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### (54) **RECIPROCATING ARM MOTION WALKER**

GEHILFE MIT HIN- UND HERGEHENDER ARMBEWEGUNG

DÉAMBULATEUR À MOUVEMENT DE BRAS ALTERNATIF

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## Description

### BACKGROUND

**[0001]** The present invention is related to a walker that provides support for an upper extremity of an associated user.

**[0002]** Walkers, rollators and gait trainers are assistive devices which provide ambulatory support for physically challenged individuals. Hands remain stationary on grips, and/or forearms remain stationary on forearm platform supports, when using these devices.

**[0003]** It is well documented that arm movement during ambulatory activities is advantageous for multiple reasons including biomechanical, neurological and other. Normal human gait involves reciprocating arm movement and this is disrupted when using these devices. For purposes of this application, the term "reciprocating" means back and forth motion or movement along a line, though when used to describe "reciprocating arm motion", reciprocating arms means the arms move out of phase. Walking with a "two point gait" and a "four point gait" involve reciprocating upper extremity (UE) movement as well. When the UEs are used for support, an arm and an opposite leg move together in the same direction (forward or backward), followed by the other arm and its opposite leg (the second leg). A "four point gait" involves the first arm moving before the first, opposite leg, and the second arm moving before the second, opposite leg, i.e. four different contacts at four points in time. When mobility aids are needed to provide bodily support, progression to four (4) point and two (2) point gait patterns which involve upper extremity (UE) movement are necessarily performed with less restrictive devices and gait quality and stability are often compromised. It would be desirable to have a walker which enabled repetitive reciprocating UE movement and which also enabled gait patterns involving alternating advancement of UE with concomitant UE weight bearing. Such a device could be used as a training device as well as a mobility aid.

**[0004]** Posture and gait kinematics are also disrupted when using walkers and rollators, regardless if used for light or heavy upper body support, due to inconsistent positioning of the feet and management of the device by the upper extremities. When significant upper body support is needed, use of standard walkers/rollators necessitates that a user exerts UE forces angled downward in order to propagate the device. Excessive upper body weight bearing often results and safety can be compromised.

**[0005]** The device presented herein is not pushed by the UEs. An overground device is thus provided which enables proper gait kinematics including UE movement when light or heavy UE support is needed, for use both as a training device and as a mobility aid.

**[0006]** When used for gait patterns requiring significant dewatering of one lower extremity (LE) for example, static upper extremity (UE) positioning may be desirable.

The device proposed herein can variably be used as a mobility aid or training device with static UE supports, and it provides benefits compared to other devices when used in this manner as will be described.

**[0007]** Mobility aids used unilaterally (mobility aids managed by one upper extremity) such as hemiwalkers, quad canes, and other, may be used due to inability to ambulate safely or effectively with currently available walkers, desire to use a less restrictive device, among other reasons. Gait asymmetries may develop or continue with use of these devices and the device may not provide sufficient support. A more functional and therapeutic mobility aid and/or daily training device such as the device presented herein may prove beneficial for users of these devices.

**[0008]** Gait and movement patterns achieved in the various training environments (such as parallel bars, treadmills, overground devices) in rehabilitation often vary with concomitant safety and treatment efficiency and effectiveness concerns. For example, a gait pattern achieved in the stable environment of parallel bars often cannot be performed with current overground mobility aids, or variably if a poor pattern is performed in parallel bars, the same is continued overground with current devices. Some individuals with significant mobility impairment are not able to safely walk outside of parallel bars with current walkers or with less restrictive devices which enable arm movement yet lack in stability. Also, when dewatering technologies are used, enabling repetitive, reciprocating UE movement, this cannot be continued with an overground device. The device presented here enables continuity in terms of gait pattern, irregardless of the amount of UE support used, or if UEs moving in repetitive reciprocating fashion or sequentially advanced. This is particularly true as related to provision of mobile forearm and mobile grip handle supports for known assistive devices for railed devices (where a "rail device" includes at least one rail such as parallel bars, and "assistive devices" are devices placed on the rail device).

**[0009]** In the presence of UE involvement such as occurs in stroke (sometimes referred to as a cerebrovascular accident or CVA), an overground ambulatory device is needed which enables a sound limb to mobilize an affected limb. Also, perhaps particularly as related to neurologic locomotor training, mechanization of reciprocating UE movement in a functional manner would be useful.

**[0010]** Asymmetrical UE function compromises gait symmetry and gait stability due to multiple factors, and neurocoupling (limb to limb neurologic facilitation: UE-UE, LE-LE, UE-LE) is disabled, among other things. A significant need in stroke (CVA) gait rehabilitation exists for a mechanical means to mobilize an involved UE in a functionally relevant manner consistent with normal gait, either by the opposite UE or mechanically. A device enabling this in railed devices such as parallel bars and treadmills and others, is presented by Johnson (utility patent application serial no. 14/719,311). The device pre-

sented herein provides a mechanical means to create out of phase reciprocating UE movement, which can be engaged or disengaged, and used irregardless of the extent of UE weight bearing needed or of the extent of UE dysfunction. The present device provides for mobilization of an involved UE in an overground device for the first time, for use as gait training device as well as a mobility aid for some.

**[0011]** Specifically addressing the needs of individuals afflicted with Parkinson's Disease (PD), current mobility aids are inadequate. Experts recommend incorporation of arm movement during gait rehabilitation in persons with PD. Erect posture, trunk rotation, and arm swing are important components of exercise and gait training in this population. During early stages of the disease process, prior to cognitive decline, training with a device offering postural support, enabling trunk rotation and reciprocating UE movement could serve as a useful early intervention training and exercise tool, which could be incorporated throughout the disease process.

**[0012]** Loss of arm swing is generally considered an early sign of the disease and efforts are necessarily directed to this component of gait. Mechanical means to address arm movement are needed, as related to training and mobility aid(s).

**[0013]** These devices have gripping surfaces or grip handles, or forearm support assemblies, and rollators in particular may have grips or forearm assemblies equipped with hand brakes. Forearm support assemblies are available for attachment to one or both sides of devices originally designed with gripping surfaces yet attachment of these assemblies is typically laborious and these assemblies do not offer hand brakes.

**[0014]** Forearm supports are used when additional upper body support is needed, when a user cannot grip and manage a walker with UE in normal fashion, to facilitate minimizing UE weight bearing, for postural support, to improve gait kinematics, among other reasons. In terms of neurologic gait rehabilitation, forearm platform use (as opposed to a gripping rail) has been recommended to enhance lower extremity (LE) function. Also, flexed elbow positioning is advised for neurologic gait rehab in order to minimize UE weight bearing and maintain an erect trunk. Forearm supports may be underutilized due to availability and other reasons.

**[0015]** A device with readily interchangeable support surfaces (grip handles, forearm supports), for use in any combination, each with braking capability, is needed and presented here. This adds safety and functionality to walking devices, particularly in conjunction with the unique feature of the device related to the ability to mobilize the UEs.

**[0016]** Unsafe feet positioning during turning often occurs with walkers and rollators, with concomitant increased fall risk. Users with cognitive impairment in particular tend to have greater difficulty managing these devices, related to cognitive demands of device management in addition to the cognitive demands of walking.

Walkers are often picked up, excessively turned resulting in unsafe placement of feet, and placed back on the ground. Multiple features of the device presented herein facilitate and safeguard turning.

**[0017]** A mechanical means to support and enable, facilitate, and potentiate reciprocating UE movement is needed in the various training environments used for locomotor training. Locomotor principles are the sensory cues and phasic information deemed important for locomotor training and include minimizing UE weight bearing and facilitating reciprocating arm movement. The device presented herein will enable adherence to a greater number of these principles. The device can be placed over treadmills, used for standing and marching in place, and for ambulation in the clinic and in the community, which is the progression incorporated in locomotor training. It can be used to enable repetitive reciprocating UE motion as well as for provision of a mobility aid to enable arm movement during ambulation irregardless of the degree of support needed.

**[0018]** In terms of design which promotes a reciprocating gait pattern, particularly for users with physical deficits, and design compatible with locomotor training principles, shortcomings of the known prior art walkers include the following:

1. Good UE function is required bilaterally to mobilize with these devices.

2. The UEs are functioning to physically advance the sides of the walker in alternating fashion, which may decrease the ability to achieve rhythmic, repetitive UE motion. Attentional fatigue and cognitive impairments would have a greater impact with these devices, as compared to the one presented herein.

3. Potentiation of movement of one limb by the other is not possible. A mechanism to mobilize a weak or otherwise dysfunctional UE by a more functional UE does not exist, and is needed, particularly in the neurologic population such as those afflicted with stroke. Also needed is a mechanism to therapeutically mobilize both affected upper limbs, which could be achieved by mechanization of such a device.

4. Forearm platform supports offer many advantages and are not presented on these devices.

5. In the presence of wheels, and particularly with asymmetrical UE function, one side of the walker could be advanced continuously farther than the other, and with the arms maintained in these positions the walker could be advanced in skewed fashion, as well as excessive distances forward, which would be a novel fall risk not associated with rigid-framed walkers.

6. The upper extremities advance these devices.

This is associated in current mobility aids with poor posture, excessive UE weight-bearing, among other faults.

7. Symmetrical arm movement (distance and/or velocity) is desirable and is not mechanically facilitated with known devices.

8. As related to geometrical consideration of these devices when one side frame is advanced, users may have the tendency to advance the ipsilateral lower extremity, which is contrary to the goal to achieve a reciprocating gait pattern. The device presented herein has a static, 4-legged frame.

9. Advancement of the contralateral lower extremity such as occurs when 2 point or 4 point reciprocating gait is performed, could conceivably result in placement of the foot anterior to the line between the front legs of the walker, which may result in loss of balance posteriorly. This would not be an issue with the device presented herein.

10. Swivel wheels are shown on the front, and standard wheels on the rear, of the 4-sided device. Walking along a straight path is challenging with this configuration, particularly when users are weak.

11. Stationary UE support whilst moving the side of the walker could result in greater UE weight bearing than would occur when the support surface is gliding upon a fixed frame.

12. The size of known modified walkers is excessive for maneuvering indoors.

13. Consistent posture and bodily positioning is problematic with known devices.

14. The degree of stability afforded by these frames is inferior to that offered by the rigid frame of the device presented herein.

15. Some known devices do not have a braking mechanism, needed for stability by many users.

**[0019]** JP 2009 106446, on which the preamble of claim 1 is based, discloses a walker comprising a pair of side frames connected to each other by a connection member. Each side frame has a front wheel and a rear wheel and the side frame also has a slider from which a handle extends. The slider of each side frame is connected to the rear wheel of the side frame by a connection rod. The connection rods are connected to the respective rear wheels at a point radially spaced from the centre of the wheel, and the rear wheels are initially positioned on the ground so that the connection rod for one side frame is 180° out of phase with the connection rod for the other

side frame. A person using the walker to walk holds the handles and as the person walks, the sliders move in a reciprocating manner along their respective side frames so that the person's hands holding on to the handles connected to the sliders also move in a reciprocating manner.

**[0020]** A need exists for an improved arrangement that provides at least one or more "features addressing shortcomings" of current devices as delineated above, as well as still other features and benefits.

## SUMMARY OF THE DISCLOSURE

**[0021]** According to the invention, a walker as claimed in claim 1 is provided. Thus, according to the present invention there is provided a walker that provides support for an upper extremity of an associated user, the walker comprising: a frame; at least first and second wheels operatively secured to and supporting the frame for selective rolling movement; and first and second upper extremity support assemblies for supporting upper extremities of the user, wherein the first and second upper extremity support assemblies are mounted to respective first and second sides of the frame and configured to have relative movement in relation to the respective sides of the frame, characterized by a reverse motion linkage operatively associated with and providing a mechanical connection between the first and second upper extremity support assemblies, the reverse motion linkage including a first state configured to provide independent movement of the first and second upper extremity support assemblies, and a second state configured to provide interrelated reciprocating movement of the first and second upper extremity support assemblies in relation to the respective sides of the frame.

**[0022]** Mechanization can be added to a reverse motion linkage or to one or both unlinked assemblies, to create reciprocating motion of the assembly along the track (and if the assemblies are placed at opposite ends of tracks, 'out of phase' reciprocating motion ensues).

**[0023]** Mobile UE support assemblies upon the frame, e.g., the upper part of the frame can be provided and the track can be straight or curved, or on frame/tube itself.

**[0024]** Interchangeable grip handles and forearm support assemblies may be provided in any combination, all with brakes if desired, or one or both can be statically positioned.

**[0025]** The reverse motion linkage can be connected or disconnected.

**[0026]** A unique frame component (torso bar) may be provided to keep a straight course when arms of the user are moving. This maintains consistent body positioning, enables the body instead of the arms to advance the device (even if supports are statically positioned, with the torso bar in place. Where the body moves the device, a user can more vigorously and appropriately rehab the lower body, and focus on stepping instead of using UEs.

**[0027]** Preferred wheel configurations include casters in the rear, and standard wheels in the front enabling safe

turns, and a straight/stable walking path.

**[0028]** A walker is provided which enables, facilitates, and potentiates reciprocating movement of both arms on both sides of the walker.

**[0029]** A walker is disclosed which enables movement of the arms which is not associated with forward movement of the walker (i.e. mobile supports on a fixed frame—unlike hinged walkers which enable reciprocating arm movement via arms alternately moving sides of walker).

**[0030]** A walker is disclosed which enables UEs to be sequentially placed, followed by weight bearing through the statically positioned support(s) in order to take steps. This can be performed with a connected or disconnected linkage and done with or without braking wheels, and with or without braking an assembly along the rail.

**[0031]** A walker is provided which enables, facilitates, potentiates out of phase reciprocating arm movement (i.e., upper extremities moving in reciprocating fashion in opposite directions). This occurs by limbs moving in opposite directions with or without linkage connection, or if the linkages disconnected, and one or both arms is weak, mechanization of one or both sides moving in opposite directions creates reciprocating motion. This describes both repetitive, freely mobile, reciprocating UEs, or alternately placed assemblies using brakes.

**[0032]** A walker is provided which enables arm movement such as occurs during 2 point and 4 point gait. For example, one side can advance, brake, and return to a starting position, or the opposite arm advances, brakes, and returns to the starting position. In 2 point gait, arm/opposite leg advance together, both weight-bearing, followed by opposite arm/leg. In 4 point gait, arm, opposite leg, opposite arm, leg, i.e., 4 points of contact. With either of these, it is conceivable that the arm may simply return to its starting position as opposed to moving in a rearward direction when the other arm advances, and also, the opposite arm may rest by the side of the user while the other arm advances. In other words, a linkage may be intact or not connected, the arms may fully move in a reciprocating, back and forth manner or move through partial range, when the linkage is disconnected.

**[0033]** A walker is provided which enables repetitive reciprocating out of phase UE movement.

**[0034]** A walker is provided which enables one upper limb to mobilize the opposite upper limb in the opposite direction (i.e. with a reverse motion linkage intact).

**[0035]** A walker is provided which enables movement of one UE or both UEs. (e.g. both UEs can advance together, with linkage disconnected, wheels braked, then step with one foot at a time).

**[0036]** The reverse motion linkage enables moving a weak limb by a strong limb, enables symmetrical, out of phase, reciprocating movement, and/or symmetrical movement (velocity, distance).

**[0037]** Mechanization of the linkage adds other benefits.

**[0038]** A walker is provided to which mechanization could readily be added to each of the two mobile assem-

blies not connected with a reverse motion linkage, one assembly positioned more forward and the second assembly positioned more rearward. Symmetrical, out of phase arm movement, and movement of a weak limb, could/would occur with mechanized movement of an assembly(ies) moving in opposite directions.

**[0039]** A walker is provided which can serve as a daily training device for proper gait kinematics, as well as a mobility aid.

**[0040]** A walker is provided which can be used for standing, marching in place, sitting, walking, gait training activities.

**[0041]** A walker is provided which has mobile assemblies which can be interconnected with a specialized linkage which creates (equal/opposite direction, reverse motion) of one assembly with respect to the other.

**[0042]** This movement can be variably mechanized (i.e. linkage intact).

**[0043]** This specialized linkage can be disconnected so as to enable independent functioning of each of the two assemblies either assembly or both assemblies can be statically positioned by the user holding in place statically or via motion stop blocks, either assembly or both assemblies can move in whatever fashion is desired.

**[0044]** A walker is provided with UE support assemblies in which one or both can be variably statically positioned upon a fixed frame. As such, the device can be used as a standard walker, with or without a torso bar feature with its associated functional benefits.

**[0045]** A walker is described which may have motion stop blocks which can be positioned along the rail or track, adjacent to one or both sides of the mobile component of the mobile support assembly in order to statically position the UE support along rail, or placed in variable distances from the mobile assembly(ies) in order to delineate the range of motion.

**[0046]** A walker may include multiple types of upper extremity support surfaces which can be readily installed in any combination: grip handle assembly, forearm support assembly.

**[0047]** A walker is provided with a braking mechanism intrinsic to all support surface assemblies.

**[0048]** A walker is provided with forearm platforms which may be installed and managed more easily than currently available platform assemblies which are attached to walkers and rollators.

**[0049]** A walker is provided with grip handle options of variably oriented gripping surfaces to optimize function.

**[0050]** A walker is disclosed which enables variable fore-aft positioning of support surfaces for optimal fit and function.

**[0051]** A walker with (hand) brakes which can be configured in any of several different ways in terms of effecting one or both wheels and/or movement of the assembly(ies) along the rail.

**[0052]** A walker with an additional frame component serves to improve gait kinematics, maintain proper bodily positioning, maintain a straight course concurrent with

reciprocating arm movement and enables the device to be advanced as related to contact with, and movement of, the body as opposed to being managed by the upper extremities, to the extent that this is desired.

**[0053]** This component can be kept in place if UE support assemblies are statically positioned, for bodily positioning and gait kinematic benefits offered by this component.

