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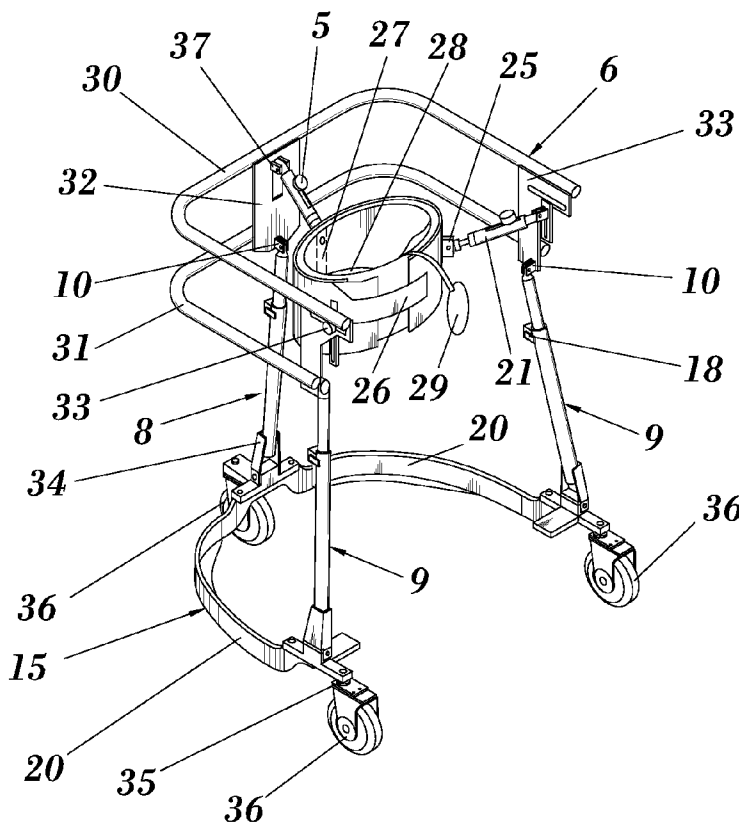
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- (71) **Applicant (for all designated States except US):** FUNDACION FATRONIK [ES/ES]; Paseo Mikeletegi, 7 Parque Tecnológico, E-20009 San Sebastian (ES).
- (72) **Inventors; and**
- (75) **Inventors/Applicants (for US only):** POPOVIC, Dejan [RS/RS]; Ruzveltoza 44, 11000 Belgrade (RS). VEG, Aleksandar [RS/RS]; Novopazarska 43, 11000 Belgrade (RS).
- (74) **Agent:** CARPINTERO LOPEZ, Francisco; Herrero & Asociados, S.L., Alcala, 35, E-28014 Madrid (ES).

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(54) **Title:** DEVICE FOR BALANCE AND BODY ORIENTATION SUPPORT



**FIG. 6**

(57) **Abstract:** Device for balance and body orientation support configured to control the body position of individuals with sensory-motor disability that prevents them from normal standing and walking, that comprises a top frame (6) linked to a bottom frame (15) by telescopic rods (8, 9), wherein the bottom frame (15) comprises wheels and the top frame (6) is linked by means of suspension elements to a lumbar belt, thus being the stiffness of the device configured to be regulated according to the disability level of the individual, and thus providing reduction of the loading of legs by partial support of the body weight; hence allow therapy of the walking in neurorehabilitation, but also exercise after surgical interventions. The device can be adjusted to fit the size of the potential individual with the simple tools.

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**DEVICE FOR BALANCE AND BODY ORIENTATION SUPPORT****DESCRIPTION****5 TECHNICAL FIELD OF THE INVENTION**

10 The invention relates to a device for balance and body orientation support, solving the technical problem of how to provide control of balance and body orientation during hands free standing and walking to individuals with compromised physical abilities caused by injury or disease of the central nervous system or other reasons, e. g., age related disability, by a device that is modular and adaptive in size to the individual and her/his needs.

**15 BACKGROUND OF THE INVENTION**

20 One possible method of solving the problem of providing the balance and body orientation during hands free standing and walking is the use of a robotic mechanism where the robot applies controlled movements to the body and extremities. The available commercial systems use two methods: 1) control of the feet movement of impaired individuals that mimics movement characteristic for the feet movements of the individuals with no orthopedic, neurological or age related disorders in parallel to body support by a harness that is adjustable to partially compensate the gravity force (Advanced Gait Trainer, RehaStim, Berlin, Germany), 2) control of leg segments movement in impaired individuals along the trajectories that are alike trajectories characteristic for movement of individuals with no orthopedic, neurological or age related disorders in parallel to body support by a harness that is adjustable to partially compensate the gravity force and use of powered treadmill (Locomat, Hokoma, Switzerland). Similar devices are in development in other research centres but using principles described above, e. g., Altacro, Free University of Brussels, Belgium).

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They are proven to be successful in restoration of walking capabilities, reducing functional impairment, as well as increasing of mobility of stroke survivors and spasticity patients. Due to the treadmill configuration, this type of equipment is limited to training of straight ground level walking, and mobility in daily situations cannot be supported.

The alternative to stationary devices are rollators and walkers of different kinds that in most cases do not allow hands free standing and walking. The shortened description of the representative rollators and walkers follows:

Standard walkers: a standard walker may include wheels and glide-type brakes. A wheeled walker is one with 2, 3 or 4 wheels. The wheels may be fixed or swivel. It may be fixed height or adjustable height. It may or may not include glide-type brakes or equivalent. A glide-type brake consists of a spring mechanism, or equivalent, which raises the leg post of the walker off the ground when the member is not pushing down on the frame.

Pediatric walkers and crawlers: specially adapted strollers may be considered medically necessary when they are used in place of a wheelchair for children.

Heavy-duty walker: a heavy-duty walker is one that is labeled as capable of supporting members who weigh more than 300 pounds. It may be fixed height or adjustable height. It may be rigid or folding. A heavy-duty walker is considered medically necessary for members who meet medical necessary criteria for a standard walker and weighing more than 300 pounds. A heavy-duty walker may include wheels and glide-type brakes. A wheeled walker is one with 2, 3 or 4 wheels. The wheels may be fixed or swivel. It may be fixed height or adjustable height. It may or may not include glide-type brakes, or equivalent. A glide-type brake consists of a spring

mechanism, or equivalent, which raises the leg post of the walker off the ground when the member is not pushing down on the frame.

5 Heavy duty, multiple braking system, variable wheel resistance  
walker: a heavy duty, multiple braking system, variable wheel resistance  
walker is considered medically necessary for members who meet medical  
criteria for a standard walker and who are unable to use a standard walker  
due to a severe neurological disorder or other condition causing the  
restricted use of one hand. Obesity, by itself, is not considered a medically  
10 necessary indication for this walker.

