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(54) Apparatus for rehabilitation of patients suffering motor dysfunction

Vorrichtung zur Rehabilitation von Patienten mit motorischen Störungen

Appareil pour la réhabilitation de patients souffrant d'un dysfonctionnement moteur

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(73) Proprietor: **Cardile, Jorge
Buenos Aires (AR)**

(72) Inventor: **Cardile, Jorge
Buenos Aires (AR)**

(74) Representative: **Winter, Brandl, Fürniss, Hübner,
Röss, Kaiser, Polte - Partnerschaft mbB
Patent- und Rechtsanwaltskanzlei
Alois-Steinecker-Strasse 22
85354 Freising (DE)**

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention.

[0001] The present invention relates to a new device that may be employed in the medical, physical training and/or rehabilitation field and, more particularly, the invention refers to a new apparatus for rehabilitation and/or re-education of an impaired patient, preferably an individual or patient with dysfunction in the lower limbs, to induce walking movements, develop balance and train muscles, preferably in handicapped persons with gross motor impairments, wherein the apparatus is effective in helping correct the postural (stance) structure and also attaining the exact reproduction of human walking, efficiently inducing the movement of the joints of the foot, heel, ankle, knee and hips, all of them with high participation in the walking movements.

2. Description of the Prior Art.

[0002] For several reasons, an important part of a community is affected by motor disorders or dysfunctions, due to accidental events or to neurological disorders. In any event, in modern communities more and more efforts are being made to incorporate disabled persons to the normal life of the community. The idea is to adopt more effective techniques in order that they may enjoy, depending on the degree of the disability, the autonomy to move among the other members of the community. It is a fact that the degree of dependence affects directly the standard of living of these citizens and, therefore, it is imperative to be socially sensitive to bring to the disabled persons the most modern solutions to cause them to be capable of joining, as long as possible, the normal persons.

[0003] The disabilities that affect the lower limbs basically hinder or limit displacement and the two-legged stance. On top of the difficulty or impossibility of walking, there is the loss of reflexes and muscle tone due to inactivity or reduced functionality, the slowdown of systemic functions such as circulation, the contraction of the abdominal cavity that hampers the respiratory and digestive functions and the proper evacuation of the bowels, progressive scoliosis, bone density loss, as well as diverse dermatological pathologies, all effects that aggravate even more the condition and quality of life of the patient.

[0004] The technical solutions available to persons with motor dysfunctions, for walking rehabilitation purposes, can be generally classified in mobile and fixed devices that have been aimed at helping patients recover their walking capabilities, without, however, efficiently achieving the right motor coordination, balance control of the limbs and torso, correction of the body posture and strengthening of the atrophic limbs. In general terms, the

known mobile equipment uses the patient's own force to move, using devices commonly known as walkers.

[0005] One of such mobile devices is disclosed in Document WO 2008058534, to Sorensen Nicolai and Balle Rune, entitled "Walking device for assisting handicapped persons or patients during rehabilitation". Other apparatus of this type are disclosed in DE 10318929 to Graf Birgit, entitled "Motorised walking aid for assisting disabled person with integrated data detection device for detecting movement data during use of walking aid", EP 0713692 to Paas Dieter, entitled "Walking training device for disabled people".

[0006] While the above devices may be helpful in assisting a handicapped person to walk and stimulate walking movements, the systems are based mainly on the force that the patient must exert with the upper limbs on the device that serves as a support to maintain the two-legged stance. The devices are a kind of a support or cart moving over some sort of rollers or wheels and the patient must exert the necessary force against the floor to move. It is obvious that the patient must be capable of standing up and walk, at least slightly and this is not possible for patients having strong neurological disorders with practically no muscles in conditions to support the body weight or to move the legs to get a minimal walking distance. In addition, the above systems do not provide any type of step regulation or limb movement sequence. But what is an additional limiting factor in this type of equipment is that not a single one of them provides for correction of the walking gait; they do not develop adequate motor coordination, and they do not allow for adopting the correct postural stance needed for human beings to take steps in the correct sequence to achieve full rehabilitation.

[0007] Other devices are disclosed in RU 2306129 to Aliev Gazi Aligadzhievich et al. entitled "Rehabilitation Assembly Provided With Arm and Leg Trainers"; DE 102005051674 to Miehlisch Dieter, entitled "Pulling apparatus for use in e.g. rehabilitation device, for muscle exercise (...) to arms or legs, where power is transmitted to output of motor", and DE 10258755 to of Haas Siegliende, Bayersdorfer Valentin and Hass Hannes, entitled "Walking exercise simulator with shallow inverted V-profile supported each side by springs and motion dampeners". These devices provide the patient with the means to strengthen, exercise and avoid numbness, loss of reflexes and mobility of some of the joints, with which a limited rehabilitation is attained. However, while a movement may be promoted, not all the foot, leg and hip articulations are involved and no achievement of postural fitness, motion balance and good alignment of limbs and torso, which is to be desired of any rehabilitation process are provided.