**[0054]** A walker may be provided with interchangeable leg attachments: standard wheels or swivel wheels or rubber-tipped legs (the latter is optional on rear only).

**[0055]** A walker is provided which can be folded for easier transport and storage.

**[0056]** A walker is described which could be fabricated using lighter weight frame materials such as aluminum, as well as heavier weight metal for added device stability.

**[0057]** A walker is provided to which could be added components such as dewatering features such as a sling support, as well as trunk and extremity positioning devices.

**[0058]** A walker is provided which could variably incorporate curvilinear rails or tracks which when used in combination with mobile UE support assemblies allow for more normal UE movement.

#### BRIEF DESCRIPTION OF THE DRAWINGS

##### **[0059]**

Figure 1 is a side view of the first embodiment of the improved walker.

Figure 2 is a rear view of the walker of Figure 1.

Figure 3A is a close up view of the mini rail with carriage, positioned atop walker frame with the cable linkage intact.

Figure 3B shows a first embodiment with the linkage disconnected.

Figures 4A-4C illustrate support surface options for attachment to a carriage of the first embodiment including a forearm trough, horizontal grip, and angled grip.

Figures 5A and 5B illustrate wrist and hand orthoses securing a distal extremity of a user to a grip handle support assembly and to grip a handle component of a forearm support assembly.

Figure 6 is a perspective view of the second embodiment of a wheeled walker including mobile UE supports and variation of a belt and pulley reverse motion linkage, and two forearm support assemblies.

Figure 7 is an enlarged perspective view of the walker of Figure 6 with selected portions of the housing

removed for ease of illustration.

Figures 8, 9, and 10A-C are perspective views of the second embodiment illustrating support surface combinations of a forearm support and grip handle support (Figure 8), grip handle supports (Figure 9), and forearm supports (Figure 10A), and end range positioning of forearm supports in Figures 10B and 10C.

Figures 11A and 11B are side and top views of a preferred walker in accordance with the present disclosure.

Figures 12A and 12B are detailed views of the torso bar.

Figures 13A-13D are schematic representations of reverse motion linkage designs, depicted on parallel railings, and in particular Figure 13D is a push pull cable linkage, a variation of which is incorporated into a first and third embodiment and Figure 13B depicts a timing belt/pulley linkage, a variation of which is incorporated into a second embodiment.

Figures 14A-C show variations of an additional push pull cable design such as could be incorporated in the first or third embodiments.

Figures 15A-C show a mobile assembly which would glide along top rail of device, as opposed to a mobile unit which glides upon a rail or track attached to the rail of the device (as in the first, second, and third embodiments) and to which support surfaces and reverse motion linkage could be attached.

Figure 16 illustrates a curved (track) which could be integrated instead of straight tracks, and a mobile support assembly.

Figure 17 shows a continuous curved track which could be incorporated instead of straight tracks and which is particularly well suited for incorporation of a push pull cable design of linkage.

#### DETAILED DESCRIPTION

**[0060]** A standard walker or aluminum walker/walker frame has been incorporated in the first embodiment and is shown in Figure 1 (side view) and Figure 2 (posterior view). The walker includes two side frames 100 (110 front, 120 rear) connected anteriorly with bars 200, creating a 3-sided walker. Each side frame 110, 120 has two legs, one anteriorly 110 and the other posteriorly 120 disposed or positioned. The height of the walker can be adjusted (for example, a conventional snap pin is located at the distal end of the walker leg and the snap pin inserts into one of several spaced holes in the fitting which at-

taches to the walker leg). Interchangeable fittings 300 typically have at their terminus standard wheels, swivel/caster wheels, glides, or rubber tips. Standard wheels 330 are shown on the front legs of the device in the illustration, and swivel wheels 320 are shown in the back, although it is understood that standard wheels could be used on all four legs, or standard wheels in front and rubber-tipped legs on the rear, or swivel wheels in front with standard wheels in the rear. At a minimum, wheels on the front legs are needed for the device to function as proposed, except in those cases when the grips are locked in position and the walker can be used as a standard pick up walker (PUW).

**[0061]** Along the upper surface of each of the side frames, a generally L-shaped member such as a piece of steel 400 is secured to the superior and lateral surfaces of the uppermost horizontal bar of the side frame in order to create a stable flat surface to accept a track 500- shown here as a ceramic-coated aluminum rail, forming a miniature linear guide. A similar length of rail is secured to the flat surface. Motion stops 600 (Figure 1), perhaps a more compact version of the carriage, with a locking mechanism, are positioned fore and aft along each of the tracks, in absence of a mechanical linkage, in order to delineate the range of motion and to prevent derailing as well as to immobilize the carriage for use of the walker as a standard mobility aid. With the linkage in place, motion stop blocks placed distal to assemblies in rearward direction serve to restrict translation distance.

**[0062]** A carriage such as a mobile anodized aluminum carriage 700 (Figures 2, 3) rests upon each of the tracks and provides the surface to which any of the various upper extremity support surfaces can be attached. An opening or hole 710 is provided (e.g., drilled) longitudinally through the entire length of the carriage, and a set screw inserted on the side of the carriage for securing cable when inserted.

**[0063]** Multiple options exist for creation of a reverse motion or reciprocating motion coupling mechanism. This type of linkage causes symmetrical motion in opposite directions, of two assemblies resting upon parallel (or mirror images-as in curved tracks, tracks/railings, etc.). See Figures 13A-D. These illustrations show linkages between devices on parallel railings, yet one can appreciate that the same mechanisms could be designed for use between devices on parallel side frames/rails of a walker.

**[0064]** The first embodiment includes a cable push-pull linkage. Incorporation of a reverse motion/push pull linkage involves the following. A member such as a curved, firm plastic tube 800 (Figure 1) is placed between the tracks, and each end of the tube is secured to the track at a location approximately even with the front cross bar of the walker and serves as the guide for the cable. The apex of the curve extends outwardly (e.g., approximately 203 mm (8 inches)) in front of the front bar of the walker, related to the rigidity of the cable, as the cable forms an arc when positioned between the tracks. The ends 810

of this tube serve as the anterior stops, when the linkage is in place, which define how far the carriage can move anteriorly along the rail. Posterior motion stops are not needed as the extent of movement in this direction is restricted by the nature of the cable connection, except for purposes of delimiting the fore-aft excursion distances of each of the two carriages. Restriction of range of UE movement may be desirable for various clinical reasons. A length of cable 900 (such as 6 mm (1/4") steel cable) is inserted, through the appropriately sized hole drilled longitudinally through one carriage, the cable guide (plastic sheath) and through the longitudinal hole drilled in the second carriage. With the carriages placed at the desired location along the tracks, the set screw on the lateral aspect of each carriage is tightened in order to secure the cable in place. The cable is sufficiently rigid such that mobilization of one side is capable of pushing and pulling the other side.

**[0065]** Removal of the cable would enable each of the two support assemblies to function independently. See Figure 3B. Either or both can be caused to move as a user desires or is able, or can be statically positioned. Whether the support assemblies are interconnected for purposes of related movement, or not connected to allow independent movement, or statically mounted, depends on the particular desired function or user requirement.

**[0066]** In the first embodiment, support surfaces are attached to the carriage as follows. An L-shaped adapter, for example a piece of steel 1000 (Figure 3), is placed on top of the carriage and is secured with fasteners such as screws 1010 into the existing holes in the carriage. A fastener is secured such as a steel bolt 1020 welded in a vertical position onto the top of the steel plate. This bolt 1020 accepts a hollow cylindrical padded grip 1310 (Figure 3B), creating a vertically-oriented gripping surface.

**[0067]** The bolt 1020 or other stable vertical piece could also accept a hollow tube to which is attached a horizontal or angled grip 1330, 1340 (shown in Figs. 4B & 4C). For attaching a forearm support 1320 (Fig. 4A), two carriages are placed on one mini rail, connected by the cable inserted through both carriages and secured with fasteners such as set screws, with desired separation between the carriages. An adapter is secured to the top of the carriages, for attachment of the forearm support assembly with hollow tubes on the undersurface to accept the upright metal pins on the adapters. Other adapters could be constructed for use, e.g., for attachment of various forearm assemblies and grip handle assemblies. Figures 4A-4C are representative of different grip handle that could be used, although one skilled in the art will appreciate that these grip handle assemblies are exemplary only and still other grip handle assemblies or combinations of forearm assemblies and grip handle assemblies can be used without departing from the scope and intent of the present disclosure.

**[0068]** A torso bar 1100 shown here as a curved aluminum tube member (Figures 1, 2, 3) is securely positioned between the side frames, with each end of the

torso bar attaching to the surface supporting the track. Fore/aft positioning could be enabled in the prototyped embodiment, e.g., by adjusting positioning via snap pins, with the ends secured in a support member or aluminum tubing secured to underside of steel support surface upon which the track rests. An adjustable strap 1200 (Figure 2) (such as a nylon webbing or other similar flexible strap) is fit with a buckle 1210 (Figure 1), and attached to each of the two ends of the curved bar member. Supports which encompass the pelvic and hip regions of the user similar to an undergarment, which attach via webbing or like material to each of the two sides of the walker frame, which are often incorporated into gait trainers, could be attached and would offer a means to provide additional bodily support.

**[0069]** The proper support surface for each of the two sides is selected and attached to each carriage. Note that any combination of grip handles and forearm support assemblies can be incorporated depending on a user's needs. A height of the forearm support can be adjusted as needed. Likewise, fore-aft position of the support surfaces along the rail are adjusted for optimal fit and function as described above.

**[0070]** Wheel selection (standard or swivel) is also made for the front legs, and wheels or standard legs selected for the rear legs. Standard wheels in the front and swivel/caster wheels in the rear is the preferred combination and results in a device which more readily travels along a straight path and can be turned safely and effectively. In those cases in which the device is used as a standard walker, with support surfaces securely and symmetrically positioned, one could use rubber tipped legs on all legs if a PUW is desired. The torso bar and belt would be removed in this case. The height of the walker is adjusted via adjusting the snap pin location in the telescoping members at ends of all four legs of the walker.

**[0071]** When forearm platforms are incorporated into the assembly, the forearm rests on the support or forearm platforms with the shoulder in a neutral and relaxed position. Standard grip support height is such that the elbow is partially flexed with the hand at approximately the level of the hip. Orthoses can be incorporated as needed to secure the user's wrist and hand to the grip support or to the grip handle component of the forearm support assembly. Figures 5A and 5B illustrate orthoses securing hand to grip handle and to a handle portion of forearm support assembly, respectively. This improves contact and hence device control when gripping function is diminished. When vertical grips (as shown in this embodiment) are used, one might choose to adjust the height such that the elbow is flexed 90 degrees. Of course, grip height other than the above may be selected for alternate fit, function and comfort.

**[0072]** The torso bar 1100 is adjustably positioned such that when the anterior aspect of the user's torso contacts the torso bar, the feet of the user are even with or slightly in front of the rear wheels. The height is not

adjustable in this embodiment yet this feature could readily be incorporated and adjustment would also be provided for fit and comfort following adjustment of the walker height. The pelvic strap length is adjusted for secure positioning of the body of the user relative to the torso bar 1100. The torso bar (with belt) serves to attenuate any forces related to arm movement of the user which would otherwise potentially cause path deviation of the device along the ground. The torso bar also serves as a tool for maintenance of optimal body positioning relative to the device. Also, advancement of the walker is preferentially caused as a result of contact of the user with the torso bar as opposed to being pushed by UE and it may provide cutaneous stimulation to the anterior hip joint which may be neurologically facilitatory in gait.

**[0073]** The features of this device accommodate significant variation in movement and gait among users and as such can be used for gait training across a spectrum of disabilities and over the course of progression for a given user. Normalization of gait or accommodating substitution patterns is also achieved as a result of using this training device and mobility aid.

**[0074]** It is also contemplated that the mobile UE supports can be braked concurrent with wheel braking for added stability. Alternatively, the UE supports may be allowed to move upon the device when the wheels are braked.

**[0075]** For training in reciprocating arm movement and reciprocating gait with freely mobile UEs, the cable linkage can be connected or disconnected with the support assemblies/carriages. The user performs continuous stepping as able, e.g., moving the arms out of phase with the legs.

**[0076]** Two and four point gait patterns may be selectively performed with the interconnecting linkage intact or disconnected, depending on UE functional status, extent of UE weight bearing needed to enable stepping, extent of support surface translation needed, support surface(s) selected, and cognition among other factors.

**[0077]** In the presence of an UE requiring immobilization, the support assembly can be statically positioned and the opposite assembly variably allowed to be mobile if desired.

**[0078]** A step to gait pattern can be performed in several ways. Statically positioned supports enable use of the device akin to a standard walker. Disconnection of the linkage enables assemblies to be advanced simultaneously, brakes applied, followed by stepping with each LE in turn. Release of the brakes following the first step may facilitate training in progression to step through gait, as forward movement of the device will be enabled without UE management as done with standard devices. With the linkage connected, and in cases such as CVA for example, the stronger UE can be advanced prior to or with the involved/weaker LE, followed by stepping with the stronger LE to a point even with the weaker LE. As such, UE movement is not restricted unnecessarily.

**[0079]** Statically positioning support assemblies and

removing the torso bar enables use of the device as a standard walker/rollator. Static assemblies in the presence of the torso bar encourage training in proper gait kinematics as LEs must function to propel the device. Inasmuch as the user is able to walk without managing the device with the UEs, more attention is directed by the user at stepping. Also, conceivably, insufficient gait stability may be detected by difficulty in walking in this manner.

**[0080]** A user can mobilize or statically position support assemblies in whatever fashion desired when the linkage is disconnected. Early active movement on an involved UE is allowed while the opposite UE moves in reciprocating fashion.

**[0081]** Mechanization of the linkage would provide multiple additional training benefits including symmetrical repetitive motion, velocity adjustment (which in turn affects stepping frequency), enabling the user to focus on LE stepping, reduction in UE fatigue for longer duration training, and setting training session duration.

**[0082]** In the presence of unilateral UE involvement, and with the linkage disconnected, mechanization could be introduced on either or both sides. For example, if mechanization is introduced on the side of the stronger limb, focus and attention of the user would be on actively mobilizing the involved limb in the opposite direction.

**[0083]** Turning the device with mobile UE supports (with the cable linkage intact or removed) is facilitated as follows. Arm support is moved in the rearward direction on the side the user is turning toward, and arm support is moved in the forward direction on the opposite side. With standard wheels in front and swivel wheels in the rear, the user sidesteps in the direction opposite the direction of the turn.

**[0084]** As noted above, a mechanism may be provided if desired whereby other mechanical gait devices can be integrated, as functionally relevant UE movement is now available with the mobility aid as taught in the present disclosure. Audible cuing at end ranges of UE movement, such as useful during gait training with Parkinson's Disease, could be integrated into this device.

**[0085]** The present device can be used for repetitive stepping training over ground or marching in place on the ground or on a treadmill. The user can variably be in a seated position and use the device for upper body training.

**[0086]** Figures 6-10 illustrate the second embodiment of the reciprocating arm movement wheeled walker which incorporates a type of timing belt/pulley linkage to create reciprocating UE motion. In Figure 6, a wheeled walker 2000 includes first, second, third, and fourth legs 2002 2004, 2006, 2008. Each of the legs 2002-2008 includes a wheel 2010 at a lower end. In the illustrated embodiment of Figure 6, the rear wheels 2010 are caster mounted at 2012 for rotation about a vertical axis as is conventionally known in the art. Further, each of the legs 2002-2008 may be height adjustable. Again, details of the height adjustability are well known in the art, although

one manner of providing adjustment is to include concentric tubes that include a snap pin received through one of a series of axially spaced openings. The snap pin is mounted to one of the tubes and includes a head or button portion that protrudes through one of the axially spaced openings to define the position (and thus the height) of the concentric tubes relative to one another. Again, particular details of this height adjustment mechanism are well known in the art so that further discussion herein is deemed unnecessary to a full and complete understanding of the present disclosure. Likewise, description of one height adjustment mechanism does not preclude use of other height adjustment mechanisms to accomplish the desired raising or lowering of the upper portion of the walker relative to lower portion.

**[0087]** Side braces 2020 extend between respective legs on each side of the wheeled walker 2000. For example, one of the side braces 2020 interconnects the front right leg 2002 with the rear right leg 2006. Likewise, the other side brace 2020 interconnects the front left leg 2004 with the rear left leg 2008. Moreover, one or more front braces 2022 may be provided between the front legs 2002, 2004.

**[0088]** The ability to support an upper extremity or upper extremities of a user (not shown) having various needs are particularly illustrated in Figures 6-10. First and second support assemblies or carriages 2030 are shown in Figures 6 and 7. Each of the support assemblies 2030 is mounted for selective sliding movement relative to a respective side of the wheeled walker 2000 (or one or both may be selectively fixed relative to a respective side of the walker). For ease of understanding and purposes of brevity, description of the structure and function of one support assembly 2030 is deemed applicable to the other forearm support assembly unless specifically noted otherwise. In a preferred arrangement, the support assembly 2030 includes a housing 2032 that extends along one side of the wheeled walker 2000. The housing 2032 is securely mounted to upper regions of the front and rear legs (2002, 2006 or 2004, 2008) on one side. In the preferred arrangement, the housing 2032 encloses a rail 2034 that extends horizontally along one side. The rail 2034 is shown as a tubular rail, although the rail could also adopt other configurations. Actuating arm 2036 is received on the rail and movement thereof actuates movement of pulleys 2074, 2076. In Figures 8-10, the mounting member is attached to the 'actuating arm', for attachment of trough and grip handle) mounting member 2036 is slidably received over the rail 2034 and is capable of linear movement relative to the rail both forwardly and rearwardly. Support members 2038 that receive opposite ends of the rail 2034 also serve as stop members to limit the longitudinal movement of the mounting member 2036 on the rail. Secured to the mounting member 2036 is a support member 2050. As evident in Figures 6-10, the support member 2050 may adopt a wide variety of styles, and may include forearm support assemblies 2052 with grip handles 2060 two of which are shown in Figures 6,

7, 10A-C. One forearm support 2052 and one grip handle support 2060 are included in the embodiment of Figure 8; and two grip handle supports 2060 are used in the embodiment of Figure 9. In Figs. 8, 9, 10, the mounting mechanism is different than the mounting mechanism of Figs. 6-7; however, one of two varieties of height-adjustable mounting member 2040 is attached to mounting member or actuating arm 2036. One variety secures only the grip handle support or tube, while another version secures this tube as well as the forearm support or trough. A handle grip 2060 is provided on each mounting member 2036 or 2040. The handle grip 2060 is shown angularly mounted relative to horizontal (e.g. 60° to 75° from horizontal) and follows the natural contour of a user's fingers when a forearm is received, for example, in a forearm support 2052. Angular mounting also places the wrist in a neutral posture when the device is used for light support. The mounting member 2040 in the version shown in Figures 10A-10C has greater height adjustment capabilities than the mounting member version 2040 illustrated in Figures 8-9.