Heavy duty, multiple braking system, and variable wheel  
resistance walker is a 4-wheeled, adjustable height, folding-walker that has  
all of the following characteristics. This support is capable of supporting  
15 individuals who weigh greater than 350 pounds, and hand operated brakes  
that cause the wheels to lock when then the hand levers are released, and  
the hand brakes can be set so that either of both can lock the wheels, and  
the pressure required to operate each hand brake is individually adjustable,  
and there is an additional braking mechanism on the front crossbar, and at  
20 least two wheels have brakes that can be independently set through tension  
adjustability to give varying resistance.

Walker with enclosed frame: a walker with enclosed frame is a  
folding wheeled walker that has a frame that completely surrounds the  
25 member and an attached seat in the back.

A state of the art walker with passive control is the NF-walker  
(Norsk Funktion, Norway). It allows children with balance problems to stand  
and to walk and provides some basic coordination of the by two elastic  
30 bands. Prerequisite for using the NF-walker is a minimum of active  
functionality of the lower limbs. Disadvantages are the difficulties to

maneuver in small rooms and the unnatural gait patterns.

5 Finally, the most sophisticated solutions, still in the domain of ideas and prototypes suggest the use of humanoid robots, e. g., HAL5 robot suit (University of Tsukuba, Japan). HAL5 can help to walk or lift heavy objects and uses bioelectric sensors attached to the skin in order to monitor the signals transmitted from the brain to the particular muscle. This nerve signal generates an electric current on the skin surface which is translated into signals for electric motors at hip and knee joints. This procedure is definitely controversial at this time. Due to that electronic information processing, the exoskeleton actuators respond faster than the human's muscles. The disadvantage of this kind of robots is the limitation to amplifying the intention of users. In order to help humans with lack of balance, such exoskeletons have to be integrated with models of walking. 10 Their great potential in rehabilitation is the ability to give assistance to both pairs of limbs and single weaker limbs. 15

The patents related to the development of the new idea presented in this application are:

20 United States patent no. US 7,111,856 (Graham, September 26, 2006) discloses a bipedal motion assisting method and apparatus that comprises a mobile support system having a central region that allows the legs to move in an unobstructed manner and providing an upper body support assembly where the weight is distributed between the elbow region and hand region of the individual for a desirable weight distribution for assisted bipedal motion such as walking or running. 25

30 United States patent no. US 7,017,525 (Leach, March 28,2006) discloses a multipurpose harness assembly for use in assisting a muscular-incapacitated person that comprises a multipurpose harness assembly for

lifting and supporting a person characteristically known to have little or no control over muscular function insofar to support oneself for purposes of standing erect or walking, the harness assembly comprising a pair of wearable harness, one of which is worn by an assisting person and a second harness being worn by a muscular-incapacitated person. Each harness comprises left- and right-handed shoulder straps tighteningly secured to the wearer by a waist belt and an upper torso strap, both of which are slidably fitted through a plurality of strap guides selectively mounted to each of the shoulder straps and tighteningly held in place by a waist buckle and an upper torso buckle, respectively, and at least one horizontal support member fixedly attached to the shoulder straps to maintain a parallel relationship to one another and minimize the occurrence of slippage from the wearer's shoulder. A pair of supporting tethers each having a first end fixedly attached to the shoulder strap of the harness worn by the assisting person and a second end releasably connected to the harness worn by the muscular-incapacitated person effectively serve as means to connect the two harnesses together for purposes of engaging in the activities of lifting the muscular-incapacitated person from an at-rest position and supporting and guiding the muscular-incapacitated person as he or she proceeds to walk, sit or stand erect in a stationary position.

United States patent no. US 6,974,142 (Shikinami, et al., December 13, 2005) discloses a vehicle to assist walking. A vehicle which has a function to help a person walk and a function that a helper can move a person, comprises a frame extending around a body of a user for supporting the body of the user when the user walks using the vehicle, wheels mounted on the frame, and a seat plate which can project from the generally lateral side of the user into an area where the legs of the walking user move. The seat plate is withdrawn from the area where the legs of the walking user move when the user walks using the vehicle.

United States patent no. US 6,755,203 (Roeglin, June 29, 2004) discloses a two-legged walker useful as a mobility assisting device for those temporarily or permanently disabled or infirm which is supported by the user's hand, not under the user's arms, is both lockably rigid and jointed to mimic and support the walking function of the user, is capable of multiple modes of use, is adjustable in its dimensions to fit the user's height and needs, and is adjustable to support use on stairs.

United States patent no. US 6,659,478 (Hallgrimsson, et al., December 9, 2003) discloses a combination walker and transport chair that comprises a wheeled walker convertible to a transport chair. The walker has a strap-type backrest that is pivotally attached to the upper end of the handlebars. The backrest can be placed in a forward position when the apparatus is used as a walker and the user wishes to rest in a rearward facing sitting position and in a rearward position when the apparatus is used as a transport chair and the user sits in a forward facing position and is propelled by a care-giver. A novel braking system locates the brake actuating linkage inside the leg and handlebar members and provides accommodates extension height adjustment of the handlebars. A brake lever system providing a linear pull non-cable brake actuation is also disclosed.

United States patent no. US 6,325,023 (Elnatan, December 4, 2001) discloses a method and an apparatus for assisting a child to walk. A method and apparatus for enabling a larger person to assist a smaller disabled person to learn to stand and to walk while keeping the hands of both persons free for other tasks. The apparatus comprises two body harnesses and a foot harness. One of the body harnesses is worn by the larger person and the second body harness is worn by the smaller person. The foot harness is worn by both persons. The first and second harnesses are connected to each other to enable the smaller person to have substantial freedom of movement while the larger person supports and assists the



smaller person to walk. A apparatus for enabling a larger person to assist a smaller disabled person to learn to stand and walk while keeping the hands of both persons free for other tasks. The apparatus comprises a harness which is worn by the larger person. The harness is connected to the smaller person so that the smaller person has substantial freedom of movement while the larger person assists the smaller person to walk.

United States patent no. US 5,794,639 (Einbinder, August 18, 1998) discloses an adjustably controllable walker. A controller for wheeled vehicles includes a mechanism which selectively shifts the vehicle between a mobile and a stable state. The vehicle may be a walker for easing an operator's efforts in walking and includes a selectively actuatable stabilizer which fixes the position of the walker or releases it for rolling motion, thus providing a stable state or a mobile state, respectively. An actuator such as a button, pressure sensor, or lever, electrically and/or mechanically actuates a stabilizer brake mechanism to engage or release the brake and thereby allow the walker's mobility to be controlled when the actuator operates the brake to stabilize or to slow the motion of the walker. Preferably, lift applied to the vehicle itself releases the brake and allows mobility. The actuator may control an electrically actuated braking mechanism, in response to a sensor such as a strain gauge that may be adjusted to the needs of the patient; alternatively, lifters may provide to act in response to the lifting force.

United States patent no. US 5,524,720 ((Lathrop, June 11, 1996) discloses a powered walker having integrated parallel bars that provides a stable and mobile walking frame for those who must pull on objects is adapted to move forward according to a user's needs. The user controls movement of the walker by depressing a switch; the speed at which the device moves is also user controlled.