[0008] In addition to the foregoing, DE 102005014204 to Steinert Christoph, entitled "Old person's natural heading movement stimulator produces movement of lower extremity/limb in frequency and with dynamics of walking, where movements of ankle joint is effected in frequency

of heading movement", and FR 2691127 to of Michel Sarciron, entitled "Medical re-training aid to assist patient in controlling feet", disclose devices to primarily stimulate joints and, in particular, ankles.

[0009] US Patent 6,666,798 to Borsheim, discloses an apparatus for rehabilitation of a functionally impaired leg of a patient suffering from paralysis, adapted for receiving also an attendant, both, patient and attendant exercising on a treadmill, with the apparatus comprising leg brackets adjacent to the patient's and attendant's knees, a connecting member coupling the leg brackets to transmit motion from an attendant's leg to a patient's leg. The apparatus also including an ankle appliance having an upper extension and a lower extension proximate the ankle is attached to a patient's foot and an ankle brace is similarly attached to an attendant's foot. Thus, the coordinated leg and ankle movement allows a patient's paralysis damaged leg to duplicate the walking motion of an attendant's leg. The apparatus also uses handrails in the treadmill and a suspension strap to keep the patient in a suspended position to allow leg movement without the hindrance of up to full body weight. This apparatus does not teach neither suggests the possibility of varying the height of the strap to permit the body weight of the patient to be transmitted to the legs to better train the lower limbs supporting at least part of the natural body weight. In addition, the belt of the treadmill runs always in the same direction without guiding the patient's feet to emulate the entire walking movement, namely along a closed loop. Document US219439 discloses an apparatus with the features of the preamble of claim 1.

[0010] As it can be seen, the state of the art and existing technologies do not offer those individuals suffering from severe motor dysfunctions an integral solution for their rehabilitation, obtaining only partial results. There is no fixed or mobile device that enables these people to rehabilitate, achieve postural fitness, motion balance and good alignment of limbs and torso, with the advantage of strengthening and working out the muscle system, tendons and circulatory system, as well as all the joints involved in the walking activity, supporting the patient's body weight in an adjustable pattern, all in a single device.

SUMMARY OF THE INVENTION

[0011] It is therefore an object of the invention to provide an apparatus for rehabilitation of patients with motor disorders, particularly of patients suffering motor dysfunctions in the legs. This object is achieved by means of an apparatus with the features of claim 1.

[0012] It is still another object of the present invention to provide an apparatus for rehabilitation of patients with motor disorders, wherein the apparatus comprises a harness for supporting the patient, with the patient having their feet affixed to a couple of walking bars to really reproduce the movements of the lower limbs when walking, step by step at a constant pace, stimulating the nervous system with a mechanical movement generated from the

lower limbs themselves, wherein, by systematically and repeatedly practising the exercise produced by the device, the patient, by reflex and voluntary activation, executes the movements necessary to help him/her walk and/or rehabilitate thanks to the recovery of the normal tone of his/her muscles.

[0013] It is even another object of the present invention to provide an apparatus for rehabilitation of patients with motor disorders, wherein the apparatus comprises a harness for supporting the patient, with the patient having their feet affixed to a couple of walking bars to really reproduce the movements of the lower limbs when walking, with the harness being pending from an upper part of the apparatus including height regulating means for moving the harness up and down to have the patient's body weight unloaded on the legs reduced or increased for better training of the legs.

[0014] It is a further object of the present invention to provide an apparatus for rehabilitation of patients with motor disorders affecting the legs, the apparatus comprising a couple of bars moving along a closed loop representing a walking step for the patient, with each bar including a plate to affix a foot of the patient and the plate being slidably arranged in the bar, with a motor connected to the bars to move the bars along the closed loop, the apparatus also having an harness to support the patient.

[0015] It is even a further object of the present invention to provide an apparatus for rehabilitation of patients with motor disorders, particularly patients suffering motor dysfunction in the legs, the apparatus comprising:

a left and right walking bars moving up and down and fore and aft along a closed movement loop;
a left and a right foot retaining means pivotally connected to the left and right walking bars respectively, for moving with the walking bars along a step distance path, and
a patient's supporting means for supporting the patient.