**[0089]** As described above, the carriages or support assemblies 2030 are mounted for sliding movement relative to a respective side, and also fore and aft relative to one another, i.e., one side advances forward while the other moves rearwardly, and vice versa. This coordinated action between the support assemblies 2030 employs a mechanical connection or link 2070 and when assembled together (connected), is referred to herein as a reverse motion linkage. The reverse motion linkage serves to move one carriage/support assembly in the forward direction at the same velocity and distance as the opposite carriage/support assembly moves in the opposite direction.

**[0090]** In the embodiments of Figures 6-10, and as particularly illustrated in Figure 7, each housing 2032 encloses one form of a mechanical connection 2070 specifically a belt and pulley assembly that includes a drive belt 2072 that forms a continuous loop about first (front) and second (rear) pulleys 2074, 2076. The pulleys 2074, 2076 are axially spaced apart relative to one another and each rotate about a horizontal axis. The belt and pulley assembly 2070 is located adjacent the elongated rail 2034 within the housing 2032. Moreover, each of the front pulleys 2074 is interconnected by a shaft 2078 to coordinate the movement between the right and left sides. Specifically, rotation of the front pulleys 2074 are interconnected via a geared mechanism so that rotation of the belt in one direction on one side is opposite the rotational direction of the belt on the other side, and consequently as one carriage 2030 on one side of the wheeled walker moves forwardly, the carriage on the other side of the wheeled walker moves rearwardly. Moreover, movement of one carriage in the forward direction is at the same velocity over the same distance as the other carriage moves rearwardly.

**[0091]** A handbrake 2080 is also conveniently positioned relative to the handle grip 2060. Actuating the

handbrake 2080 as shown in Figures 6 and 7 is intended to stop movement of the carriages along the rail as represented by cable 2082. As illustrated in Figures 8-10, a second cable 2084 is shown so that the handbrake 2080 is connected to one or both front wheels 2010 for braking thereof. Users with decreased functionality of one UE would find this arrangement desirable. It is also contemplated that the handbrake mechanism 2080 could provide for stopping movement of the individual carriages 2030 as well as providing a braking force to the wheels 2010 with a single cable, or with a different braking assembly. It may also be desirable to be able to brake the wheels, without concurrently braking movement of carriage along rail. Multiple braking options are possible, in order to achieve the most efficient, functional, safe gait pattern given a user's physical characteristics.

**[0092]** The carriages are positioned symmetrically, with fore-aft positioning such that when the support surface is engaged by the user, the shoulder is in a neutral position (i.e. even with midline of body when viewed laterally). As related to variable fore-aft contact location of the extremity with the support surface, when comparing grip support to forearm trough support, bilateral grip handle supports will be symmetrically placed slightly more forward along the rails, and bilateral forearm supports will be symmetrically placed farther back along the rails. This is due to the ability to vary the UE contact point with the rail depending on the elbow position of a particular user. One grip handle and one forearm support may be desirable, as well, for various clinical reasons. With the current embodiment with grip supports in place, the carriage can be mobilized anterior relative to the neutral position to a location approximately even with the front horizontal bar of the walker (e.g. approximately 178 mm (7 inches) anterior to the neutral position) and posterior relative to the neutral position to a location roughly even with the attachment of the torso bar to the side frame (e.g., approximately 178 mm (7 inches) posterior to the neutral position), enabling symmetrical arm motion during gait. Of course one skilled in the art will recognize that the noted dimensions are exemplary only and the subject disclosure should not be unduly limited to these dimensions.

**[0093]** The carriages can be connected with the reverse motion linkage or can be unlinked simply by removing the coupling shaft. Removing the coupling shaft or unlinking the carriages from cooperating movement with one another would allow for independent movement of each of the two carriages along each of the two respective rails. As such, the direction of and the extent of glide of each of the two mobile assemblies, is independent of the other.

**[0094]** In terms of performing any of the possible gait patterns involving out of phase arm movement with this device, the reverse motion linkage may be kept in place or removed, depending on the functional ability of the user, unique movement considerations, and still other considerations or factors.

**[0095]** Figure 10A illustrates symmetrical (forearm) support assembly positioning, while Figures 10B and 10C illustrate support positioning at the end range of movement of the support assembly/carriage.

**[0096]** The carriages allow for very low resistance gliding along the tracks. Is it kosher to say that variable Resistance to glide could be introduced in any of the embodiments.

**[0097]** In the second embodiment, the device is unfolded by moving one side frame away from the other until the joints between the two front legs and the two horizontal front frame members lock into place. The end plates of the torso bar are lowered into the pockets on the inner surfaces of the housing. The desired wheel type is selected for optimal functioning and leg attachments are changed as needed. The walker height for a particular user is adjusted for proper fit and function by adjusting the positions of the snap pins in the holes of the leg attachment pieces. The height of the forearm support trough(s) is likewise adjusted if this type of support surface is selected. It is also understood that a grip surface on one side and a forearm support assembly on the other side or two grip handle supports could be used. The desired support surfaces are selected and secured to the device.

**[0098]** The actuating arms (mounting members) are positioned for fit and function for a particular user. Motion of a support surface of, for example, up to 445 mm (17.5 inches) of total travel has been achieved with this embodiment, and again, a greater or lesser amount of travel is contemplated without departing from the scope and intent of the present disclosure. This disclosure accommodates variable introduction of grip supports or forearm supports and the variable neutral positioning associated with each. A device with a shorter travel distance, and hence a shorter side frame component, could be envisioned, such as for consistent use of one type of support surface, e.g., grip supports or forearm supports. The coupling shaft is engaged to lock the support surfaces into the desired positions, which may be asymmetrically placed, for example, if both a grip and a forearm support are used. Otherwise, the supports would typically be symmetrically placed. In the mid-position, the same amount of travel fore and aft relative to the midline of the body results. Alternately, placement of the support or carriage more forward results in a greater percentage of the travel in front of the midline, and placement of the support or carriage closer to the rear of the device results in a greater percentage of the travel posterior to the midline of the body. The coupling shaft is left disengaged if independent movement of the arms is desired.

**[0099]** Testing of brake functionality is performed for safety purposes. Brakes can be engaged as needed, for purposes of arresting the movement of the support surface along the rail, and/or for arresting the movement of the device along the ground. When the coupling shaft is in place, braking one side will cause braking of both UE supports. One brake lever can be configured to brake

both wheels of the device if this is desired, such as in cases of UE dysfunction unilaterally.

**[0100]** The torso bar could be made to be adjustable for fore-aft and vertical positioning. Adjustability of the torso bar is not specifically shown in this embodiment but it is well within the purview of one skilled in the art to provide an arrangement that permits such adjustment. The user addresses the walker, and with the current embodiment, maintains contact of the abdomen of the user with the torso bar and secures the belt such that constant contact with the device through the torso bar is achieved. The arms of the user are placed on the support surfaces, and orthoses incorporated as needed to adequately position and/or secure the distal UE to the support surface for optimal functioning. Various functionalities of the second embodiment are the same functionalities as described previously for the first embodiment.

**[0101]** It will be recognized that the present disclosure is not limited to the physical structures and functions described herein, but is intended to encompass variations and modifications that are reasonable extensions of these teachings. For example, a glide on track; glide directly on rail; or any other device which stably glides along a track..." Alternately, an undersurface of a forearm trough is equipped with rollers, bearings, or any of several other mechanisms to accomplish secure mobility (i.e., relative sliding) along a track.

**[0102]** Fig. 11A and 11B illustrate a preferred embodiment of the disclosure in which the support assemblies are capable of being adjusted upwardly and outwardly (see adjustment openings in vertically aligned plates) to allow the support platform to be raised and lowered, and to be mounted forwardly and rearwardly as desired. The torso bar 3310 is also moved rearwardly so that the user can push their torso against the arc-shaped torso bar (see Figure 11B) and the user is urged into engagement with the torso bar by the adjustable belt or strap 3312.

**[0103]** Figs. 12A and 12B are enlarged, detailed views of the torso bar and the adjustable belt. It is also recognized that the torso bar may be selectively raised and lowered (see adjustable fixture 3314 secured to the side frames) and that through use of screws or the like, the vertically extending tubes 3316 extending from the rear portion of the torso bar in place can be selectively raised and lowered.

**[0104]** Figs. 13A-13D are different designs of reverse motion linkages which could variably be integrated into walker design. Shown on parallel rails which can represent the parallel rails (top portions of side frames) of a walker. The linkage assemblies provide for reverse motion of the first and second rail linkage assemblies (and hence whatever support surface is attached thereto) when secured to parallel rails.

**[0105]** As explained, this linkage can be connected or disconnected, the latter enabling independent movement of each of the two support assemblies. The component which is mobile upon the rail is similar in function to a mobile device presented in figs. 15A-C and will be called

a rail linkage assembly. It is understood that mobile devices which glide along a track as opposed to directly on the rail such as in embodiments 1 and 3 could also be connected with reverse motion linkages. In Figs 13A and 13B, the support surface has not yet been attached to rail linkage assembly. In Figs. 13C and 13D, a forearm trough is attached directly to the top surface of the rail linkage assembly, hence creating mobile devices. As the forearm trough is affixed directly to the rail linkage assembly, elevation of the walker height such that the forearm can rest on the surface is necessitated. The spanning members are affixed to the anterior portion of walker frame. In Fig. 13B, the first and second rail linkage assemblies 1360 each move relative to their respective rail, and each move relative to one another via an interconnecting flexible member such as a wire, cable, etc. received around one or more pulleys. Thus, as one of the rail linkage assemblies move rearwardly, the other rail linkage assembly moves forwardly. In Fig. 13C, a different mechanism is shown. A three bar linkage assembly is shown that includes a central arm pivotally mounted to the cross member. Opposite ends of the central arm are, in turn, pivotally connected to link arms that are connected at their distal end to respective slidable rail linkage assemblies. In Fig. 13D, still another variation of a reverse motion linkage is illustrated. Here, additional links or arms are pivotally connected to one another and to the support portions of the rail linkage assembly. A cable could also attach to the mobile assemblies and travel along the U shaped track. The cross member has a generally U-shape and includes a track or group that receives connection members or pins that join the individual links together, and partially constrain relative movement or orientation as the rail linkage assemblies move to and fro.

**[0106]** In Figs. 14A-14C a push pull cable 5000 is provided. Custom made spring 5010 keeps the cable 5000 from buckling when the cable is pushed. Other components other than a spring such as a bellows or the like, could be used to prevent the cable from buckling while still permitting the sliding component 5006 to move forwardly and rearwardly in slot 5008 formed in the tube 5004 having a hollow portion with an elongated slot. The support assemblies or carriage assemblies described above in connection with, for example, Figures 6 - 9 would be secured to the component 5006.

**[0107]** Figs. 15A-15B are side and cross sectional views of an assembly which can be securely positioned upon a top rail of walker as opposed to an assembly which is mobile upon a track which rests on upper surface of walker frame. The assembly is, for example, a rigid member such as a cylindrical steel (or other metal, polymer, composite) tube of variable thickness lined with a material that facilitates sliding movement relative to the rail/bar on which the assembly is mounted such as a self-lubricating polymer such as ultra high molecular weight polyethylene (UHMWPE). The polymer is cut to be variable thickness and geometry (and hence cross-sectional shape when viewed following lining the cylinder with the

layer of material and examining cross sectional), such that it conforms to the rail onto which it will be attached and along which it will translate. An assembly with a collar fitting rails of variable shape other than round, will not freely rotate about the long axis of the rail; as such, vertical stability of the device will be inherent. The resultant inside profile or diameter of the device is the same as or equal to the outside profile or diameter of the rail onto which it is attached, in the case of a round railing. The polymer can be backed with an adhesive and hence affixed to the internal surface of the cylindrical tube, or attached in other ways so as to enable exchanging and reusing collars readily. The plastic collar can be simply removed and replaced with an alternate collar, such that the device can be used on an alternate rail if desired. For example, a slit is cut lengthwise along the cylinder and the assembly is hinged to enable opening such that the assembly can be opened and put on a rail and subsequently secured in place. A tube weldment is located on the top (or other surface) of the device and receives and secures the linkage. A fastener serves to approximate the two separated edges of the cylinder and can be tightened or loosened in order to vary the amount of friction when the device moves relative to or glides along the rail. The fastening device can be of any design/configuration and one or more could be incorporated as needed to achieve friction adjustment of the device. It is also contemplated that instrumentation of the fastening device would be desirable to allow objective measures of resistance to movement hence incorporated. One or two tube clevises are secured via welding or other means to one side of the device and serve as the receptacle for the upright tube which is the attachment mechanism of the various UE support assemblies. Tightening screws serve as one option of a method to tighten the tube clevis around the tube. It is also contemplated that the collar and inner lining could be a single component, i.e. the lining integrally formed as a part of the tube such as a reinforced polymer collar that includes a lubricious material (or is inherently lubricious) to facilitate manufacture of the arrangement. Again, the present disclosure is intended to illustrate one preferred embodiment but is not deemed to be limited to only this embodiment.

**[0108]** Fig. 15C is a cross sectional view of device with a plastic lining (collar) with two projections which run longitudinally within the device, and which is fabricated to accommodate a railing of alternate shape (i.e. one with longitudinally-running grooves along the superior and inferior aspects). The same device is lined in this example with a specified thickness of plastic, for example, which lines a portion of each hemisphere of the cylinder, and has projections (on the top and bottom in this example) which accommodate a railing with mirror image indentations. As is illustrated here, the device can be split and the two portions hinged secure with the fastening screw(s) which simply secure the abutting edges of the cylinder assembly together as opposed to serving as a progressive tightening mechanism. Functionally, a de-

vice which conforms to a noncircular rail such as this would be inherently stable and a linkage serving to provide rotational stability of the device on the railing would likely not be needed. A reverse or reciprocating motion linkage such as those illustrated in fig. 13A-13D or other, could variably be incorporated and therefore an attachment site (such as a tube weldment shown here) for such is needed.

**[0109]** Figs. 16 and 17 provide curved tracks which can be attached to an upper portion of walker frame to enable rotational component of shoulder motion as the arm moves back and forth.

**[0110]** In Fig. 16, the track 7002 is curvilinear which enables rotational component of shoulder motion as the UE moves in reciprocating fashion, as compared to straight sagittal plane movement which is facilitated with use of straight track(s). Track is preferably incorporated bilaterally yet could be used unilaterally if there is a need to statically position the opposite UE. Tracks are stably positioned on top of walker frame member with device 7014, 7016 which serves to stably position the tracks in a selected position on the rail.

**[0111]** In Fig. 17, the track 7002 is secured to both rails (side frames of the walker), by two or more assemblies 7014, 7016. Piece 7018 glides along the track and provides the surface to which the various UE support surfaces are attached. A cable is connected to each of the two pieces and is securely mobilized through a housing which is or rests on a spanning member. Alternately, another connection between the assemblies is envisioned, via mobile components contained within or along the track. As other reverse motion linkages accomplish, movement of a weak limb can be potentiated by a stronger limb, for example. The track 7002 is curved such that greater degrees of freedom of movement of the shoulder can be accomplished as described above. Cane handle grips 7014 or forearm supports 7020 are shown as the support surface in this example.

**[0112]** It is also understood that the walker frame itself could be fabricated with discontinuous (fig. 16) or continuous (fig. 17) curved tube(s) upon which a mobile device such as fig. 15 could glide.

## Claims

1. A walker (100, 2000) that provides support for an upper extremity of an associated user, the walker comprising:

a frame (100);  
at least first and second wheels (330, 2010) operatively secured to and supporting the frame (100) for selective rolling movement; and  
first and second upper extremity support assemblies (700, 2030) for supporting upper extremities of the user, wherein the first and second upper extremity support assemblies (700, 2030)

are mounted to respective first and second sides of the frame (100) and configured to have relative movement in relation to the respective sides of the frame (100),

### characterized by

a reverse motion linkage (2070) operatively associated with and providing a mechanical connection between the first and second upper extremity support assemblies (700, 2030), the reverse motion linkage (2070) including a first state configured to provide independent movement of the first and second upper extremity support assemblies (700, 2030), and a second state configured to provide interrelated reciprocating movement of the first and second upper extremity support assemblies (700, 2030) in relation to the respective sides of the frame (100).

2. The walker of claim 1 wherein the first and second upper extremity support assemblies (700, 2030) reciprocate along the respective sides of the frame (100) in at least one of opposite directions, equal distance, and equal velocity.
3. The walker of claim 1, wherein at least one of the first and second upper extremity support assemblies (700, 2030) includes a handle grip (1310, 1330, 1340) for selective gripping by a hand of the associated user.
4. The walker of claim 1 or 3, wherein at least one of the first and second upper extremity support assemblies (2030) includes a forearm support trough (2050) dimensioned to receive at least a portion of a forearm of the associated user.
5. The walker of claim 1, further comprising a brake assembly (2080) for braking at least one of the first and second upper extremity support assemblies (2030) relative to the frame (100).
6. The walker of claim 5, wherein the brake assembly (2080) is operatively connected to at least one of the first and second wheels (2010) for braking the at least one of the first and second wheels (2010).
7. The walker of claim 1, wherein the reverse motion linkage (2070) includes first and second flexible drive members (2072) operatively connected to the first and second upper extremity support assemblies (2030), respectively, and the first and second flexible drive members (2072) are interconnected to one another for synchronized movement therebetween.
8. The walker of claim 1, further comprising an adjustment member (2040) whereby a position of at least one of the first and second upper extremity support assemblies (700, 2030) relative to a respective frame

(100) is adjustable.