United States patent no. US 5,224,717 (Lowen, July 6, 1993)

discloses a walking aid device which allows the user to retain a full upright position while providing continuous support of a portion of the user's body weight and allow the user to easily maneuver the device. The device has wheels which support two side sections providing upper portions at approximately elbow height. A brace member joins the side sections and spaces the upper portions thereof at a transverse distance slightly greater than the person's body width. Armrests are attached to the upper portions and extend in the fore and aft direction so as to provide a rear elbow engaging portion with a forearm engaging portion extending forwardly from the elbow engaging portion and having an upright hand grip at the forward end thereof. A transverse rib-rest is provided between the arm-rest means adjacent the rear of the armrest. The brace member between the side sections may be located between rear legs of the side section and is located near the upper portion to allow free leg room when the user is positioned against the rib-rest behind the device. The area defined between the side sections and in front of the rib-rest may be entirely open to allow the user to enter the space between the side sections from what would normally be the front of the device.

United States patent no. US 5,133,377 (Truxillo, July 28, 1992) discloses an invalid walker. An improvement in walkers including a set of specially designed, spring biased, retractable casters on at least the four corner legs of the walker apparatus to assist the user in moving the walker apparatus from one point to another. The walker further includes an adjustable seating system situated to the rear of the user for ease of utilization without the need to turn around when seating oneself. Additionally, an accessory food tray sub-system is provided. The walker is designed to provide an effective means for invalids, the elderly, and the like to comfortably, easily and without fear move about an area, while also having a seat and tray readily available so that the user can rest and even comfortably sit and eat or engage in other activities, thereby relieving the user of the

necessity of having to manipulate furniture in sitting and getting up, an often painful process for the infirm.

5 United States patent no. US 4,987,912 (Taylor, January 29, 1991) discloses a walker assembly having stabilizer means. Walker having four legged frame defining front and a pair of sides, each having a cross-bar. The invention provides a stabilizing bar secured to the front cross-bar to extend angularly forwardly at an acute angle to provide a non-tippable structure particularly while the user is using the walker as support during the act of  
10 assuming a sitting position or rising therefrom. The stabilizer bar can be adjusted as to length and, can be pivotally mounted so that it can be swingably maneuvered to be inactive when the walker is not being used.

15 United States patent no. US 4,869,279 (Hedges, September 26, 1989) discloses an invalid walker comprising right and left side frame members in the form of an inverted Y-shape, each frame member containing a vertical leg, a side leg attached downwardly and rearwardly from the vertical leg and a horizontal brace connecting the vertical leg and side leg, a front horizontal member connecting the right and left side frame members,  
20 and handgrip support attached to the upper end of each vertical leg. Stair climbing convenience is provided by a forward extension of the horizontal brace and a restraint strap between the handgrip supports provides an optional safety feature.

25 United States patent no. 4,621,804 (Mueller, November 11, 1986) discloses a therapeutic roller/walker. A therapeutic walker has features which permit its use by persons with varying degrees of disability and is capable of adaptation to be used in different ways as the level of disability diminishes. A walker frame extends substantially around three sides of the region occupied  
30 by person using the walker and a removable closure bar is attached across the frame on its open side. An elongated crotch-cradling panel of flexible

material is removably attached between the closure bar and the frame on the opposite side of the walker. The person using the walker straddles the crotch-cradling panel which is adjustable in length for persons of different sizes. The legs of the walker are adjustable in height and terminate in removable or retractable casters. A person using the walker can either sit down on the seat or stand up in the walker, with appropriate adjustments being made in the length of the legs. In more severe cases of disability, the caster wheels are employed and the seat acts as a safety feature if the person using the walker should stumble or fall, since it will catch the person and prevent or minimize injury. For persons with less disability, the seat may be removed and the casters may be removed or retracted; so that the walker can be used in a conventional manner.

#### **SUMMARY OF THE INVENTION**

The present invention relates to a device for balance and body orientation support to be used for control of balance and orientation of the body in humans with decreased ability to stand and walk hands free due to partial damage of the central nervous system or impaired neuromuscular or musculoskeletal system by interfacing the individual with an ergonomic specially reinforced lumbar belt with three connecting points articulated via suspension elements or suspensors, e. g. consisting of damped springs mechanisms, to an open top frame, where the top frame is above the center of mass connected or linked with an open bottom frame that interfaces the ground by a plurality of wheels that allow motion of the platform defined by both frames and wheels in horizontal plane, where the connection between the bottom and top frames is made by telescopic rods, acting as supporting bars or tubes, and the center of mass of the device is low, close to the ground. The length and stiffness of the suspension elements is configured to be regulated according to the properties, characteristics and disability level of the individuals.

The lumbar belt can be expanded with corset and/or harness between the legs of the individual if additional support is needed because of the degree of disability of the user in order to ensure balance and body orientation within the device proposed by the invention.

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The advantage of the device proposed by the invention compared with the existing systems is that top and bottom frames, comprised by the platform, are modular and transportable, the center of mass is low providing stability, the size of the platform conforms with the home usage, the size of the wheels allows negotiations of low obstacles and curb, the height of the connecting points is adjustable and controllable, and over all provides standing and walking hands free because the balance and body orientation with respect the vertical are secured with the lumbar belt and the suspension elements. Wheels can include mechanisms configured to limit the rotation about the vertical axes by means of a spring or the like, being contemplated that wheels comprise self-locking mechanism and being instrumented with brakes configured to move the device in different directions.

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Suspension elements can also be of different shape, e. g. springs metal or plastic suspension system, in order to achieve the advantage of having more free space for arm movements and with a designed variable thickness of the suspension element we can design the direction of the force.

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It is contemplated that the form of the bottom frame can be defined in a manner that secures that a front wheel is on the central axes of the body in the sagittal plane, and that two side wheels are behind the center of mass symmetric to the sagittal plane at a distance which guaranties that the center of mass projects in front of the center of pressure of the device when a person is using the platform. The platform can be detached to the symmetric left and right sides. Each wheel comprises a wheel supporting mechanism that is configured to support the telescopic rods acting as

supporting bars of the top frame. The length of the telescopic rods can be fixed by screws with handles. The telescopic mechanism is realized with two concentric tubes, where the external tube has longitudinal gaps that when tightened does not allow the change of the length. At the top end of the telescopic mechanism is a double joint with three degrees of freedom that allows automatic positioning towards the top frame.

Thus, the device for balance and body orientation support proposed by the invention is configured to control the body position of individuals with sensory-motor disability that prevents them from normal standing and walking, wherein the dimensions of the device are selected to conform with the architectural barriers typical for home and clinical setting and standards for accessibility, wherein 90 cm is the minimal size of the door frame. The invention provides reduction of the loading of legs by partial support of the body weight; hence allows therapy of the walking in neurorehabilitation, but also exercise after surgical interventions. The device can be adjusted to fit the size of the potential individual with the use of simple tools.

