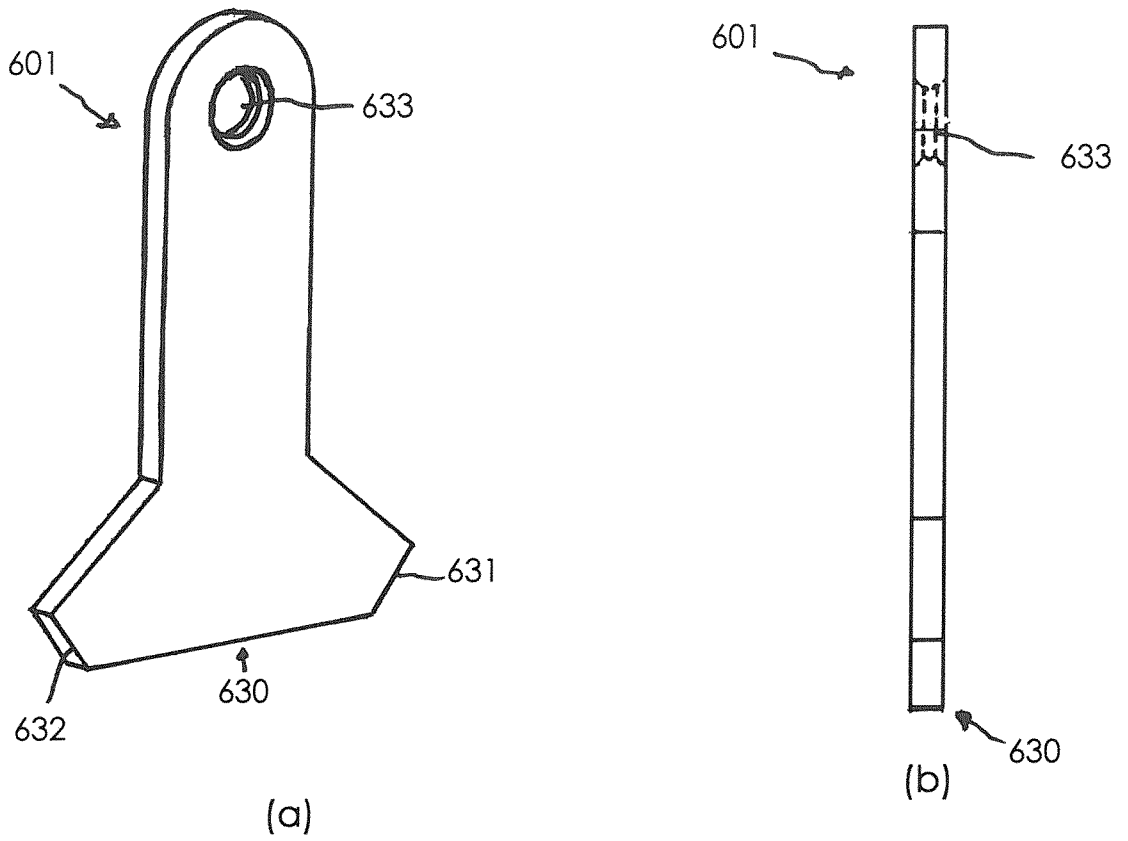


Fig. 30

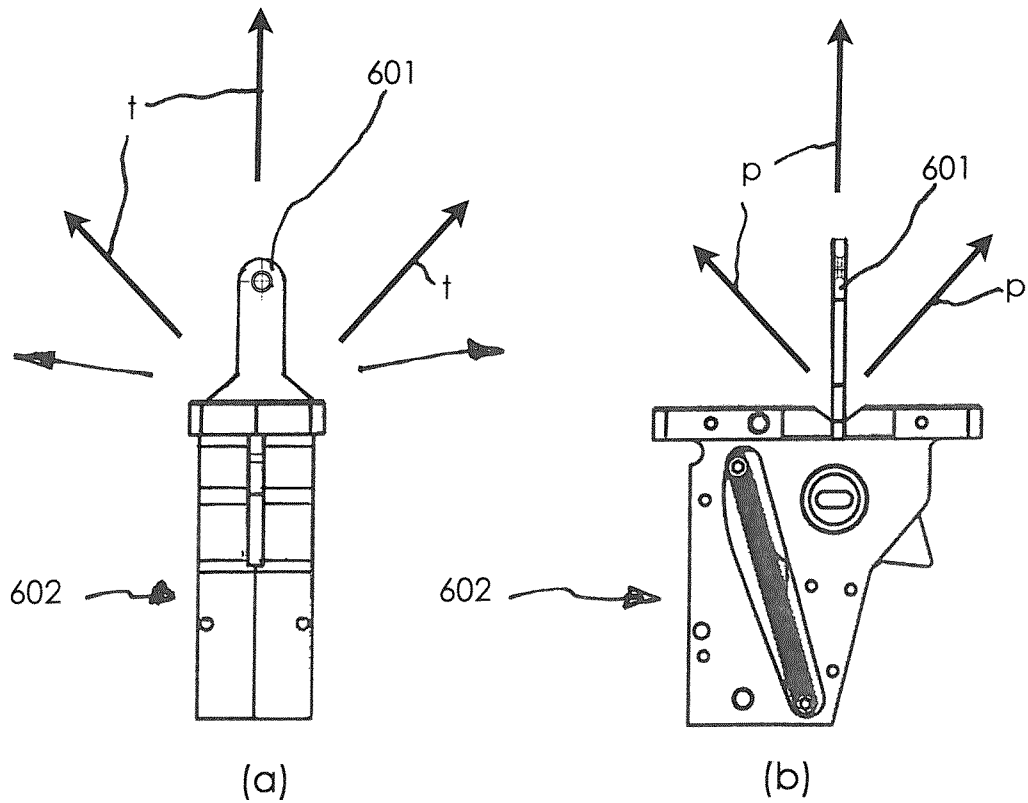


Fig. 31

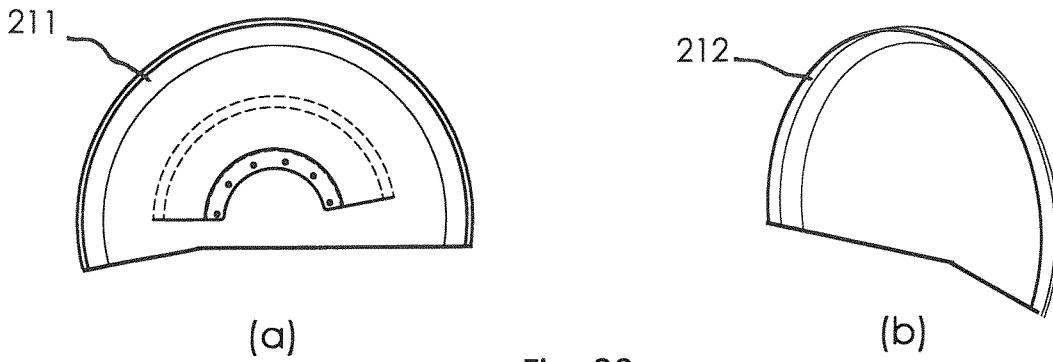


Fig. 32

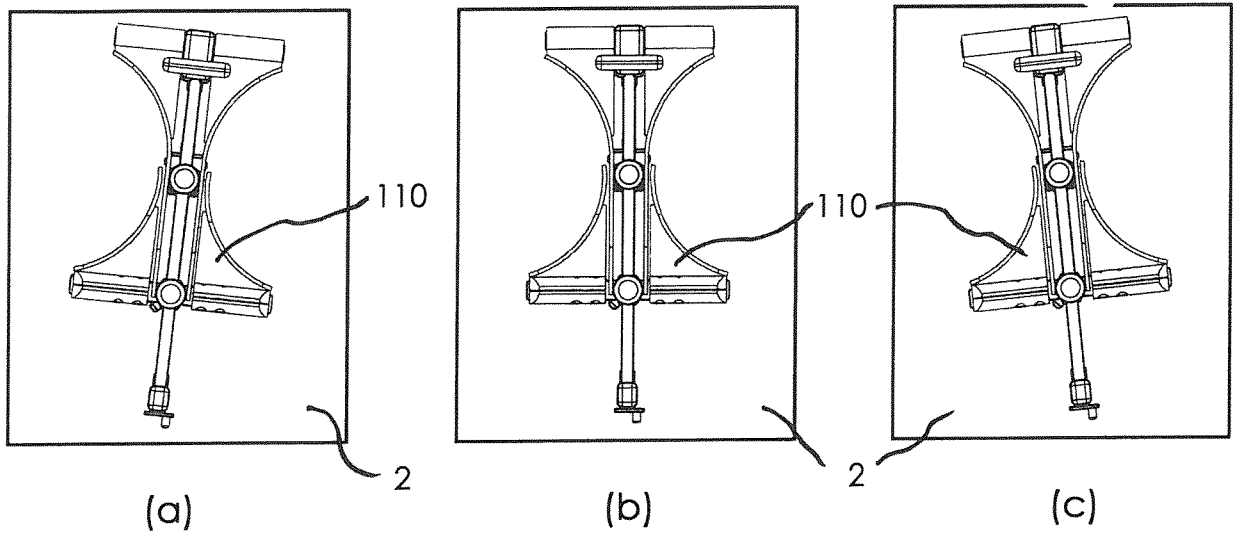


Fig. 33

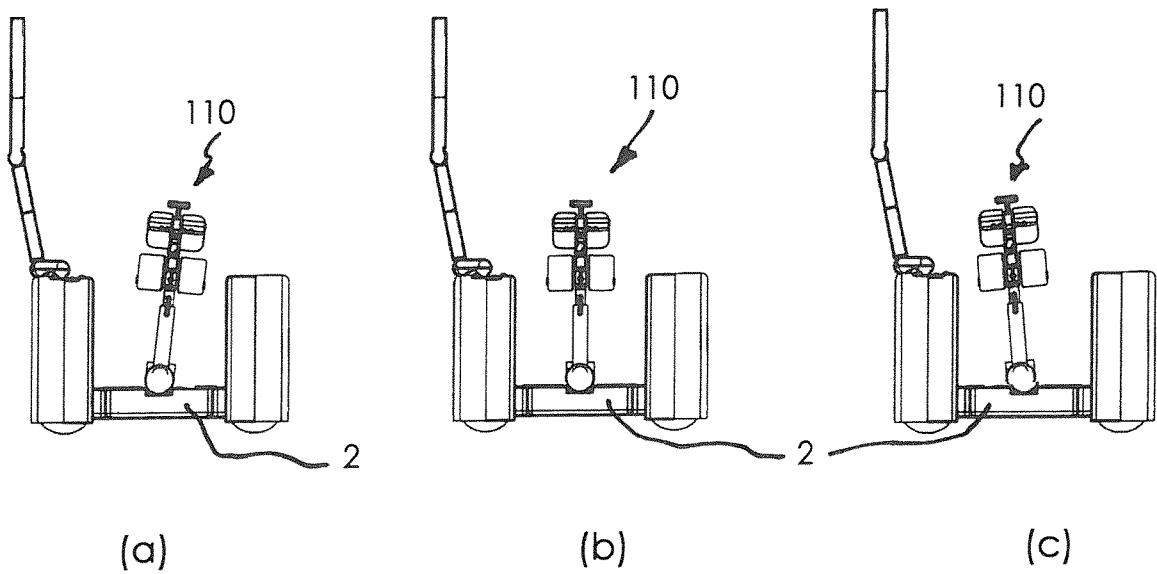


Fig. 34

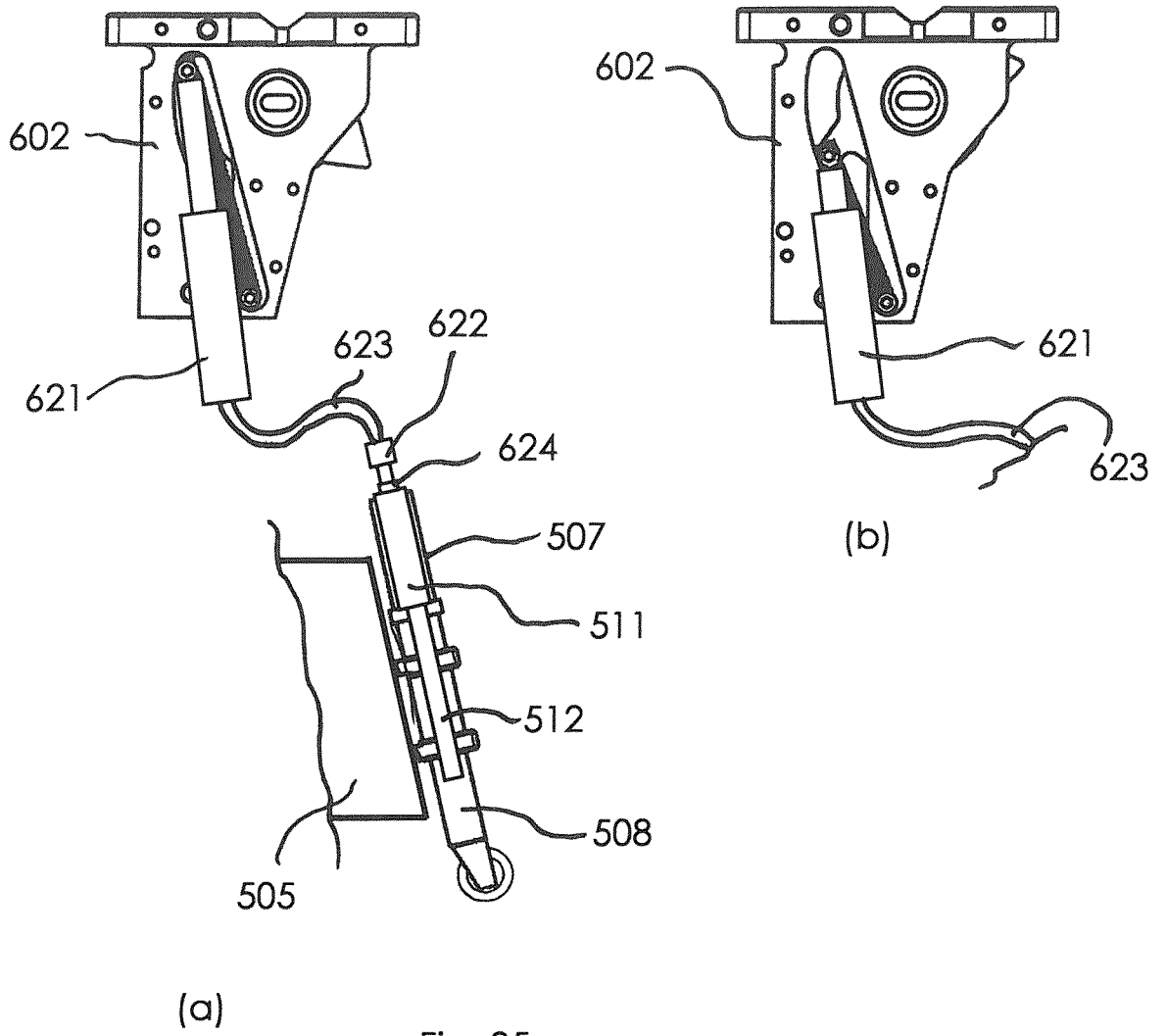


Fig. 35

INTERNATIONAL SEARCH REPORT

International application No  
PCT/EP2012/056339

A. CLASSIFICATION OF SUBJECT MATTER  
 INV. B62H1/12 B62K3/00 B62J11/00 B62J25/00  
 ADD.  
 According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED  
 Minimum documentation searched (classification system followed by classification symbols)  
 B62H B62K B62J  