9. The walker of claim 8, wherein the reverse motion linkage (2070) includes a coupling shaft (2078) operatively associated with the first and second upper extremity support assemblies (2030) and selectively disconnectable from at least one of the first and second upper extremity support assemblies (2030) to permit folding of the frame (100). 5
10. The walker of claim 1, further comprising a torso bar (1100) on the frame (100) adapted for engagement with the torso of an associated user. 10
11. The walker of claim 10, wherein the torso bar (1100) is adjustable for fore-aft and vertical positioning on the frame (100). 15
12. The walker of claim 1, further comprising at least one stop block (600) operatively associated with at least one of the first and second upper extremity support assemblies (700) to limit movement of the at least one of the first and second upper extremity support assemblies (700) in at least a first direction relative to the frame (100). 20
13. The walker of claim 1, wherein the first and second wheels (330, 2010) comprise casters in a rear and standard wheels in a front of the walker, wherein the casters in the rear and standard wheels in the front enable safe turning of the walker, and a straight/stable walking path. 30
14. The walker of claim 1, including interchangeable leg attachments comprising standard wheels or swivel wheels or rubber-tipped legs wherein rubber-tipped legs are optional on a rear of the walker only. 35

#### Patentansprüche 40

1. Gehhilfe (100, 2000), die für eine obere Extremität eines zugeordneten Benutzers eine Unterstützung bereitstellt, wobei die Gehhilfe umfasst: 45
  - einen Rahmen (100);
  - ein erstes und ein zweites Rad (330, 2010), die für eine selektive Rollbewegung wirksam an dem Rahmen (100) befestigt sind und diesen unterstützen; und 50
  - eine erste und eine zweite obere Extremitäten unterstützende Anordnung (700, 2030) zum Unterstützen oberer Extremitäten des Benutzers, wobei die erste und die zweite obere Extremitäten unterstützende Anordnung (700, 2030) jeweils an einer ersten und einer zweiten Seite des Rahmens (100) angebracht und dazu konfiguriert sind, eine relative Beweglichkeit bezüg-

lich der jeweiligen Seiten des Rahmens (100) zu haben,

#### gekennzeichnet durch

- eine Umkehrbewegungswirkverbindung (2070), die der ersten und der zweiten obere Extremitäten unterstützenden Anordnung (700, 2030) zugeordnet ist und eine mechanische Verbindung zwischen diesen bereitstellt, wobei die Umkehrbewegungswirkverbindung (2070) einen ersten Zustand, der dazu konfiguriert ist, eine unabhängige Bewegung der ersten und der zweiten obere Extremitäten unterstützenden Anordnung (700, 2030) vorzusehen, und einen zweiten Zustand aufweist, der dazu konfiguriert ist, eine voneinander abhängige Hin- und Herbewegung der ersten und der zweiten obere Extremitäten unterstützenden Anordnung (700, 2030) bezüglich der jeweiligen Seiten des Rahmens (100) vorzusehen.
2. Gehhilfe gemäß Anspruch 1, wobei die erste und die zweite obere Extremitäten unterstützende Anordnung (700, 2030) sich entlang der jeweiligen Seiten des Rahmens (100) in mindestens einer aus entgegengesetzten Richtungen, gleichem Abstand und gleicher Geschwindigkeit hin- und herbewegen.
3. Gehhilfe gemäß Anspruch 1, wobei mindestens eine aus der ersten und der zweiten obere Extremitäten unterstützenden Anordnung (700, 2030) einen Handgriff (1310, 1330, 1340) zum selektiven Ergreifen durch eine Hand des zugeordneten Benutzers aufweist.
4. Gehhilfe gemäß Anspruch 1 oder 3, wobei mindestens eine aus der ersten und der zweiten obere Extremitäten unterstützenden Anordnung (2030) eine wannenartige Unterarmstütze (2050) aufweist, die dazu abgemessen ist, mindestens einen Teil eines Unterarms des zugeordneten Benutzers aufzunehmen.
5. Gehhilfe gemäß Anspruch 1, ferner umfassend eine Bremsanordnung (2080) zum Bremsen mindestens einer aus der ersten und der zweiten obere Extremitäten unterstützenden Anordnung (2030) relativ zu dem Rahmen (100).
6. Gehhilfe gemäß Anspruch 5, wobei die Bremsanordnung (2080) mit mindestens einem aus dem ersten und dem zweiten Rad (2010) wirksam verbunden ist, um das mindestens eine aus dem ersten und dem zweiten Rad (2010) zu bremsen.
7. Gehhilfe gemäß Anspruch 1, wobei die Umkehrbewegungswirkverbindung (2070) ein erstes und ein zweites flexibles Antriebselement (2072) aufweist, das mit der ersten bzw. der zweiten obere Extremität

täten unterstützenden Anordnung (2030) wirksam verbunden ist, und das erste und das zweite flexible Antriebselement (2072) für eine untereinander synchronisierte Bewegung miteinander verbunden sind.

8. Gehhilfe gemäß Anspruch 1, ferner umfassend ein Einstellelement (2040), durch das eine Position von mindestens einer aus der ersten und der zweiten obere Extremitäten unterstützenden Anordnung (700, 2030) relativ zu einem jeweiligen Rahmen (100) einstellbar ist. 10
9. Gehhilfe gemäß Anspruch 8, wobei die Umkehrbewegungswirkverbindung (2070) eine Kopplungswelle (2078) aufweist, die der ersten und der zweiten obere Extremitäten unterstützenden Anordnung (2030) wirksam zugeordnet ist und von mindestens einer aus der ersten und der zweiten obere Extremitäten unterstützenden Anordnung (2030) selektiv lösbar ist, um ein Zusammenklappen des Rahmens (100) zu ermöglichen 20
10. Gehhilfe gemäß Anspruch 1, ferner umfassend einen Torsobügel (1100) auf dem Rahmen (100), der zum In-Eingriff-Kommen mit dem Torso eines zugeordneten Benutzers angepasst ist. 25
11. Gehhilfe gemäß Anspruch 10, wobei der Torsobügel (1100) für eine Vor-Rück- und vertikale Positionierung auf dem Rahmen (100) einstellbar ist. 30
12. Gehhilfe gemäß Anspruch 1, ferner umfassend mindestens einen Anschlagblock (600), der mindestens einer aus der ersten und der zweiten obere Extremitäten unterstützenden Anordnung (700) wirksam zugeordnet ist, um eine Bewegung der mindestens einen aus der ersten und der zweiten obere Extremitäten unterstützenden Anordnung (700) in mindestens einer ersten Richtung relativ zu dem Rahmen (100) zu begrenzen. 40
13. Gehhilfe gemäß Anspruch 1, wobei das erste und das zweite Rad (330, 2010) Nachlaufräder hinten und standardmäßige Räder vorne an der Gehhilfe umfassen, wobei die Nachlaufräder hinten und die standardmäßigen Räder vorne ein sicheres Wenden der Gehhilfe und einen geraden/stabilen Gehweg ermöglichen. 45
14. Gehhilfe gemäß Anspruch 1, aufweisend austauschbare Fußanbauteile, die standardmäßige Räder oder schwenkbare Räder oder Füße mit Gummikappen umfassen, wobei Füße mit Gummikappen nur hinten an der Gehhilfe optional sind. 50

## Revendications

1. Déambulateur (100, 2000) qui fournit le support pour une extrémité supérieure d'un utilisateur associé, le déambulateur comprenant : 5
  - un bâti (100) ;
  - au moins des première et seconde roues (330, 2010) fixées, de manière opérationnelle à et supportant le bâti (100) pour le mouvement de roulement sélectif ; et
  - des premier et second ensembles de support d'extrémités supérieures (700, 2030) pour supporter les extrémités supérieures de l'utilisateur, dans lequel les premier et second ensembles de support d'extrémités supérieures (700, 2030) sont montés sur les premier et second côtés respectifs du bâti (100) et configurés pour avoir un mouvement relatif par rapport aux côtés respectifs du bâti (100),**caractérisé par :**
  - une liaison de mouvement inverse (2070) associée de manière opérationnelle à et fournissant un raccordement mécanique entre les premier et second ensembles de support d'extrémités supérieures (700, 2030), la liaison de mouvement inverse (2070) comprenant un premier état configuré pour fournir le mouvement indépendant des premier et second ensembles de support d'extrémités supérieures (700, 2030) et un second état configuré pour fournir le mouvement réciproque interdépendant des premier et second ensembles de support d'extrémités supérieures (700, 2030) par rapport aux côtés respectifs du bâti (100).
2. Déambulateur selon la revendication 1, dans lequel les premier et second ensembles de support d'extrémités supérieures (700, 2030) effectuent un mouvement alternatif le long des côtés respectifs du bâti (100) dans au moins l'une parmi les directions opposées, une distance égale et une vitesse égale.
3. Déambulateur selon la revendication 1, dans lequel au moins l'un des premier et second ensembles de support d'extrémités supérieures (700, 2030) comprend une poignée (1310, 1330, 1340) pour la saisie sélective par une main de l'utilisateur associé.
4. Déambulateur selon la revendication 1 ou 3, dans lequel au moins l'un des premier et second ensembles de support d'extrémités supérieures (2030) comprend un creux de support d'avant-bras (2050) dimensionné pour recevoir au moins une partie d'un avant-bras de l'utilisateur associé.
5. Déambulateur selon la revendication 1, comprenant en outre un ensemble de frein (2080) pour freiner au

moins l'un parmi les premier et second ensembles de support d'extrémités supérieures (2030) par rapport au bâti (100).

6. Déambulateur selon la revendication 5, dans lequel l'ensemble de frein (2080) est raccordé, de manière opérationnelle, à au moins l'une des première et seconde roues (2010) pour freiner la au moins une des première et seconde roues (2010). 5
7. Déambulateur selon la revendication 1, dans lequel la liaison de mouvement inverse (2070) comprend des premier et second éléments d'entraînement flexibles (2072) raccordés, de manière opérationnelle, aux premier et second ensembles de support d'extrémités supérieures (2030) respectivement, et les premier et second éléments d'entraînement flexibles (2072) sont interconnectés entre eux pour le mouvement synchronisé entre eux. 10
8. Déambulateur selon la revendication 1, comprenant en outre un élément d'ajustement (2040) moyennant quoi une position d'au moins l'un parmi les premier et second ensembles de support d'extrémités supérieures (700, 2030) par rapport à un bâti (100) respectif est ajustable. 15
9. Déambulateur selon la revendication 8, dans lequel la liaison de mouvement inverse (2070) comprend un arbre de couplage (2078) associé, de manière opérationnelle, avec les premier et second ensembles de support d'extrémités supérieures (2030) et pouvant être déconnecté sélectivement d'au moins l'un parmi les premier et second ensembles de support d'extrémités supérieures (2030) pour permettre le pliage du bâti (100). 20
10. Déambulateur selon la revendication 1, comprenant en outre une barre de torse (1100) sur le bâti (100) adaptée pour la mise en prise avec le torse d'un utilisateur associé. 25
11. Déambulateur selon la revendication 10, dans lequel la barre de torse (1100) est ajustable pour le positionnement avant - arrière et vertical sur le bâti (100). 30
12. Déambulateur selon la revendication 1, comprenant en outre un bloc d'arrêt (600) associé, de manière opérationnelle, avec au moins l'un parmi les premier et second ensembles de support d'extrémités supérieures (700) pour limiter le mouvement d'au moins l'un parmi les premier et second ensembles de support d'extrémités supérieures (700) dans au moins une première direction par rapport au bâti (100). 35
13. Déambulateur selon la revendication 1, dans lequel les première et seconde roues (330, 2010) comprennent des roulettes à l'arrière et des roues standard 40

à l'avant du déambulateur, dans lequel les roulettes à l'arrière et les roues standard à l'avant permettent la prise de virage en toute sécurité du déambulateur, et une trajectoire de marche droite / stable.

14. Déambulateur selon la revendication 1, comprenant des fixations de pied interchangeables comprenant des roues standards ou des roues pivotantes ou des pieds à pointe caoutchouc, dans lequel les pieds à pointe caoutchouc sont facultatifs à l'arrière du déambulateur uniquement. 45