In a sophisticated embodiment of the invention the device is robotized and includes external control of wheels, i. e. propulsion assist with regulated velocity and direction control, control of position of the center of mass with respect the device that is highly important for healthy-like walking and control of the tilt of the body that would facilitate the walking exercise. The envisioned invention would use sensory driven control, and possibly integrate therapeutic functional electrical stimulation or active orthotics. The invention is configured to allow clinical rehabilitation, but also home and private life use, i. e. house, street, backyard and the like.

The invention is to be used for control of balance and orientation of the trunk in humans with decreased abilities to stand and walk because of

the disability of the sensory-motor systems in a manner that the special belt worn by the individual is attached to the frame by means of elastic suspensors which control the tilt and orientation with respect the frame in the zone of the body directly above the center of mass where the frame is moveable and can be disassembled, have the center of mass close to the ground, and contacts the ground at three points via wheels with direction control.

The advantage of this invention when compared with the existing systems is that the systems can be disassembled, that the center of gravity is in the lower zone, that the dimensions are adapted to fit home and outdoor environment, that the size of the wheels allows negotiation of curb and low obstacles, that allows simple regulation of the height of the system and rigidity of suspensor connections thereby limits the tilt of the trunk, that allows walking in different directions due to the directional control of the wheels, and allows standing and walking without the need to use hands for support in the free space without the risk of falling and controlled orientation of the trunk with respect the vertical.

The benefits of using the device proposed by the invention are the followings:

Early training of standing and walking. The device provides body support and postural orientation; thereby, providing many individuals with disability to begin ambulatory rehabilitation.

The device stabilizes the trunk in vertical position in the case of the stumbling or collapse of the paralyzed leg; therefore, greatly decreases the risk of fall of individuals during the walking exercise.

The device decreases the load on therapists during exercise;

thereby, reduces back injuries to therapists.

5 The device allows longer walking sessions that allow the therapist to focus on improved walking pattern instead of concentrating on the risk of fall.

The device can be used in various environments and based on simple construction reduces costs for medical facilities.

## 10 **BRIEF DESCRIPTION OF THE DRAWINGS**

For a better understanding of the described embodiments and to show more clearly how they may be carried into effect, reference will now be made, by way of example, to the accompanying drawings in which:

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Figure 1.- Shows a perspective view of the lumbar belt according to the invention.

Figure 2.- Shows a longitudinal section of a suspension element.

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Figure 3.- Shows a perspective view of a joint element between the top frame and each telescopic rod.

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Figure 4.- Shows a perspective view of the securing mechanism comprised in each telescopic rod in order to fix the relative position of the inner and external rods.

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Figure 5.- Shows a perspective view of the platform according to the invention, comprising a top frame linked to a bottom frame by three telescopic rods, and further comprising three wheels.



Figure 6.- Shows a perspective view of a variant embodiment of the platform represented in figure 5, wherein can be appreciated the lumbar belt linked to the top frame by three suspension elements.

5 Figure 7.- Shows a detail, according to a perspective view, of a suspension element situated in its work position.

Figure 8.- Shows a detail of a connecting point between the lumbar belt and a suspension element.

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Figure 9.- Shows a detail, according to a perspective view, of the front side of the bottom frame and its corresponding wheel.

15 Figure 10.- Shows an schematic view corresponding to a variant of embodiment of the suspension elements.

## PREFERRED EMBODIMENT OF THE INVENTION

20 A preferred embodiment of the invention is presented in figures. The device for providing balance and body orientation to the individuals with disability comprises an ergonomic lumbar belt (23), reinforced with spring bars integrated into the lumbar belt (23) on the inner side (24) of the lumbar belt (23), where the perimeter of the lumbar belt (23) is adjustable by a broad flap (26) having quick fastening means, e. g. Velcro means or the like, as  
25 shown in figure 1.

30 The lumbar belt (23) tightly fit the lumbar region of the individual and comprises three connecting points (25), on the outer side of the lumbar belt (23), configured to connect with suspension elements (21), i. e. suspensors shown in figure 2, that are adjustable in length and have adjustable stiffness allowing the positioning of the individual with respect the

platform, and adjusting of the loading that the platform will absorb with respect the body weight of the individual, and adjusting of the stiffness that controls the relative movement of the center of mass and body incline towards the vertical with respect the platform. The suspension elements (21),  
5 as shown in figure 2, comprise springs (1) selected based on calculations of the stiffness, sliding channels (2) with limiters (3), i. e. supports of the springs (1), and external capsule (4) with a hand controlled wheel (5), acting as a screw, to lock the suspension elements (21) after adjustments.

10 The suspension elements (21) are connected in three points (7) to a top frame (6) of the platform composed of ergonomically designed telescopic rods (8, 9), acting as supporting bars or tubes, that hold the individual and carry three joints elements (10), one frontal telescopic rod (8) at a front side, and two lateral telescopic rods (9) at left and right lateral sides  
15 of the platform. All three telescopic rods (8, 9), comprise double joint element (10) that can be fixed in any selected position and is configured to link, in articulated manner, each telescopic rod (8, 9) with the top frame (6). The joint element (10) comprises an L element (11), that is led by the mechanism shown in figure 3 and screw (12) is fixed to the top frame (6) and allows  
20 adjustments by rotating around the screw (12). Other degree of freedom exists on the opposite end of the L element (11), by means of a second L element (13), where said second L element (13) connects with the upper end of the corresponding telescopic rod (8, 9) with the joint rotation axes about the axes of a second screw (14) for fixation. This construction allows the  
25 positioning of the upper top frame (6) with respect to a lower bottom frame (15) with the minimal number of supporting bars, i. e. three telescopic rods (8, 9); yet guaranteeing the appropriate stability and stiffness of the platform as a whole.

30 The bottom frame (15) has a form of an open rectangle with the dimensions determined to fit into the circle with the diameter of 90 cm; yet

large enough to allow entry from the back side with a wheelchair. The top frame (6) has a minimum height of 10 cm and a form of an open rectangle that allows the individual when standing from a sitting position to enter into the platform.

5

The setting of the height of the platform is designed by a securing mechanism (18) configured to secure the length of the telescopic rods (8, 9), as shown in figure 4, where the fixation is provided by tightening of the perimeter of an external rod (16) around an inner rod (17), comprised by each telescopic rod (8, 9), after screwing of a screw with a nut comprised by the securing mechanism (18). The inner rod (17) and the external rod (16) can rotate one with respect the other providing the necessary degree of freedom of the platform as a whole.

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According to a preferred embodiment of the invention, the three telescopic rods (8, 9) have adjustable length between 50 and 130 cm, providing rigid connection between the bottom frame (15) and top frame (6) by means of joint elements (10)

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Telescopic rods (8, 9) in the zone of the bottom frame (15) are articulated to three wheel supporting mechanisms (19). The bottom frame (15) is designed by two symmetric massive metal profiles (20) securing that the center of mass of the platform is close to the ground securing from tipping of the system when individual is supported by the platform. The massive profiles (20) are designed in manner that allows detaching, but also include space for additional weight (22) when this becomes necessary for taller and higher individuals for increased safety and stability of the platform. Each wheel supporting mechanisms (19), shown in figure 5, have in the middle a hole for the connection to a wheel fork that connects with the axial bearing and secured with a screw and support.