 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
 Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
 EPO-Internal , WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2009 120177 A (TOYOTA MOTOR CORP) 4 June 2009 (2009-06-04)  abstract; figures 1,4 -----	1-3 , 8-11 , 14-19
X	US 7 303 132 B2 (KNOWLES C H [US] ET AL KNOWLES C HARRY [US] ET AL) 4 December 2007 (2007-12-04) cited in the application paragraph [0051] ; claims ; figure 5 -----	1, 12, 13 , 20-30
Y	US 2008/209783 A1 (TRAINER CHARLES [US] ) 4 September 2008 (2008-09-04) claims ; figures -----	31-42
X	US 2008/209783 A1 (TRAINER CHARLES [US] ) 4 September 2008 (2008-09-04) claims ; figures -----	1,2
Y	DE 20 2006 015937 UI (WITTENBAUER RUDOLF [DE] ) 21 December 2006 (2006-12-21) claims ; figure 2 -----	31-33
	-/- .	

Further documents are listed in the continuation of Box C.  See patent family annex.

\* Special categories of cited documents :  
 "A" document defining the general state of the art which is not considered to be of particular relevance  
 "E" earlier application or patent but published on or after the international filing date  
 "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)  
 "O" document referring to an oral disclosure, use, exhibition or other means  
 "P" document published prior to the international filing date but later than the priority date claimed  
 "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention  
 "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone  
 "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art  
 "&" document member of the same patent family

Date of the actual completion of the international search  13 July 2012	Date of mailing of the international search report  20/07/2012
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer  Grunfeld, Michael

## INTERNATIONAL SEARCH REPORT

International application No  
PCT/EP2012/056339

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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