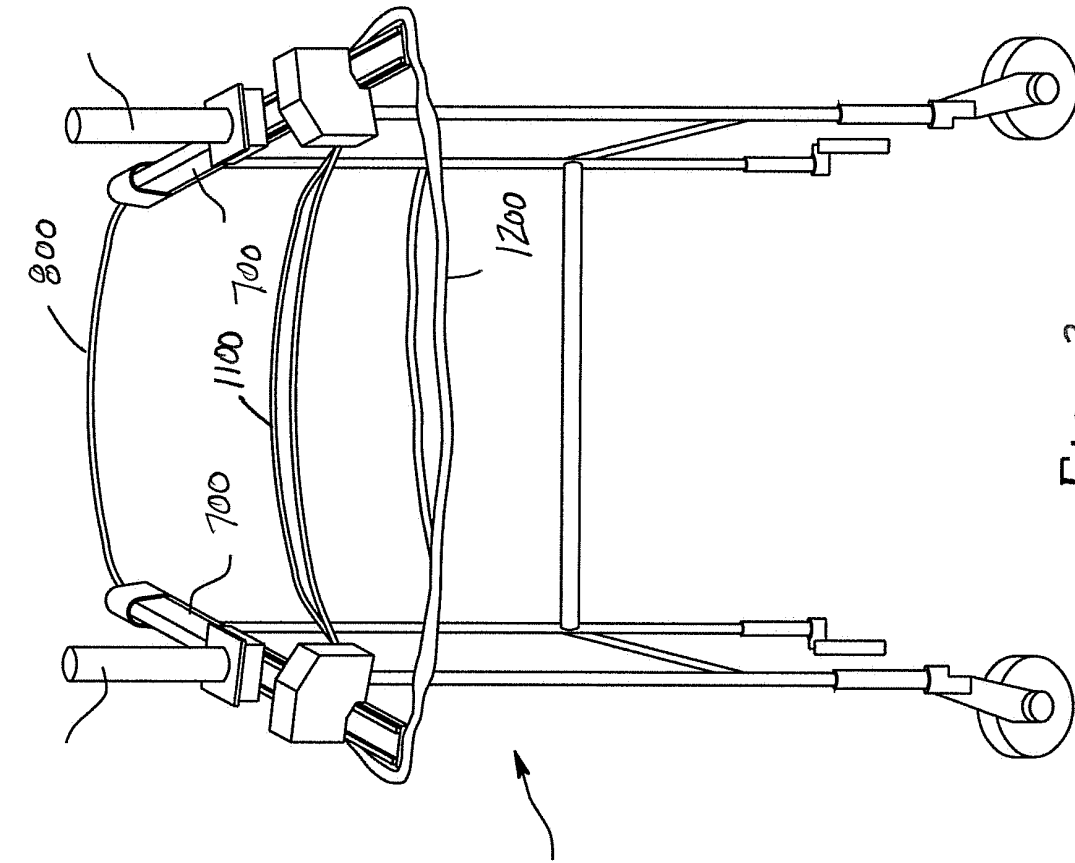


Fig. 1

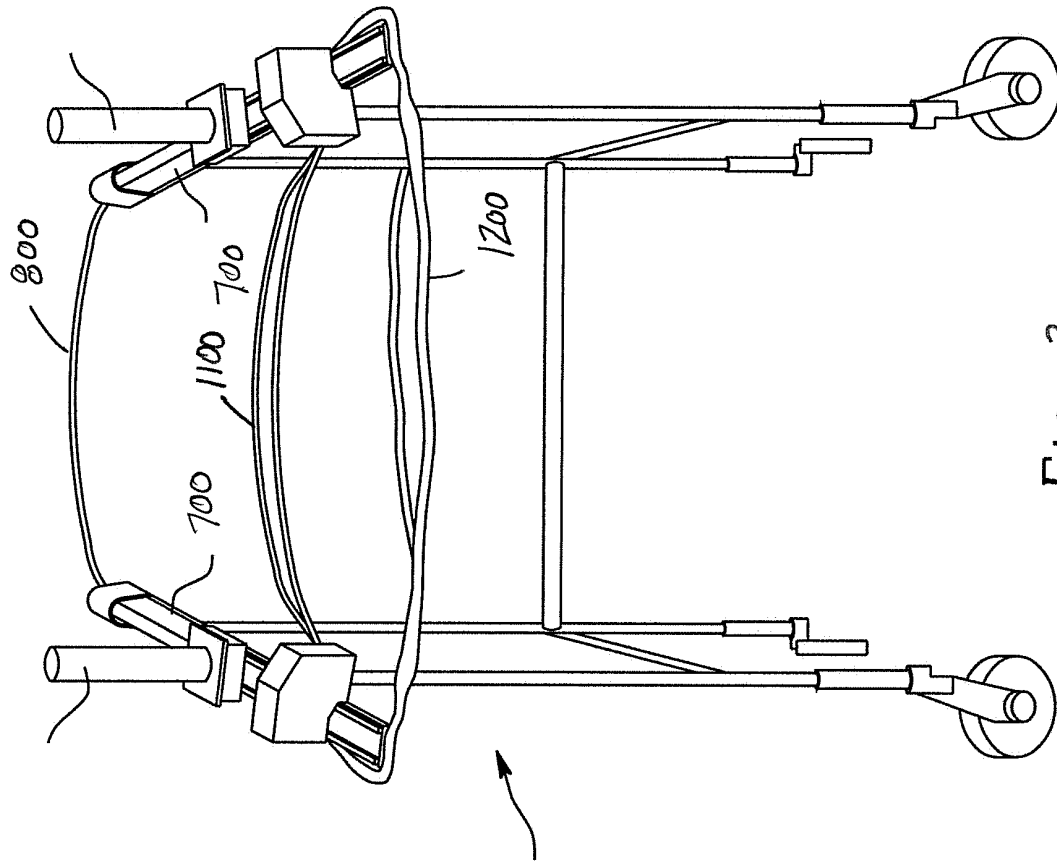


Fig. 2

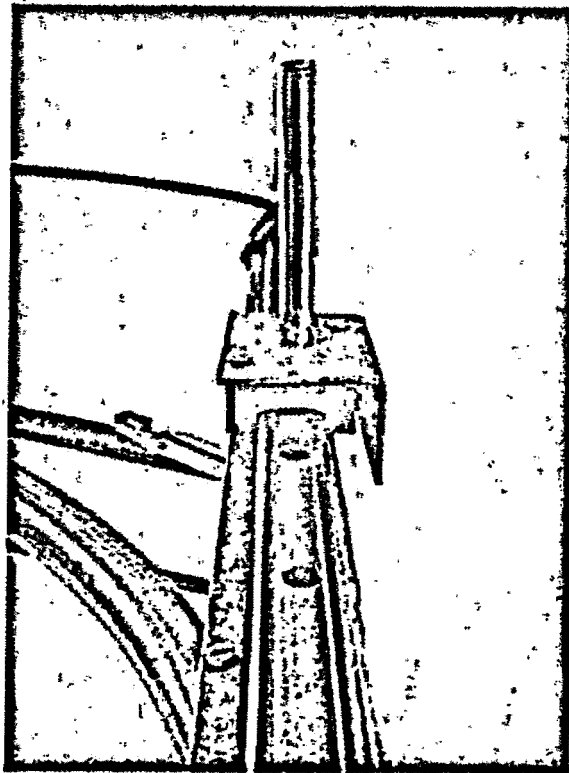


FIG. 3A

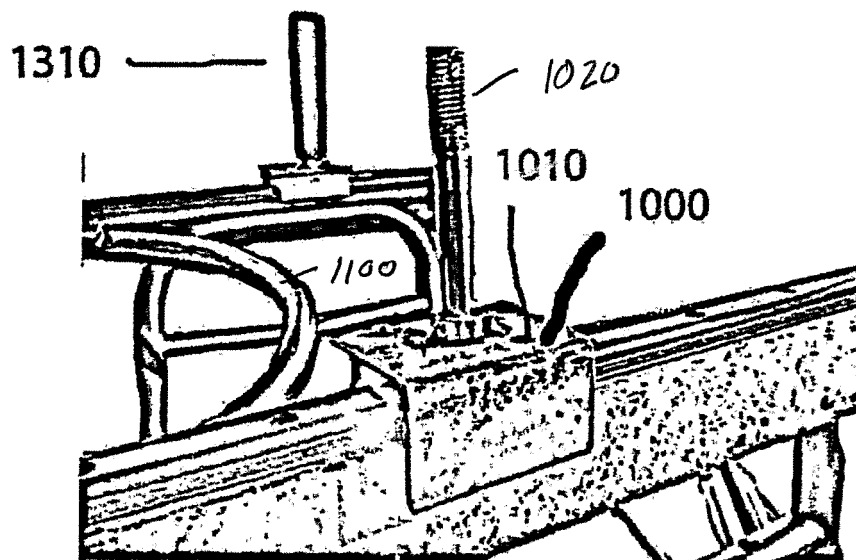
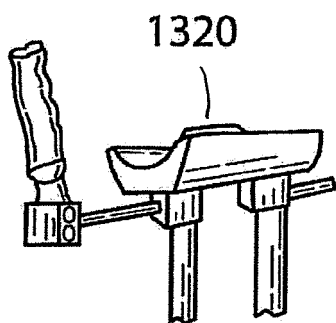
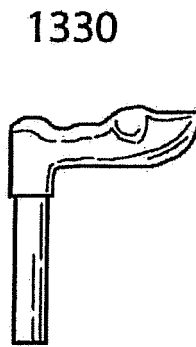