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According to a variant embodiment of the invention, shown in figures 6 to 9, the bottom frame (15) is defined in a manner where the front central wheel (36) in the central sagittal plane of the user and comprises free rotation around the vertical axes, is connected by two horizontal profiles (20) which at the ends have one wheel (36) each.

The wheel supporting mechanisms (19) are used as the lower connection points of the adjustable telescopic rods (8, 9) that can be fixed at desired length by means of securing mechanisms (18) consisting of hand controlled brackets and locking mechanism based on a clamp and the adjusting screw. The telescopic effects are realized by use of two concentric tubes (16, 17) of two matching diameters and the fixation of the length is by a special bracket with the screw and locking handle.

On the top end of the telescopic rods (8, 9) is a double joint element (10) which allows full adjustability of the angle between the supporting rods (8, 9) to the top frame (6), where the fixation of the angle is done by screw mechanisms (12, 14).

According to the above referred variant of embodiment of the invention, shown in figures 6 to 9, the device comprises a two-layer ergonomic lumbar belt (23) with the external layer strengthened with three axial plastic bars (27) integrated into the external belt, and internal layer comprises air chambers (28) and a pump (29) for good fit to the body contours that can be adjusted in length to match the perimeter of the waist and trunk of the user by means of a flap (26) with fastening means consisting of Velcro, wherein the lumbar belt (23) has three connecting points (25) consisting of hinge joints parallel to the vertical line for connecting to the suspension elements (21) having adjustable stiffness and fixing the orientation of the external belt with respect the vertical line.

5 The top frame (6) comprises an upper tube (30) linked to a lower tube (31) by means of a frontal connecting plate (32) and two lateral connecting plates (33). The suspension elements (21), connected to the connecting points (25), allows adjusting of the stiffness between the body and the top frame (6) with the special joints allowing vertical and horizontal positioning of the ends of suspension elements (21) with hinge joints within the lateral connecting plates (33) and vertical positioning at the frontal connecting plate (32) with the joint.

10 The two metal profiles (20) that compose the bottom frame (15) are connected by a frontal hinge joint (34) having the horizontal axes to three identical telescopic rods (8, 9) that connects to the top frame (6) with the joint elements (10) consisting of hinges.

15 Suspension elements (21) are connected to the top frame (6) with adjustable joints connected to the connecting plates (32, 33), and connected to the lumbar belt (23) with the connecting points (25).

20 Figure 10 shows a variant of embodiment corresponding to the suspension elements (21) that consists of a springs suspension system, thus achieving the advantage of having more free space for arm movements and with a designed variable thickness of the suspension element we can design the direction of the force.

25 The bottom frame (15) has three vertical rotational joints (35) at front central sagittal plane of the device, and at both rear ends of the profiles (20). These vertical rotational joints (35) are configured to allow controlled rotation around the vertical axes of the wheels (36), thereby maneuverability of the device when walking. The rear wheels (36) are instrumented with a pad braking mechanisms (37). Even though is not represented, but it is contemplated that only the frontal wheel (36) comprises a vertical rotational

30

joint (35) remaining both rear wheels (36) in a fixed position.

5           Although this invention has been shown and described with respect to exemplary embodiments thereof, it should be understood by those skilled in the art that the foregoing and various other changes, omissions, and additions in the form and detail thereof may be made therein without departing from the spirit and scope of the invention. Accordingly, the present invention has been described in several embodiments by way of illustration rather than limitation.

**CLAIMS**

5 1.- Device for balance and body orientation support, for control of  
balance and orientation of the body in humans with decreased ability to  
stand and walk hands free, characterized in that it comprises a lumbar belt  
(23), configured to interface the individual, that is articulated in three  
connecting points (7) via suspension elements (21) to a top frame (6), where  
10 said top frame (6) is connected with a bottom frame (15) that interfaces the  
ground by three wheels (36) configured to allow motion of a platform defined  
by both frames (6, 15) and wheels (36) in horizontal plane, where the  
connection between the bottom frame (15) and the top frame (6) is made by  
telescopic rods (8, 9) and the center of mass of the device is close to the  
ground, wherein the length and stiffness of the suspension elements (21) is  
15 configured to be regulated according to the properties, characteristics and  
disability level of each individual.

20 2.- Device for balance and body orientation support, according to  
claim 1, characterized in that the bottom frame (15) is configured to secure  
that a front wheel (36) is on the central axes of the body of the user in the  
sagittal plane, and that two side wheels (36) are behind the center of mass  
symmetric to the sagittal plane at a distance which guaranties that the center  
of mass projects in front of a center of pressure of the device when an  
individual is using the platform.

25 3.- Device for balance and body orientation support, according to  
any of the previous claims, characterized in that the length of each telescopic  
rod (8, 9) can be fixed by a securing mechanism (18).

30 4.- Device for balance and body orientation support, according to  
any of the previous claims, characterized in that a top end of each telescopic  
rod (8, 9) is connected, in an articulated manner, to the top frame (6) via a

joint element (10) with three degrees of freedom configured to allow automatic positioning of the top frame (6).

5 5.- Device for balance and body orientation support, according to any of the previous claims, characterized in that the lumbar belt (23) is reinforced with spring bars integrated into the lumbar belt (23), where the perimeter of the lumbar belt (23) is adjustable by a flap (26) having quick fastening means.

10 6.- Device for balance and body orientation support, according to any of the previous claims, characterized in that the bottom frame (15) comprises two symmetric massive profiles (20) configured to secure that the center of mass of the device is close to the ground, wherein the massive profiles (20) are configured to allow detaching.

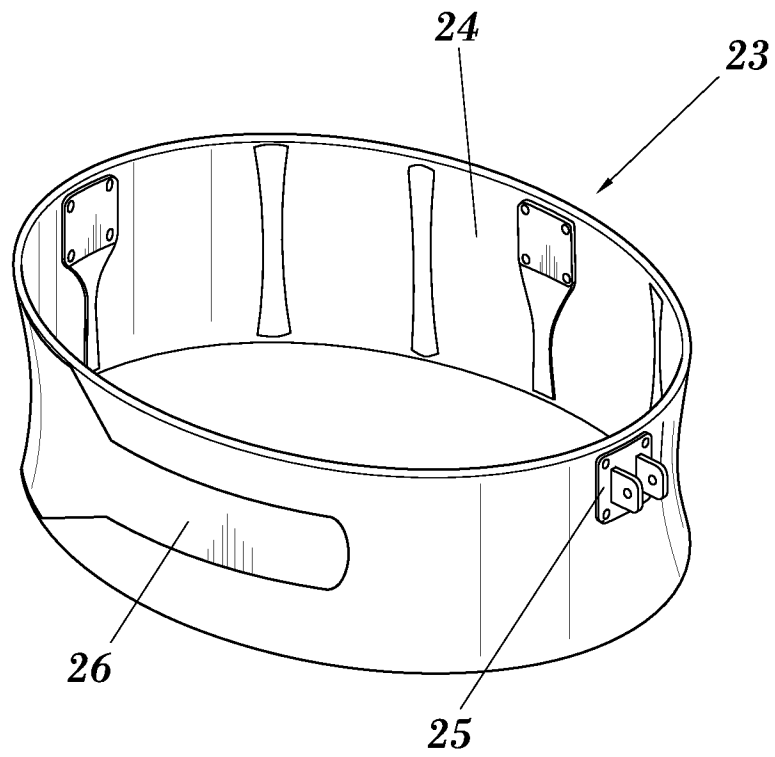
15 7.- Device for balance and body orientation support, according to any of the previous claims, characterized in that the lumbar belt (23) is strengthened with three axial bars (27) integrated into the lumbar belt (23), and an internal layer of the lumbar belt (23) comprises air chambers (28) and  
20 a pump (29) for good fit to the user's body contours.