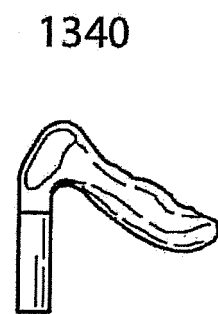
FIG. 3B



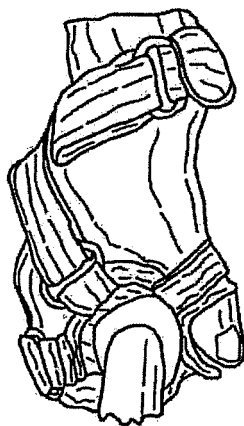
*Fig. 4A*



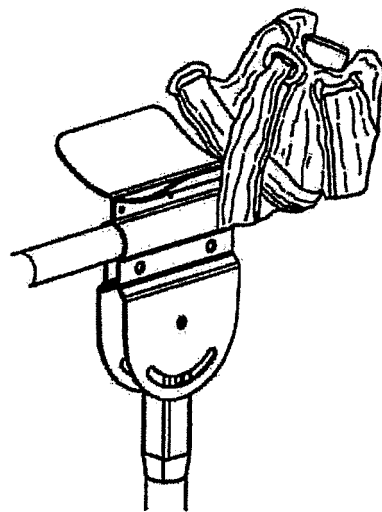
*Fig. 4B*



*Fig. 4C*



*Fig. 5A*



*Fig. 5B*

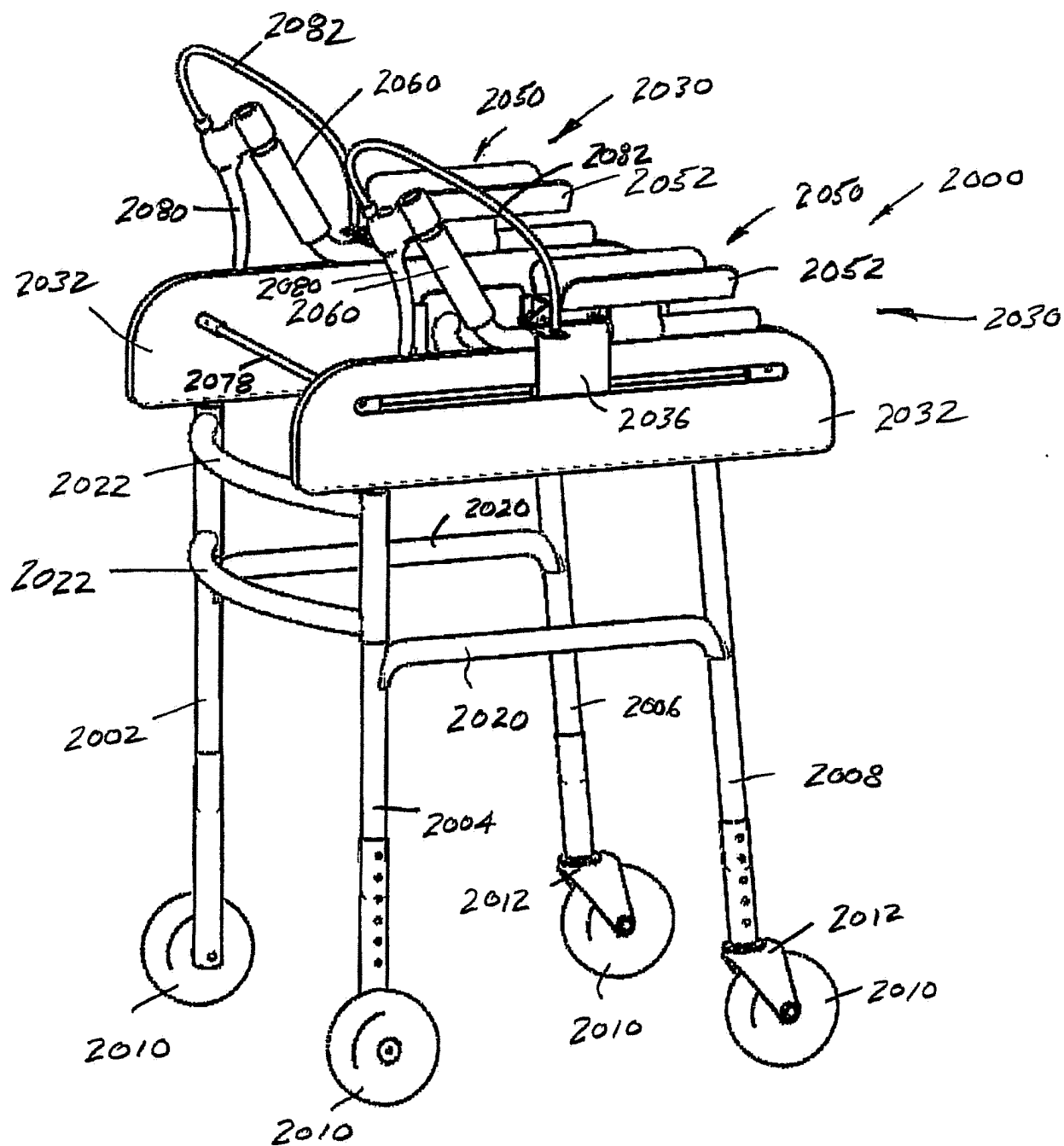


Fig. 6

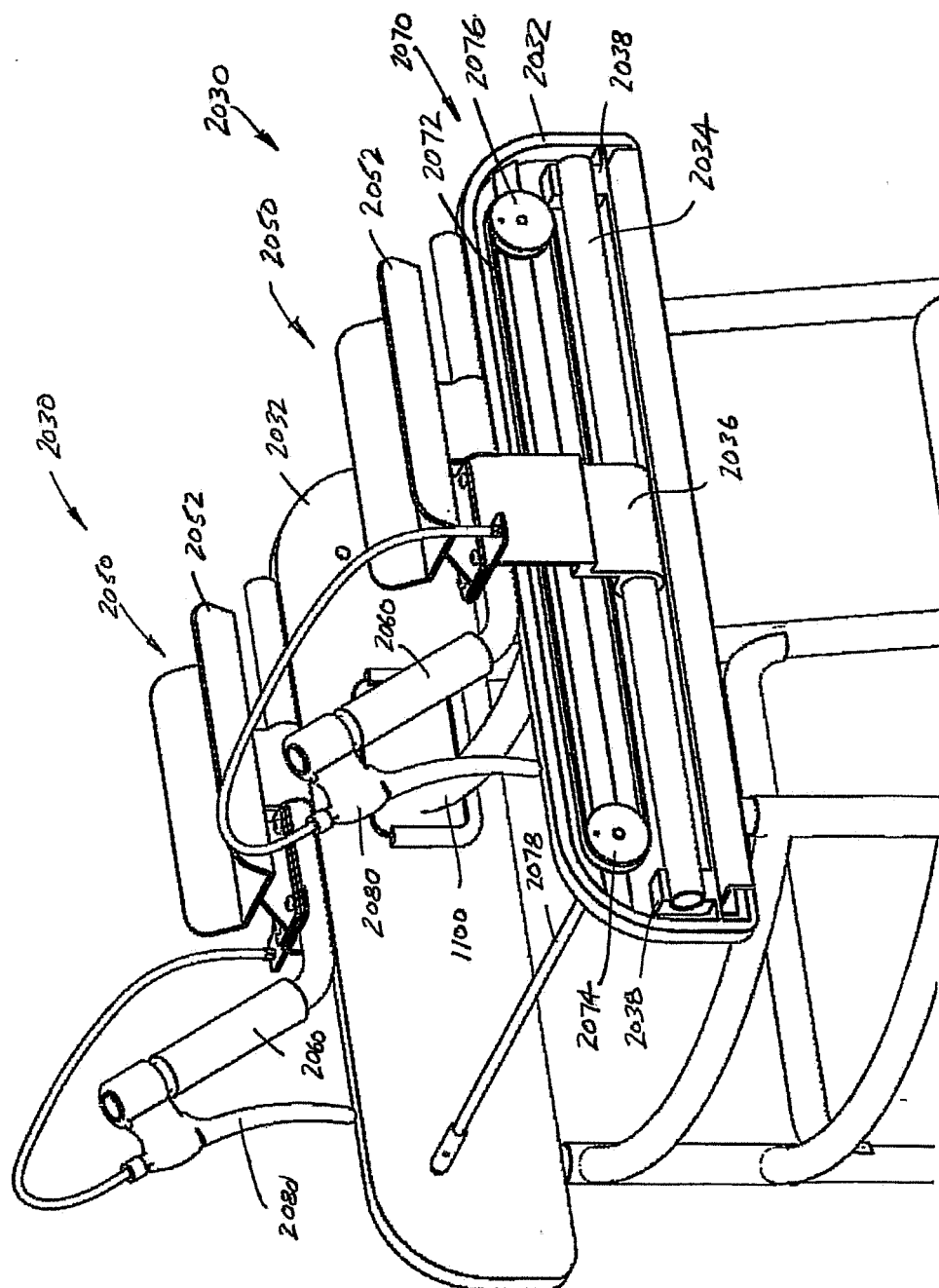


Fig. 7

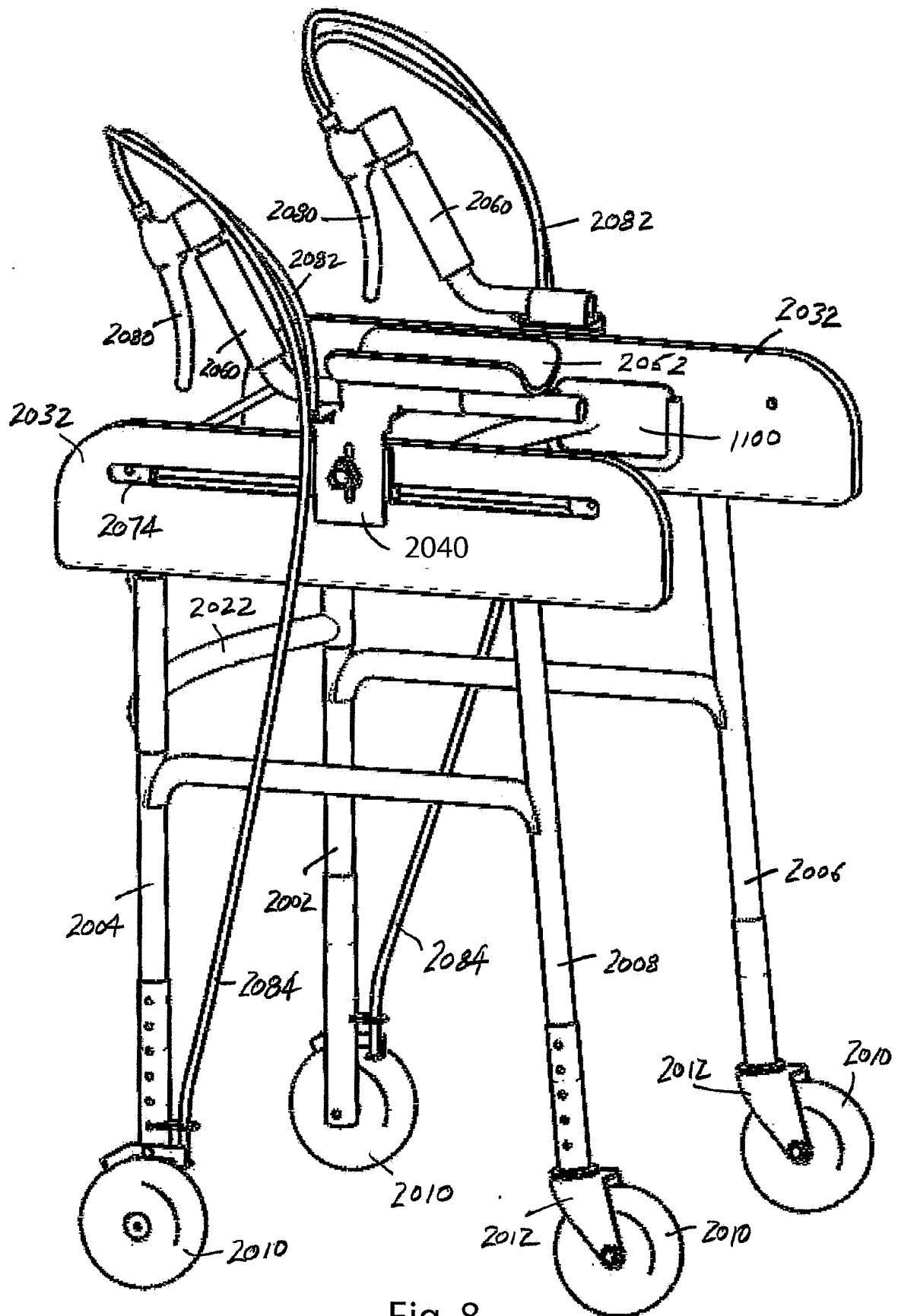


Fig. 8

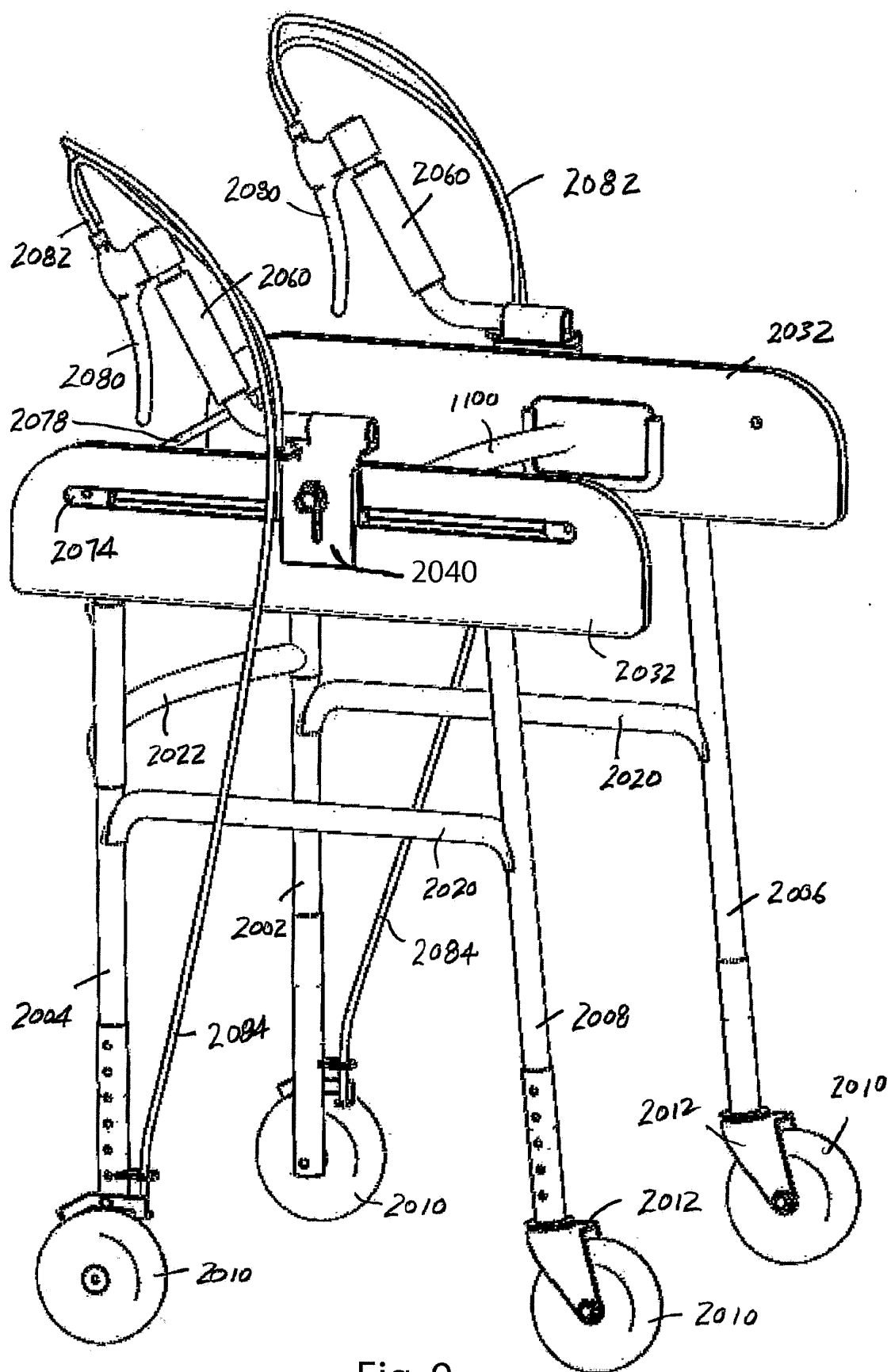


Fig. 9

FIG. 10A

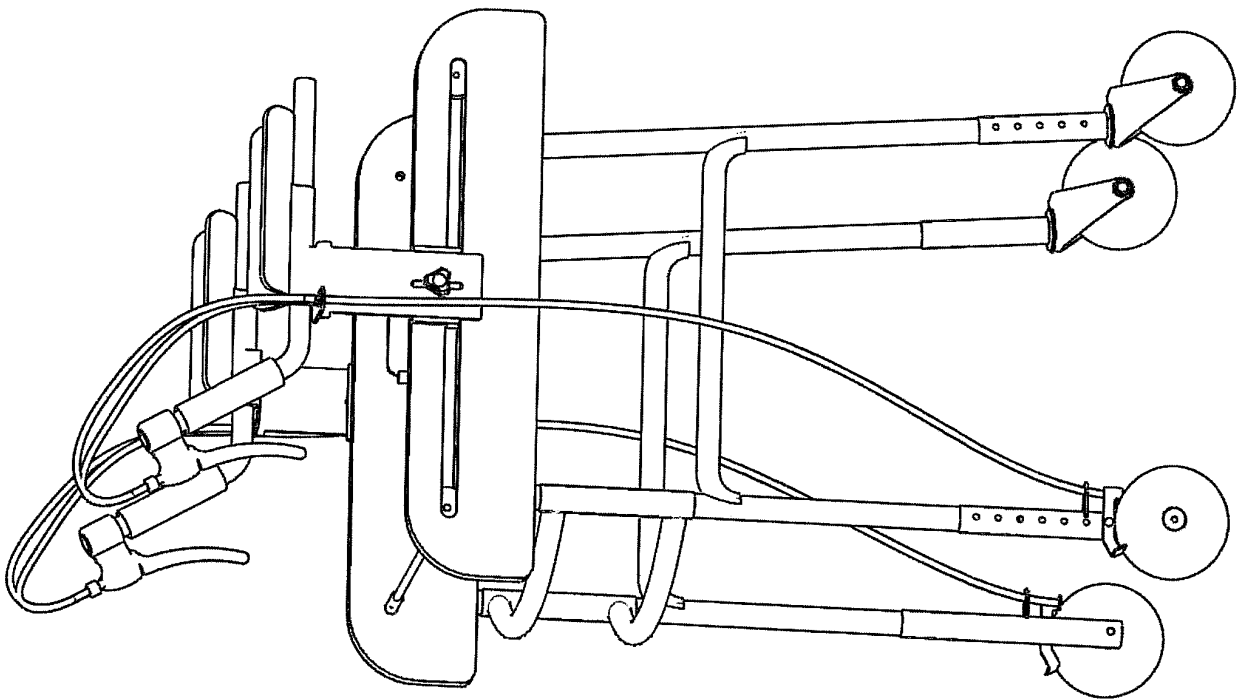


FIG. 10B

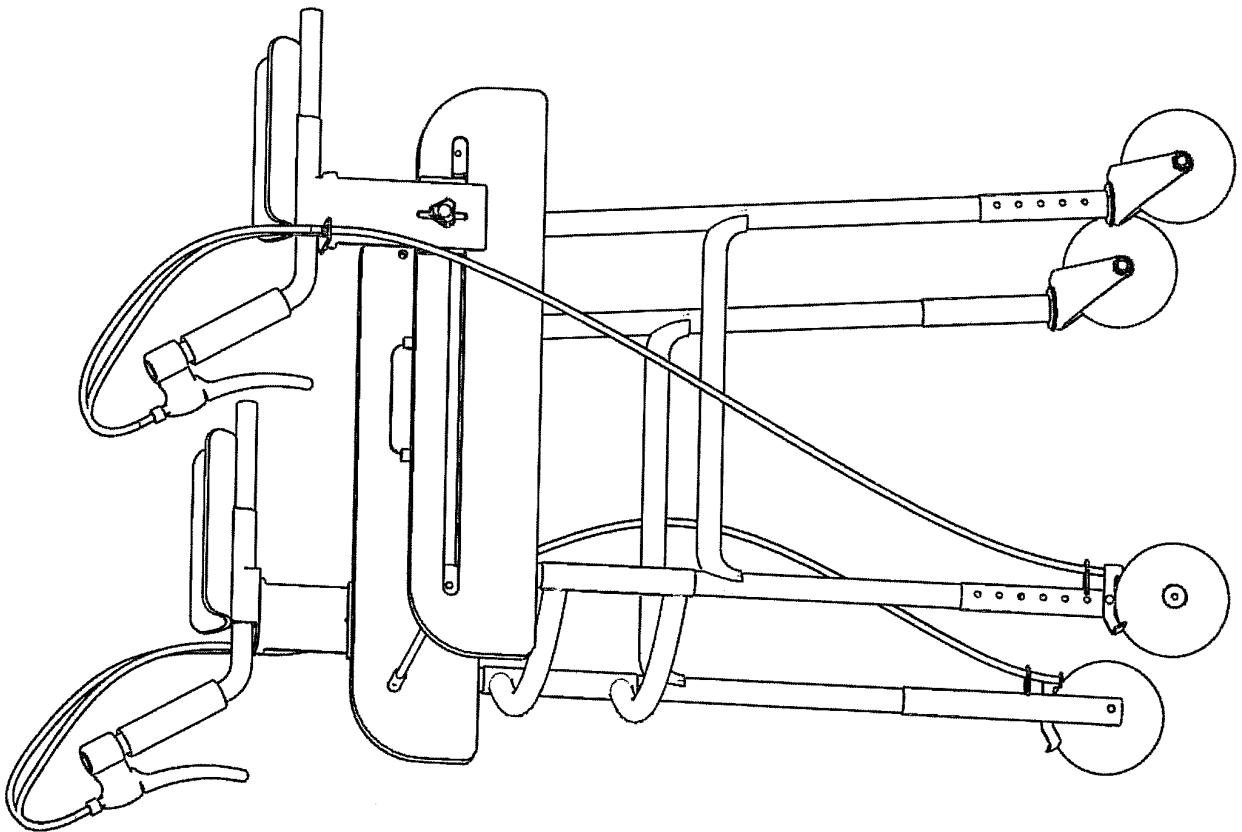
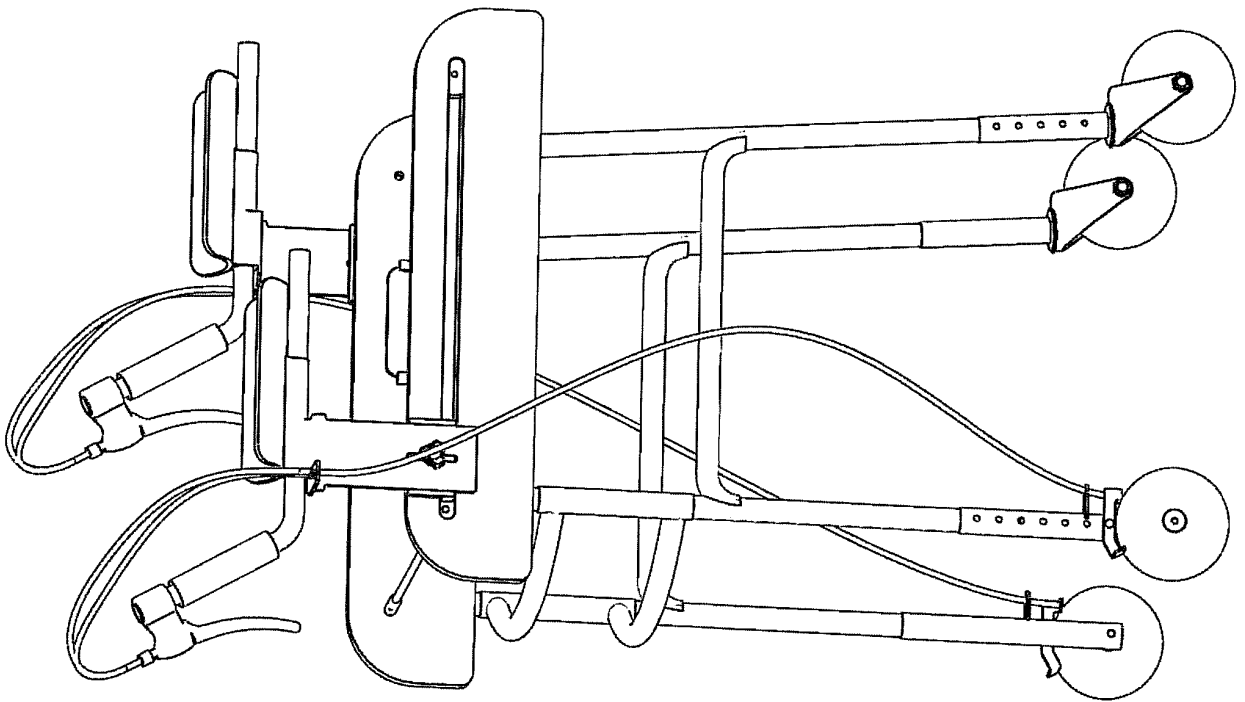


FIG. 10C



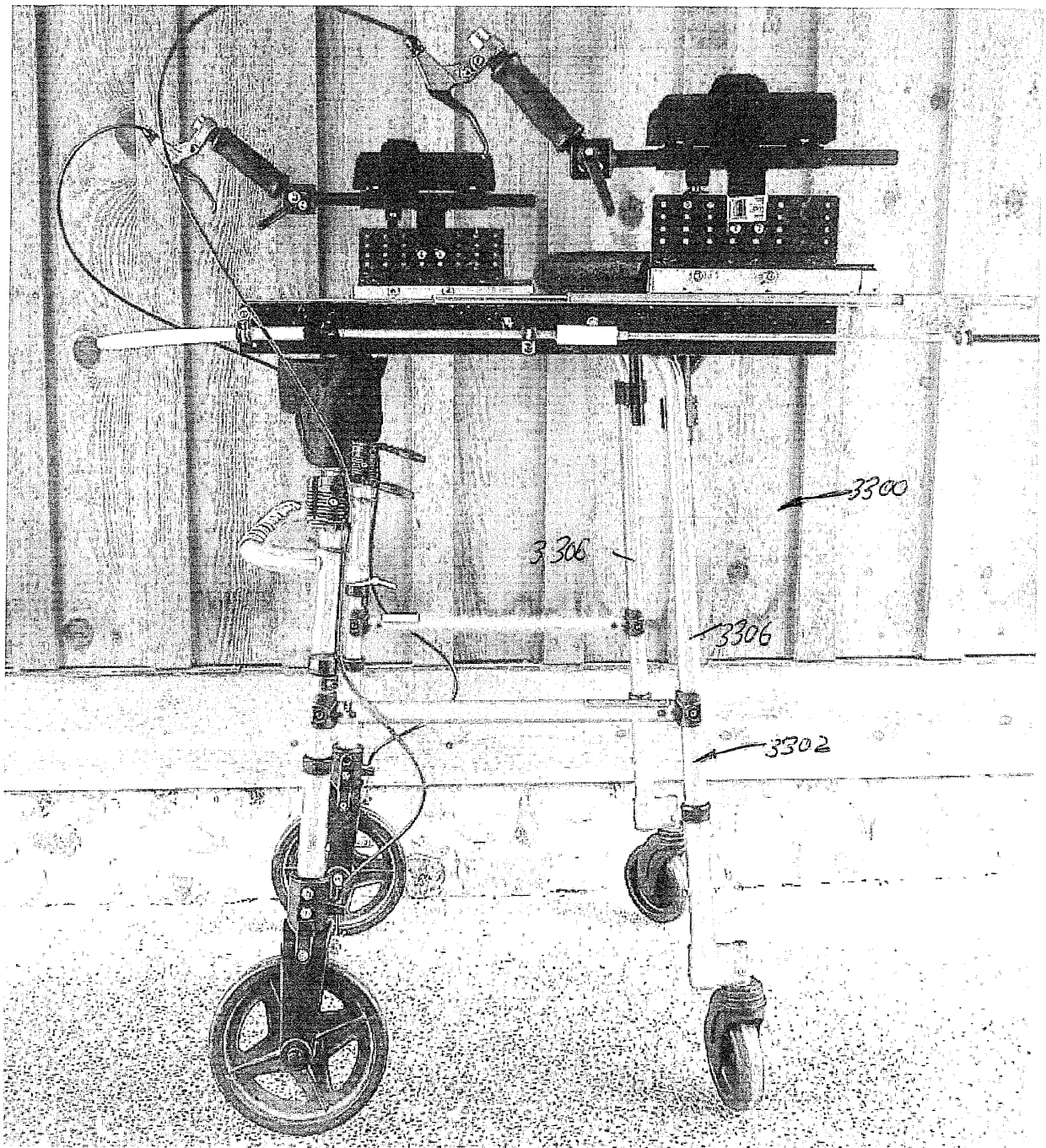
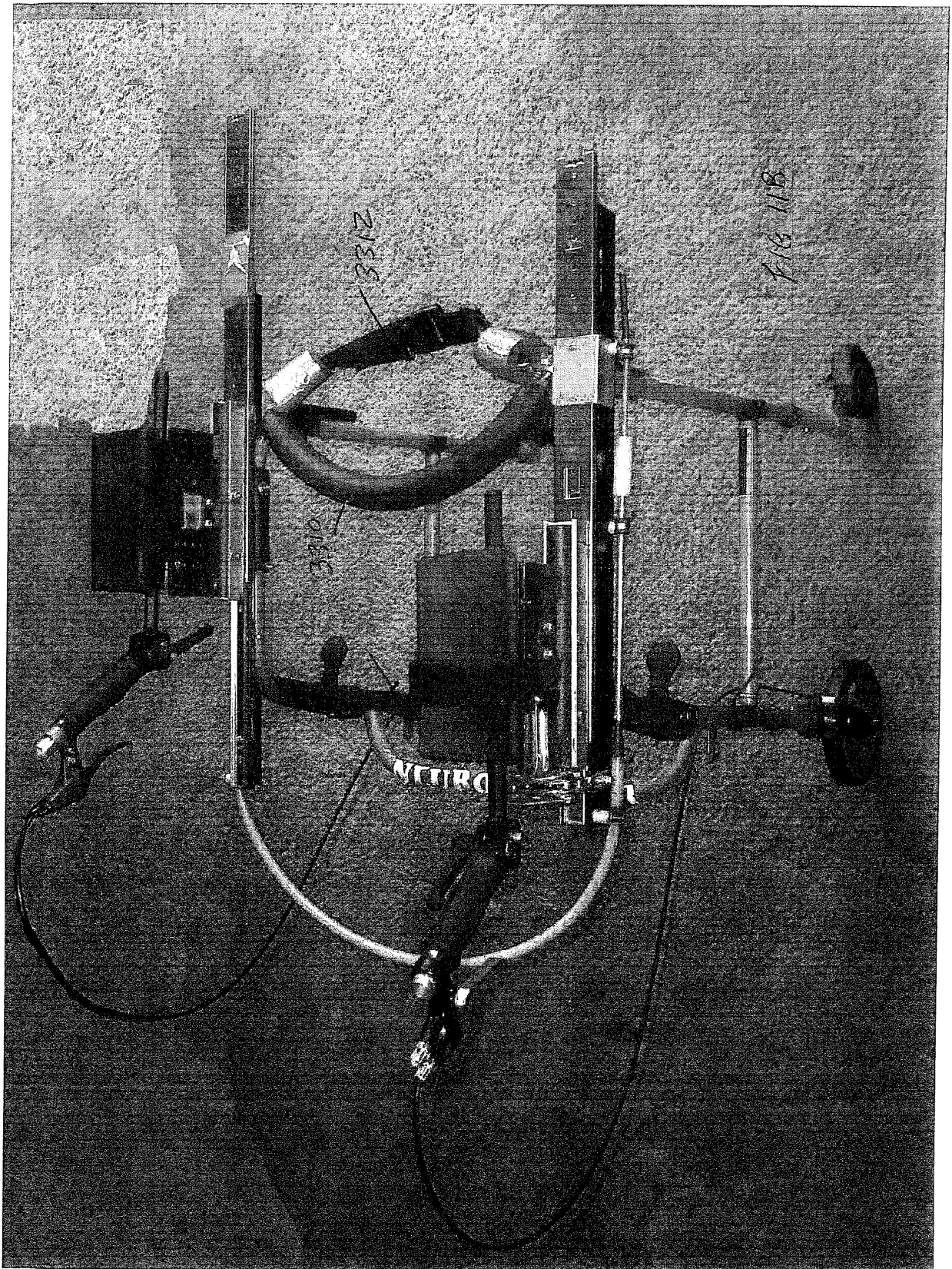
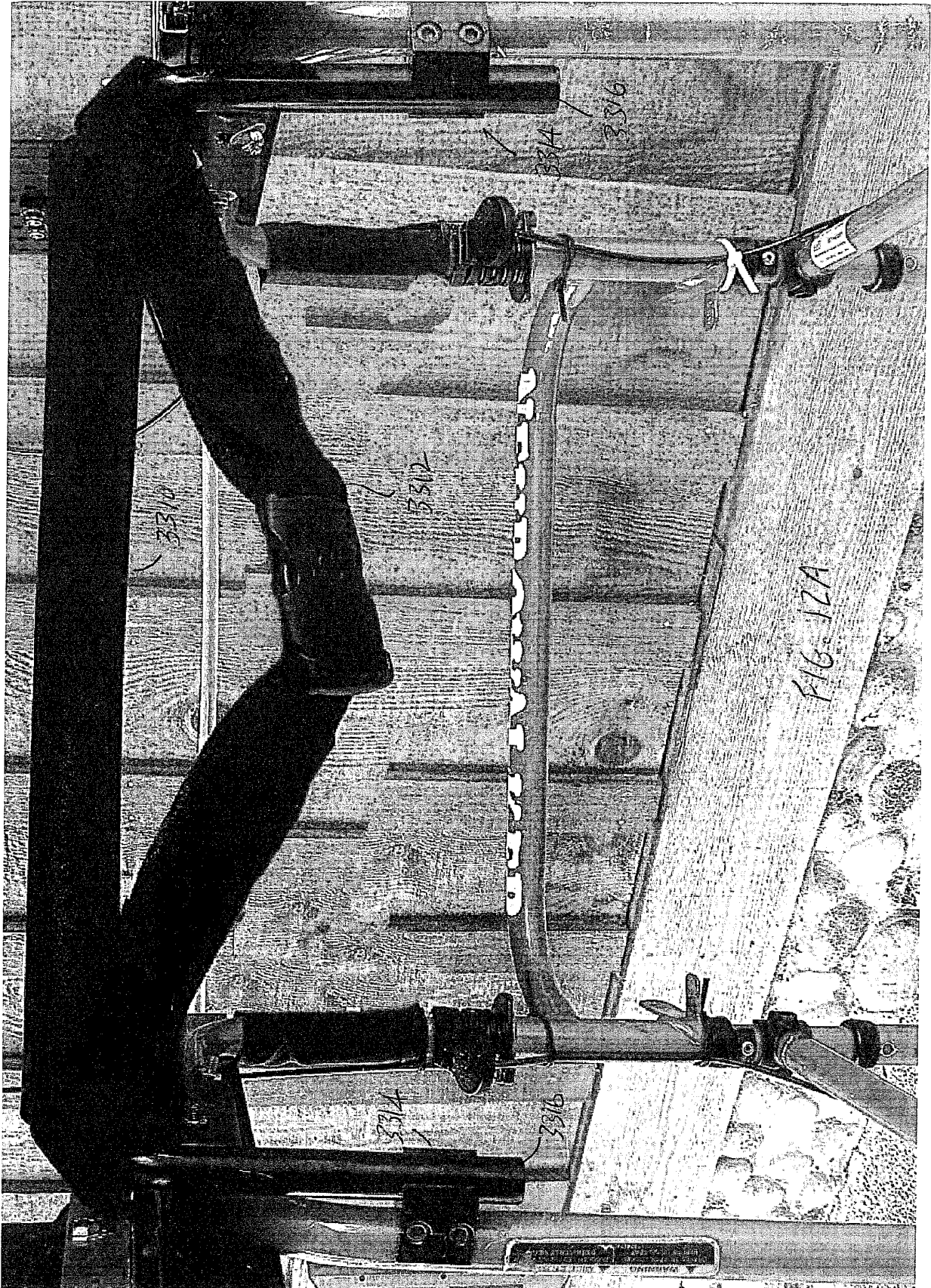
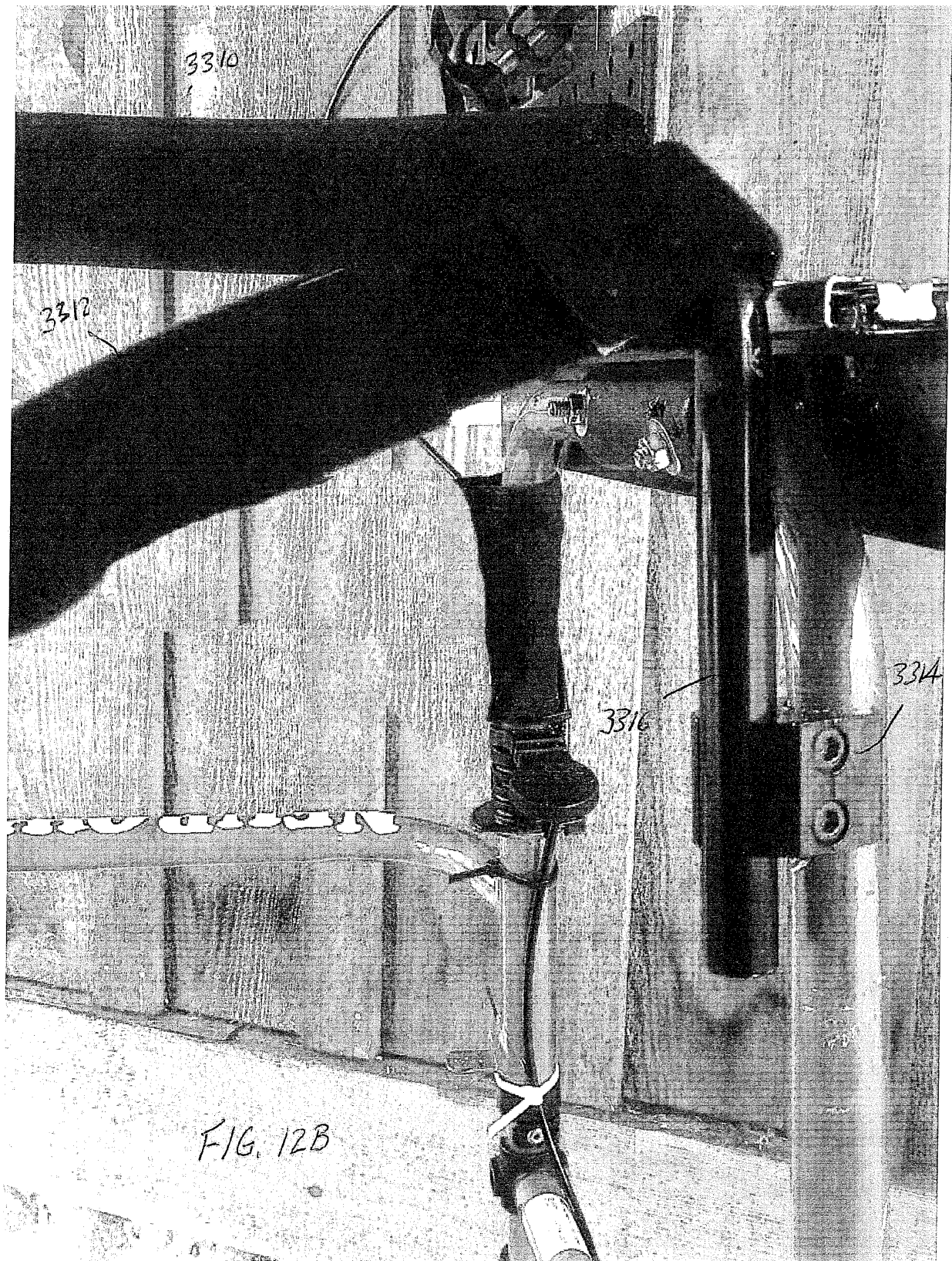