25 8.- Device for balance and body orientation support, according to any of the previous claims, characterized in that the top frame (6) comprises a frontal connecting plate (32) and two lateral connecting plates (33), wherein the suspension elements (21) are configured to allow adjusting of the stiffness between the body and the top frame (6) comprising special joints allowing vertical and horizontal positioning of the ends of suspension elements (21).

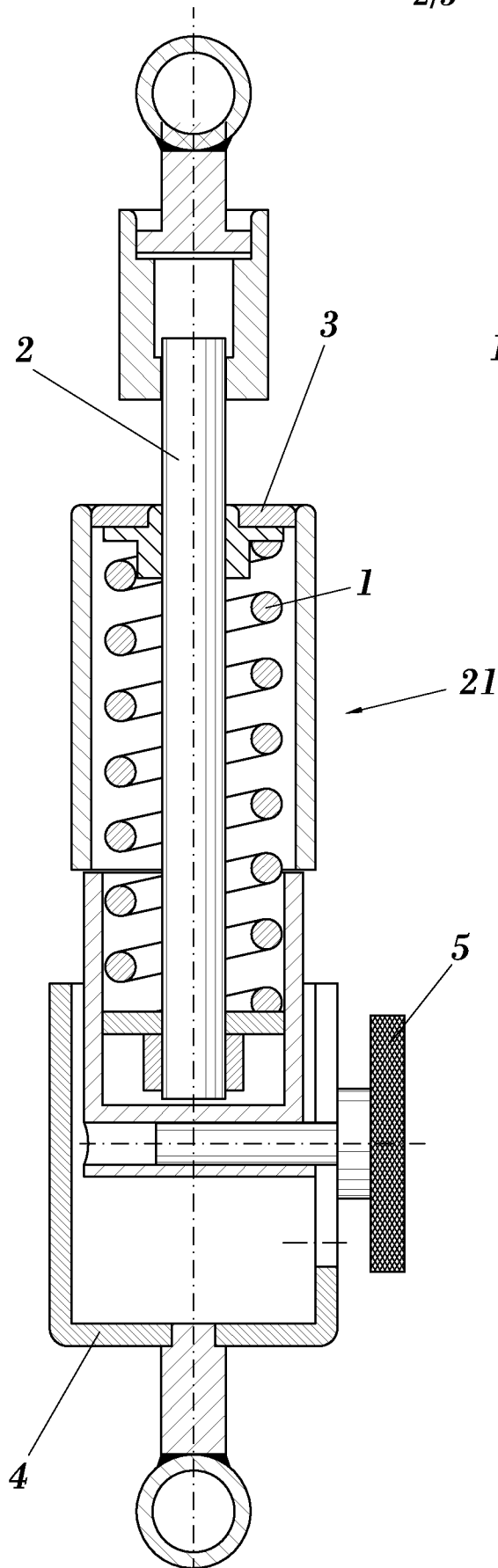
30 9.- Device for balance and body orientation support, according to any of the previous claims, characterized in that the bottom frame (15) has



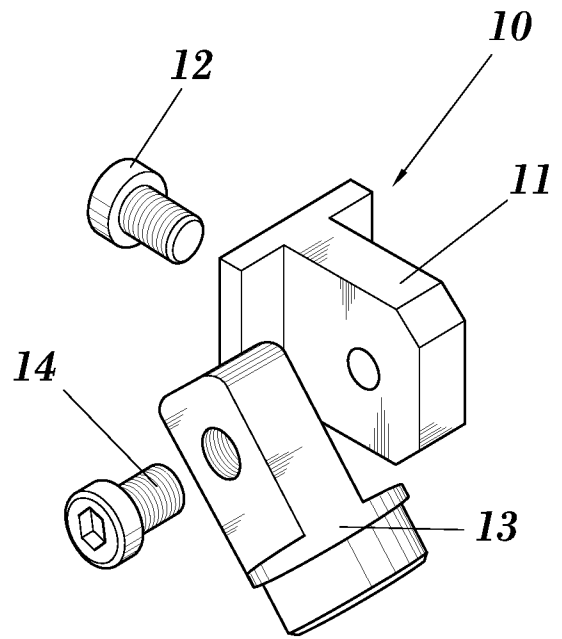
three vertical rotational joints (35) at front central sagittal plane of the device, and at both rear ends of the profiles (20), being configured said vertical rotational joints (35) to allow controlled rotation around the vertical axes of the wheels (36), thereby maneuverability of the device when walking.



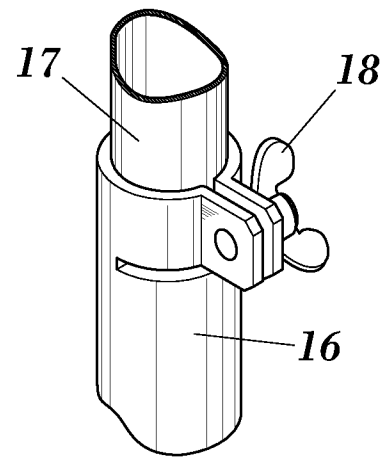
**FIG. 1**



**FIG. 2**

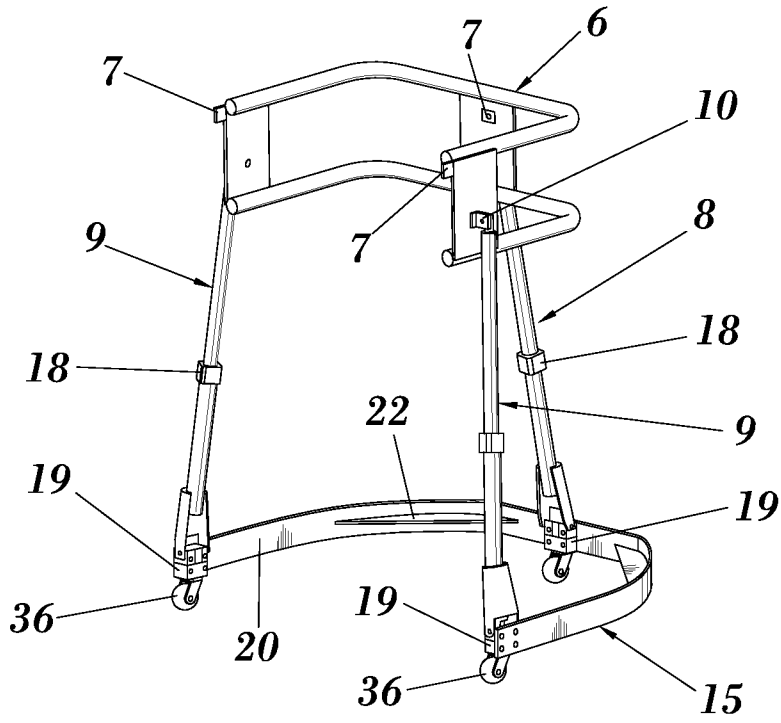


**FIG. 3**

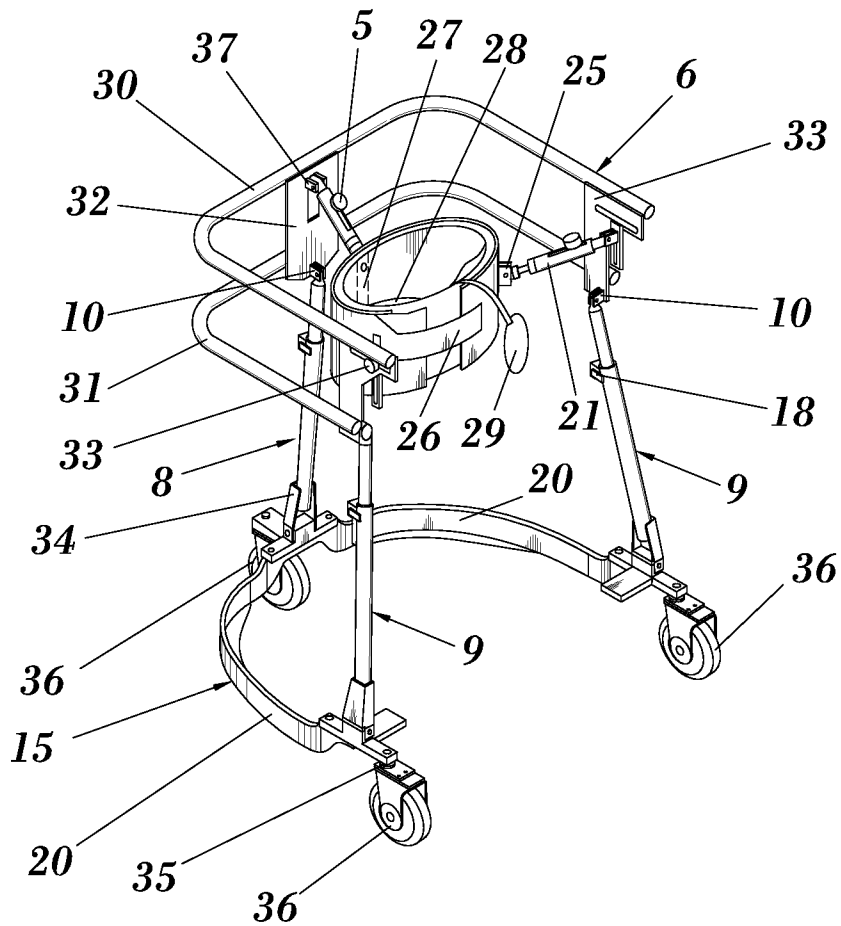


**FIG. 4**

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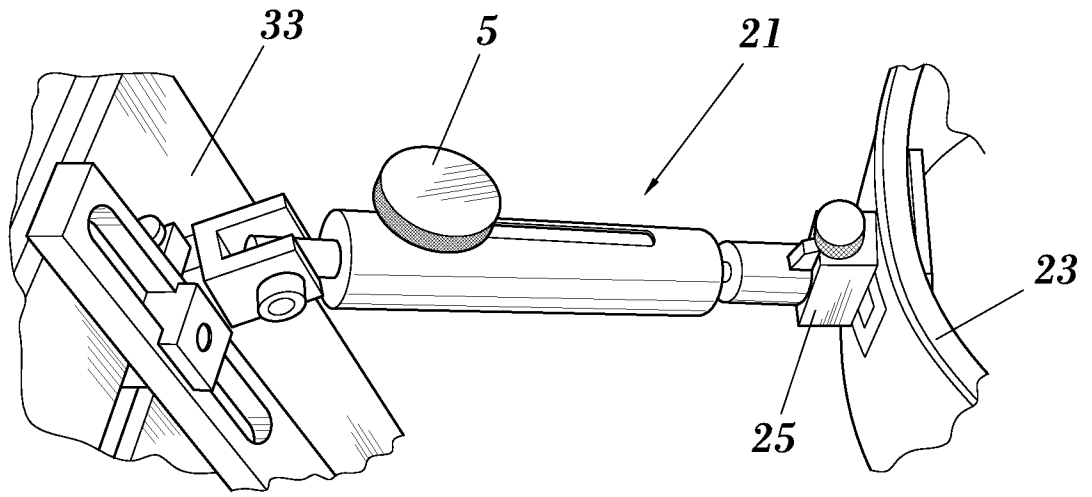