FIG. 11A







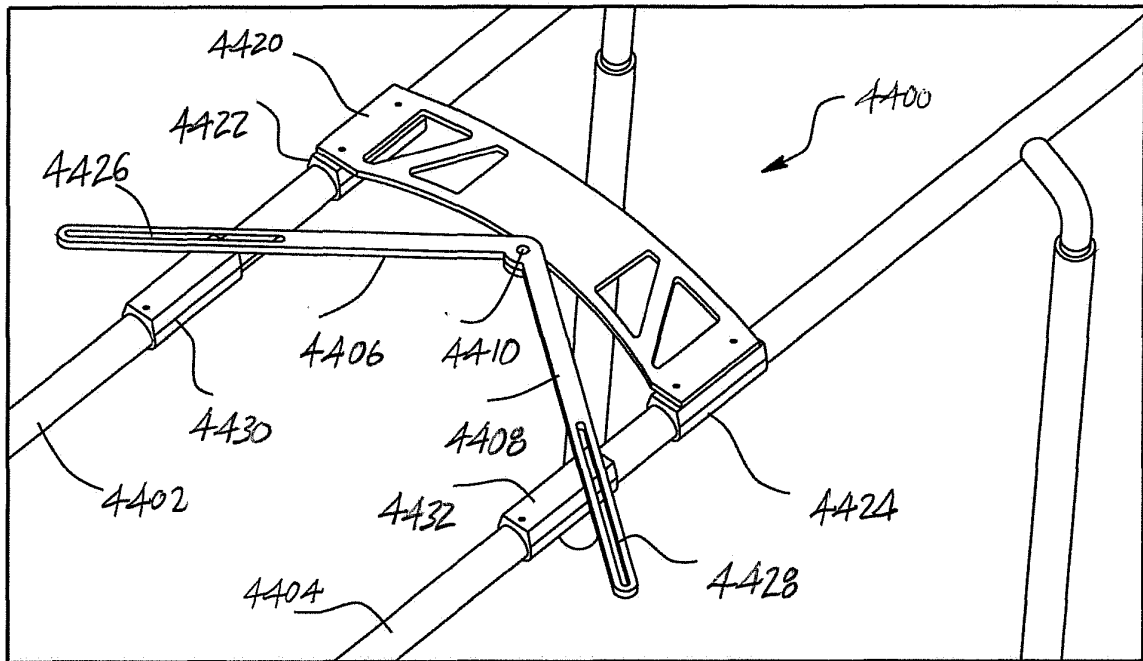


Fig. 13A

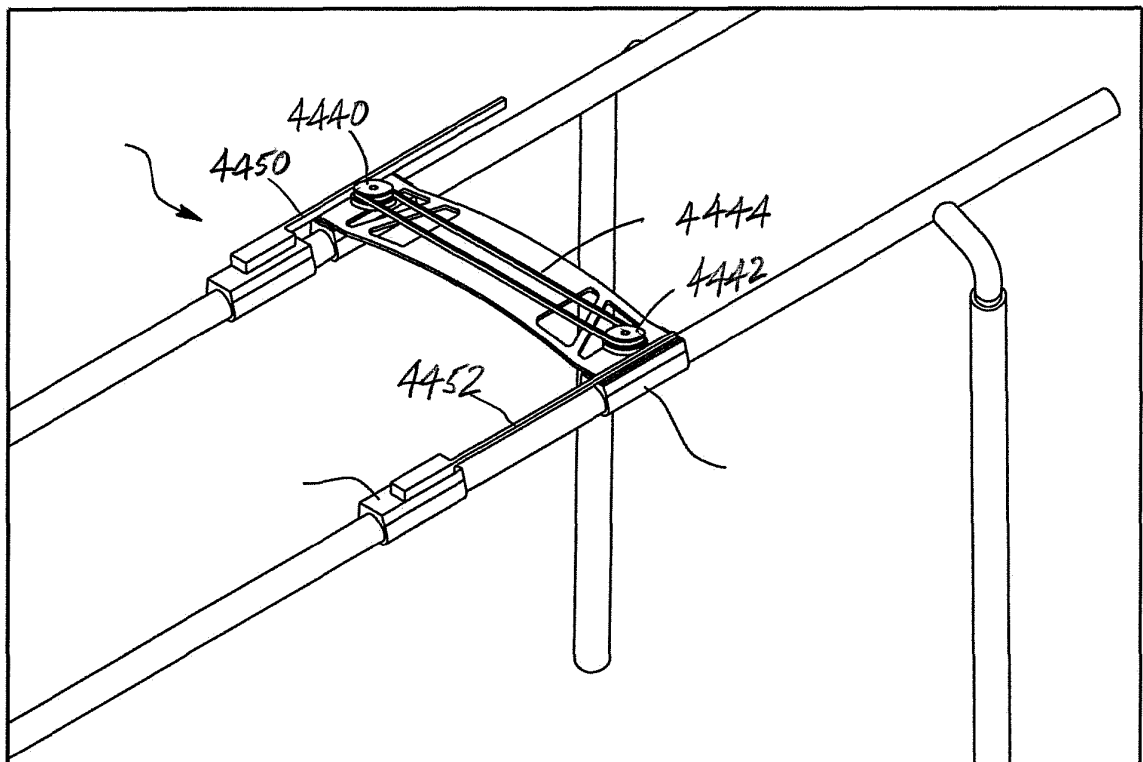


Fig. 13B

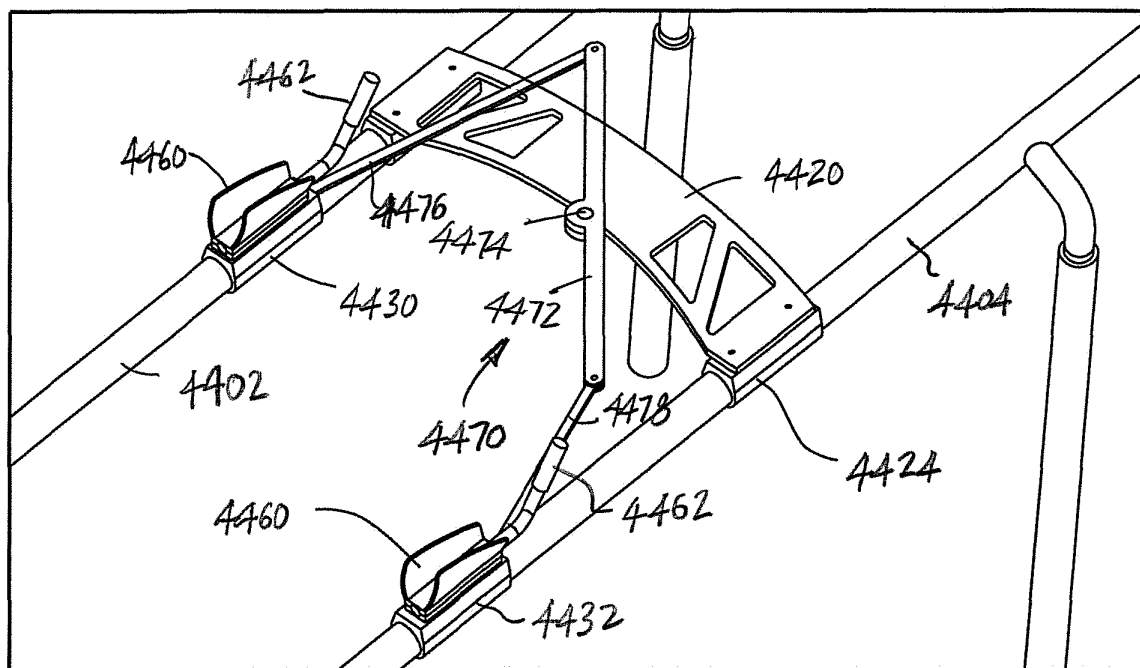


Fig. 13C

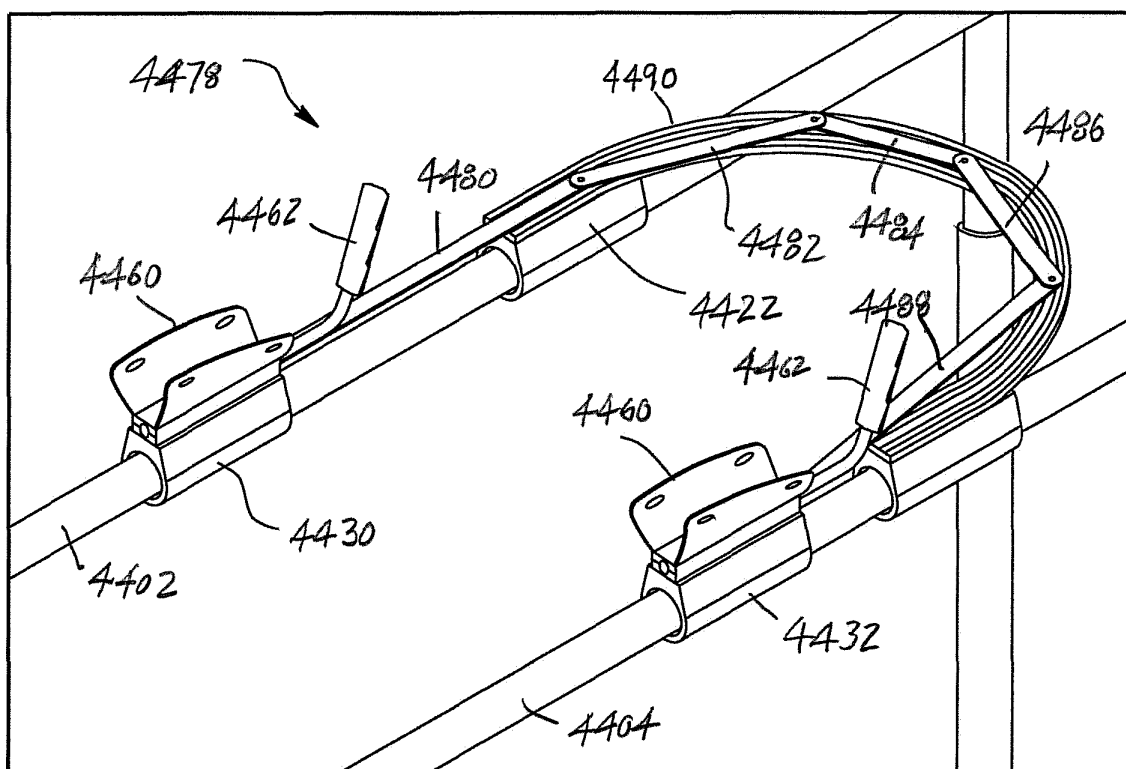


Fig. 13D

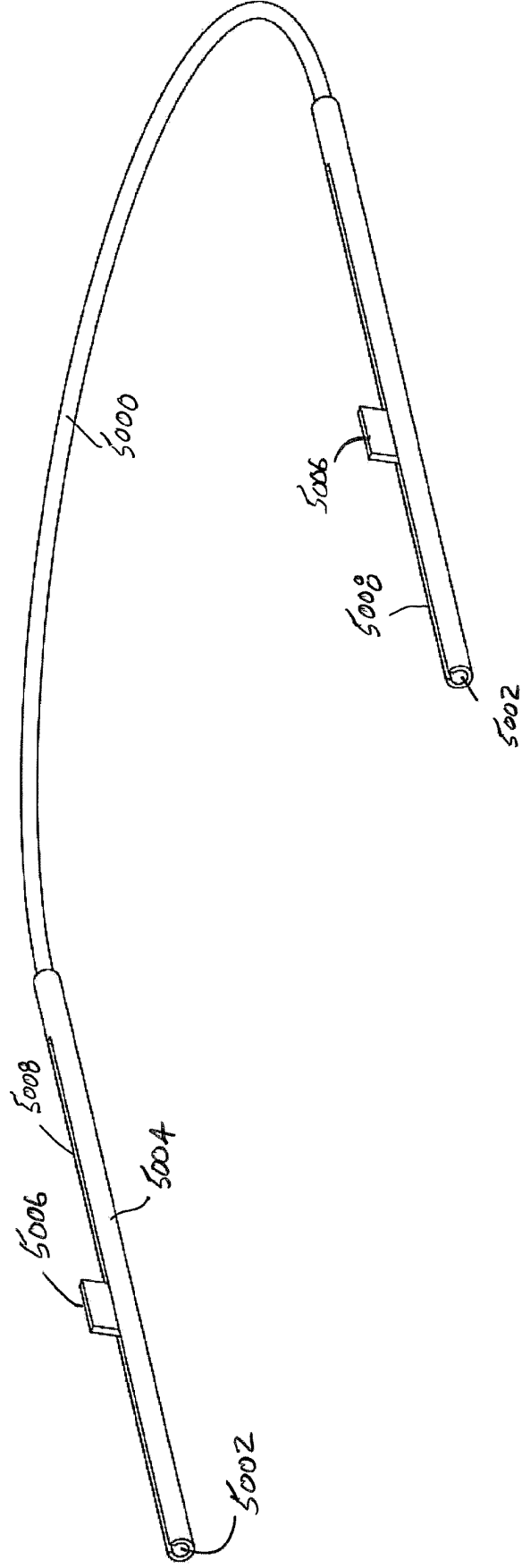


FIG. 14A

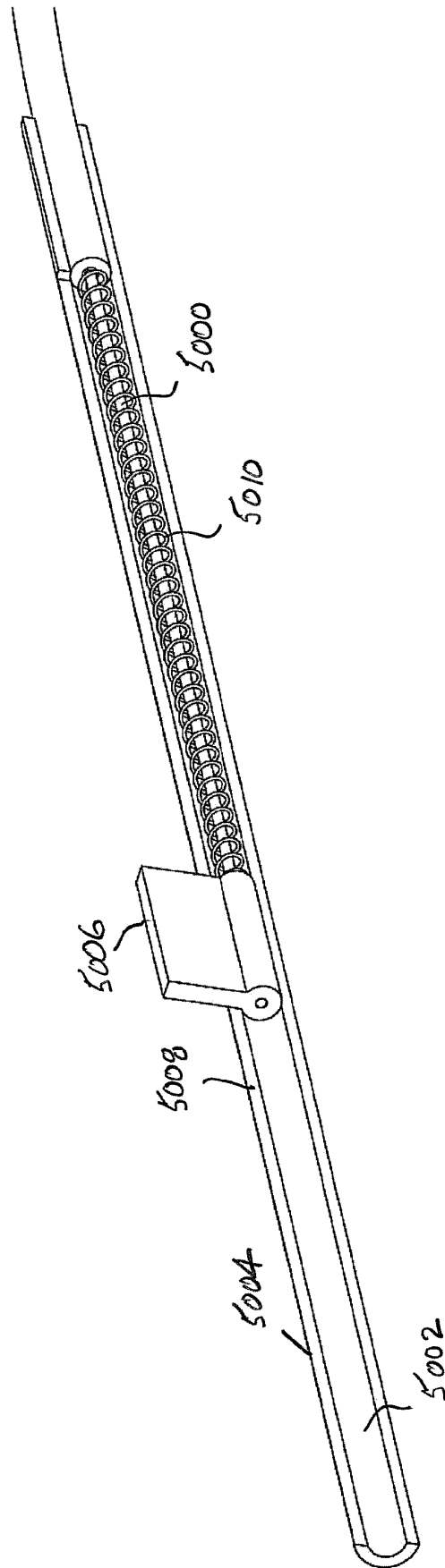


FIG. 14B

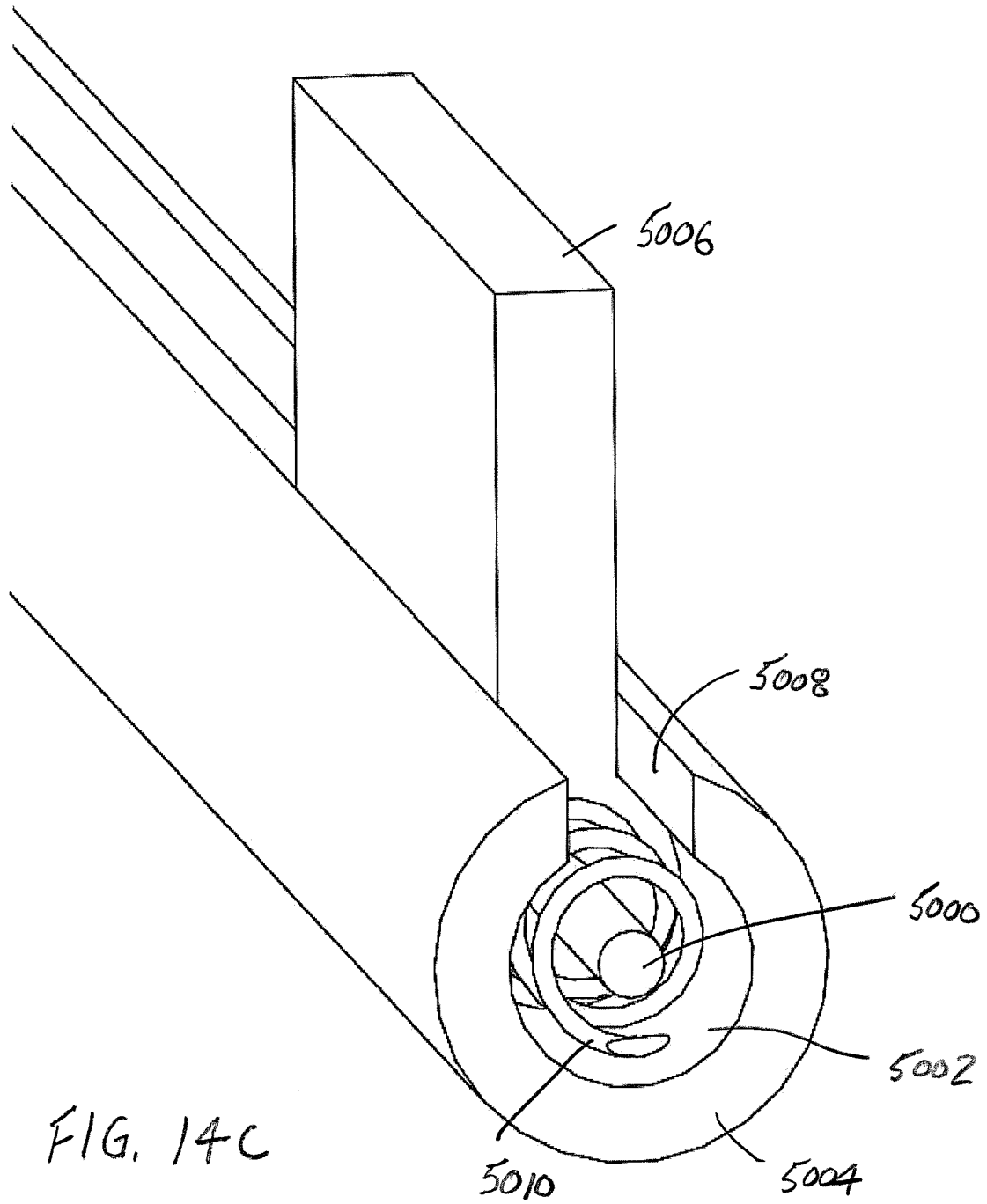


Fig. 15 A

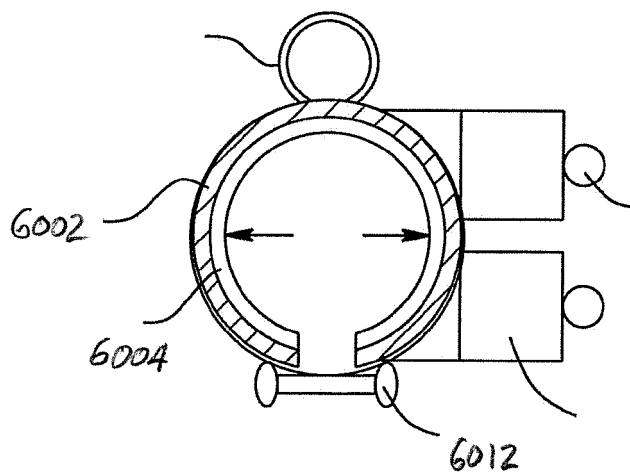
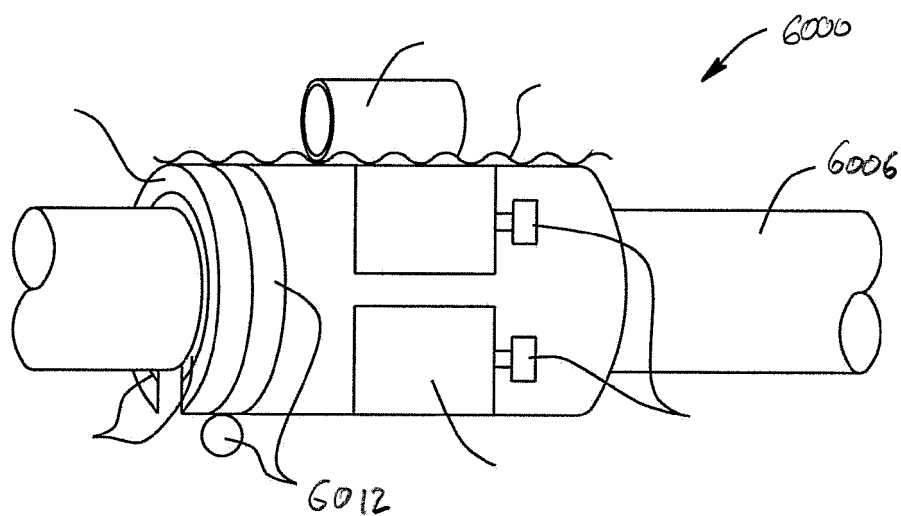


Fig. 15 B

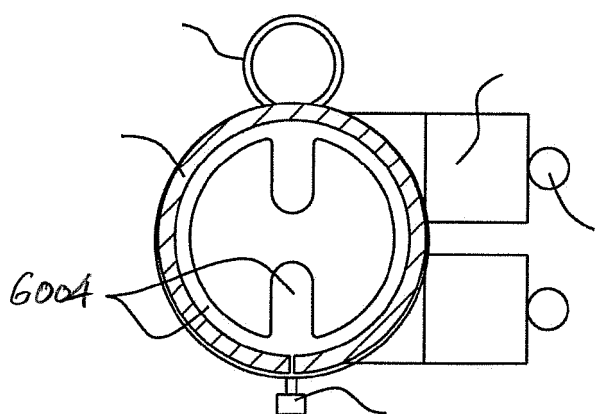


Fig. 15 C

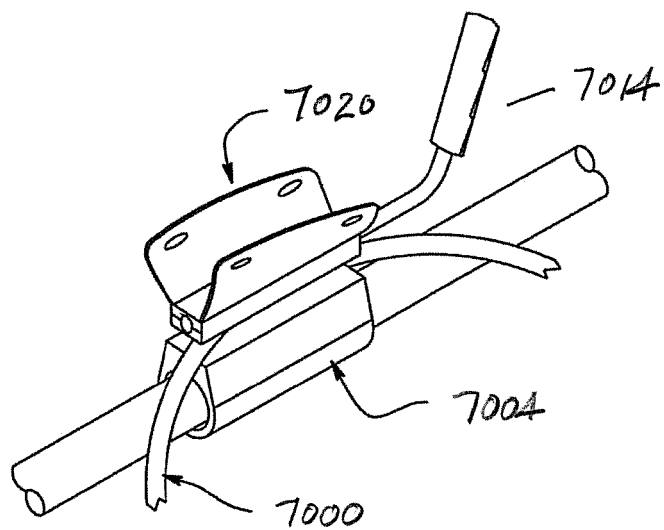


Fig. 16

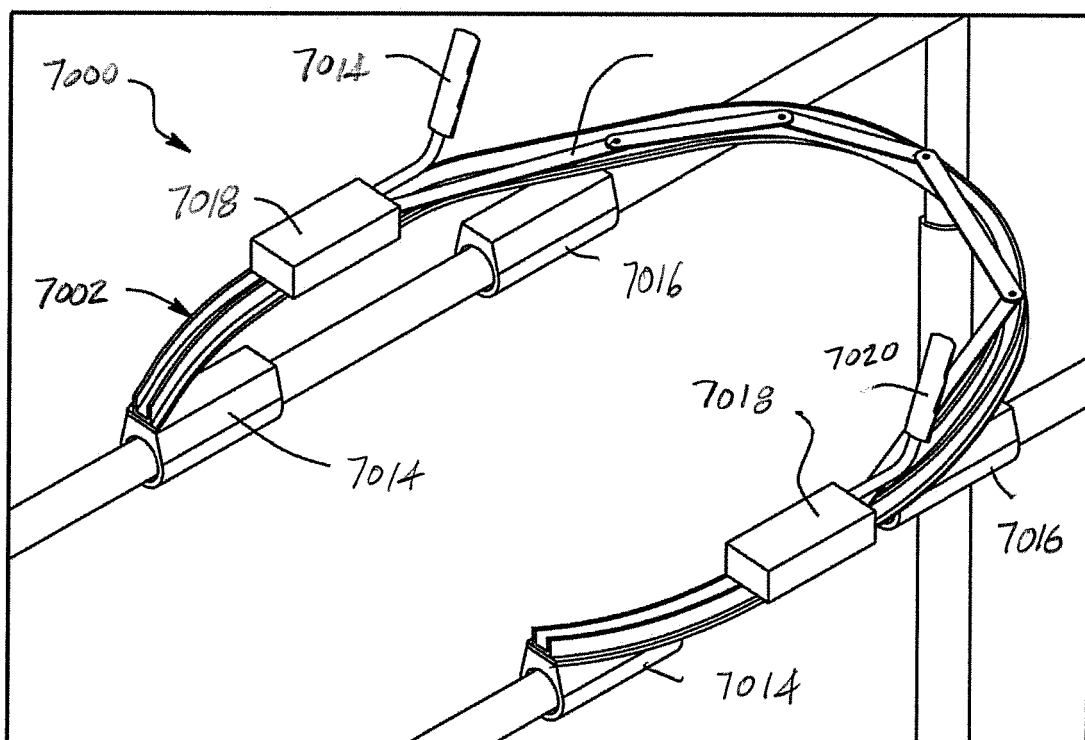


Fig. 17

**REFERENCES CITED IN THE DESCRIPTION**

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- JP 2009106446 A [0019]