**FIG. 5**

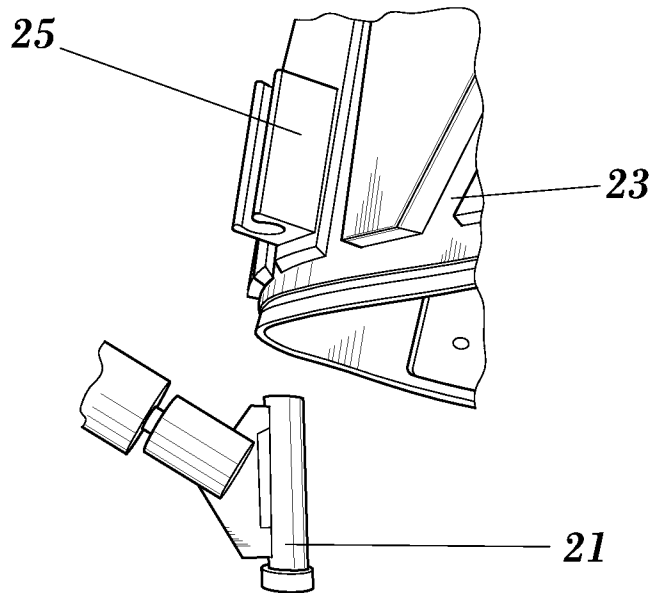


**FIG. 6**

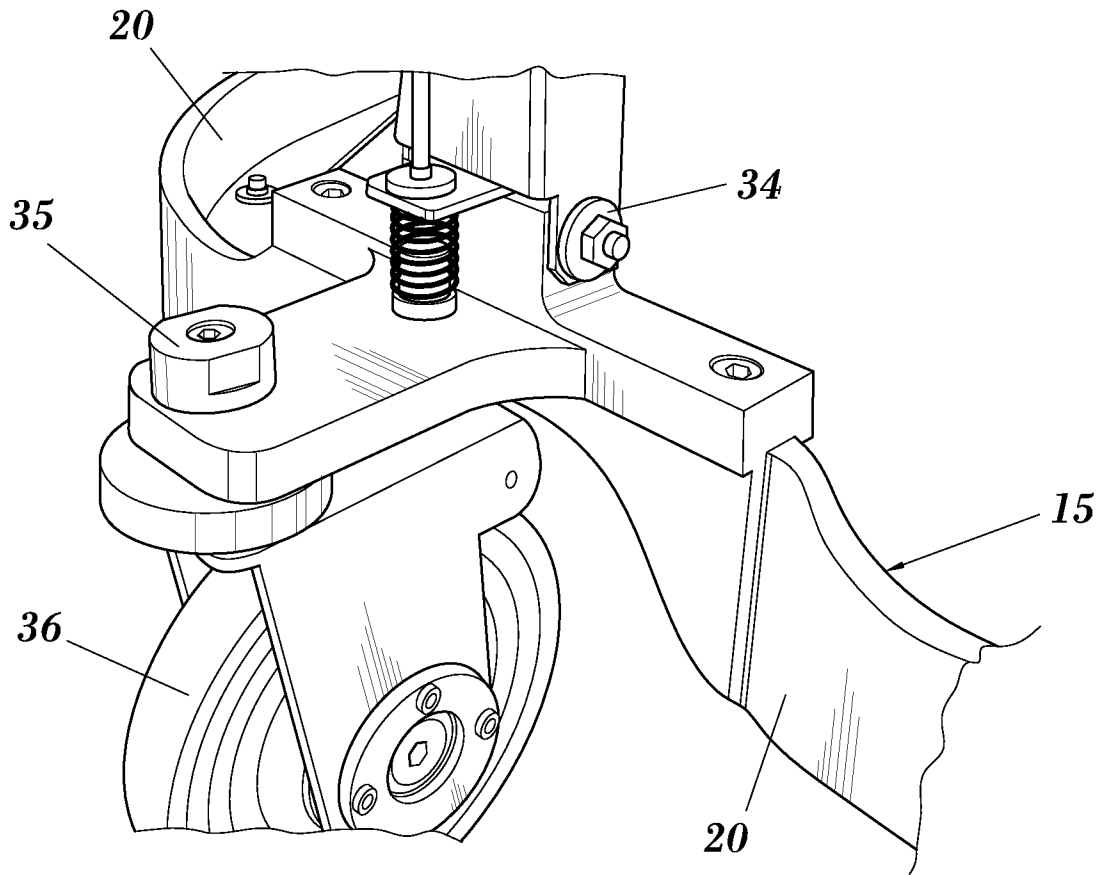
4/5



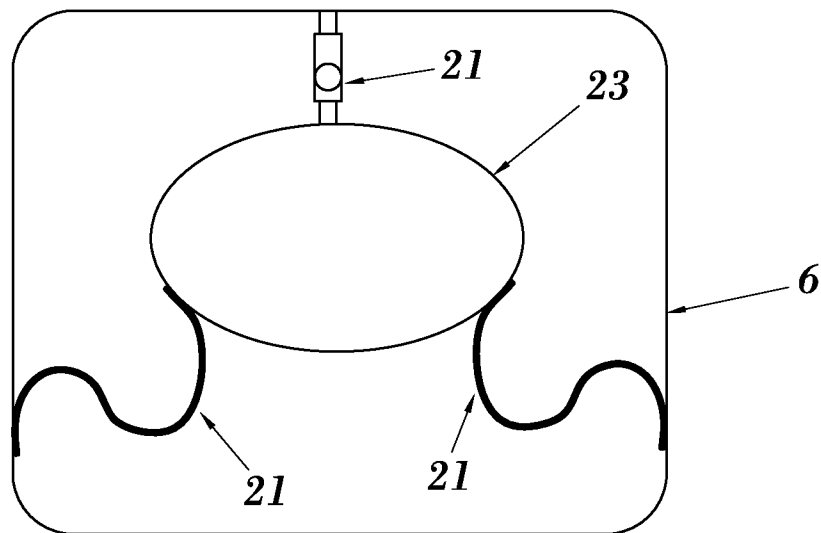
**FIG. 7**



**FIG. 8**



**FIG. 9**



**FIG. 10**

INTERNATIONAL SEARCH REPORT

International application No  
PCT/EP2008/056537

<p>A. CLASSIFICATION OF SUBJECT MATTER INV. A61H3/00 A61H3/04</p>		
<p>According to International Patent Classification (IPC) or to both national classification and IPC</p>		
<p>B. FIELDS SEARCHED</p>		
<p>Minimum documentation searched (classification system followed by classification symbols) A61H A63B A47D A61G</p>		
<p>Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched</p>		
<p>Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal, WPI Data</p>		
<p>C. DOCUMENTS CONSIDERED TO BE RELEVANT</p>		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 112 044 A (DUBATS BARBARA A [US]) 12 May 1992 (1992-05-12) column 4, line 43 - column 5, line 18 figures 1,2	1-9
X	US 6 527 285 B1 (CALANDRO II VITO JOHN [US]) 4 March 2003 (2003-03-04) column 3, line 37 - column 4, line 7 column 4, line 40 - column 5, line 30 column 6, lines 32-55 figures 1-5,12,13	1-9
X	US 2005/010150 A1 (FIRSOV IGAL [IL]) 13 January 2005 (2005-01-13) paragraphs [0111] - [0119]; figures 12-18	1-9
	-/--	
<p><input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.</p>		
<p>* Special categories of cited documents:</p>		
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<p>"&amp;" document member of the same patent family</p>		
<p>Date of the actual completion of the international search</p>		<p>Date of mailing of the international search report</p>
<p>21 July 2008</p>		<p>28/07/2008</p>
<p>Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016</p>		<p>Authorized officer  Fischer, Elmar</p>

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/EP2008/056537

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 526 893 A (HIGER GARY [US]) 18 June 1996 (1996-06-18) column 6, line 3 - column 7, line 35; figures 1-4	1-9
X	US 6 742 523 B2 (DUBATS DAVID EDWARD [US]) 1 June 2004 (2004-06-01) column 3, line 24 - column 4, line 47; figures	1-9
X	US 5 174 590 A (KERLEY JAMES J [US] ET AL) 29 December 1992 (1992-12-29) column 3, line 63 - column 4, line 26 column 4, lines 44-48 column 4, line 54 - column 5, line 60 column 6, lines 1-47; claim 6; figures 5-10,12,13,18-23	1-9
A	US 5 476 432 A (DICKENS ROBERT [US]) 19 December 1995 (1995-12-19) column 7, lines 2-12; figure 10	7



# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2008/056537

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5112044	A	12-05-1992	NONE
US 6527285	B1	04-03-2003	NONE
US 2005010150	A1	13-01-2005	NONE
US 5526893	A	18-06-1996	NONE
US 6742523	B2	01-06-2004	US 2002185137 A1 12-12-2002
US 5174590	A	29-12-1992	NONE
US 5476432	A	19-12-1995	NONE