[0016] It is still a further object of the present invention to provide an apparatus for rehabilitation of patients with motor disorders, particularly patients suffering motor dysfunction in the legs, the apparatus comprising:

a left and right walking bars moving up and down and fore and aft along a closed movement loop;
a left and a right foot plate pivotally connected to the left and right walking bars respectively, for moving with the walking bars along a step distance path;
fastening means in the left and right plates for retaining the feet of a patient during a treatment;
a front guide stop at a front end of the step distance path and a rear guide stop a rear end of the step distance path, to cause the foot plates move up and down in the ends of the step distance path, and
a supporting harness for supporting the patient.

[0017] The above and other objects, features and advantages of this invention will be better understood when taken in connection with the accompanying drawings and description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] The present invention is illustrated by way of example in the following drawings wherein:

Figure 1 is a perspective top view of the apparatus according to an embodiment of the present invention;

Figure 2 is a perspective top view of the apparatus of Figure 1 with some end front and rear caps removed for clarity purposes;

Figure 3 is a detailed perspective view taken from the front end of the apparatus to show how the walking bars are slidably mounted in the front guide means;

Figure 4 is a detailed perspective view taken from the rear end of the apparatus to show the motor means for moving the walking bars;

Figure 5 is a detailed side perspective view of the foot plates pivotally connected to the walking bars and the front and rear guide stops, with a couple of schematic feet representing the feet of a patient, during a sequence in the movement of the feet;

Figure 6 is a detailed front perspective view of the apparatus, similar to Figure 5, showing the schematic feet of a patient during another sequence in the movement of the feet;

Figure 7 is a detailed side perspective view of the apparatus, similar to Figure 6;

Figure 8 is a detailed rear perspective view of the apparatus, showing the schematic feet of a patient during the sequence in the movement of the feet showing in Figures 6 and 7;

Figure 9 is a detailed side perspective view of the apparatus, similar to Figure 5, showing the schematic feet of a patient during another sequence in the movement of the feet;

Figure 10 is a detailed side elevation view of the apparatus, showing the schematic feet of a patient during the sequence in the movement of the feet showing in Figure 9;

Figure 11 is a detailed side perspective view of the apparatus, similar to Figure 5, showing the schematic feet of a patient during another sequence in the movement of the feet;

Figure 12 is a detailed side perspective view of the apparatus, similar to Figure 11, showing the schematic feet of a patient during another sequence in the movement of the feet;

Figure 13 is a detailed rear perspective view of the apparatus, showing the schematic feet of a patient during the sequence in the movement of the feet showing in Figure 12;

Figure 14 is a top perspective view of the apparatus according to another embodiment of the invention, with to provide access to patients in wheelchairs, trolley or stretcher;

Figure 15 is a top perspective view of the apparatus of Figure 14, and

Figure 16 is a side elevation view of the apparatus according to another embodiment of the invention;

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0019] Now referring in detail to the invention, the same refers to an apparatus for use preferably in medical areas to rehabilitate patients with motor disorders, particularly patients suffering motor dysfunction in the lower limbs. However, while more specific reference will be made to rehabilitation of the lower limbs, the present apparatus has shown to be effective in a re-educating and rehabilitating a handicapped person integrally, such as correcting postural disorders, neuronal disorders, standing disorders and other physical dysfunctions. The apparatus, generally indicated by reference number 1 in Figures 1 and 2, comprises a support structure such as a chassis 2 of a light and resistant construction and material, of aluminium or steel for example, having a base 3, a top or upper end 4 and a plurality of columns 5, 6, 7, 8. The chassis 2 is resistant and capable of supporting at least the weight of a patient and the components.

[0020] Mounted at a bottom part of the chassis 2, a left and a right walking bars 9, 10 are provided, with the walking bars 9, 10 being mounted to move along a path emulating, duplicating or copying the natural walking movement, such as up and down and back and forth along a closed movement loop, such as a seesaw movement, for example. Walking bars 9, 10 may be made of any suitable material such as steel or aluminium and preferably of a hollow metal profile to be resistant and of a light weight to support the patient's weight. The weight of the patient will be controllably unloaded, partially or totally, on the walking bars 9, 10.

[0021] To move along a desired predetermined path, such as a closed loop, copying a walking step movement, each walking bar 9, 10, has a respective rear end 11, 12 connected to motor means 13 and a respective front end 14, 15 slidably connected to respective front guide means 16, 17. The sliding connection between front ends 14, 15 of walking bars 9, 10 are preferably established by a bracket 18, 19 having, at a lower edge thereof, a rotary shaft (not shown) with end rollers of which only one roller 20 is shown in bracket 19, and only one roller 21 is shown in bracket 18, see Figures 3 and 6. While not shown, the rotary shafts in brackets 18, 19, are provided with rollers opposite and associated to rollers 20, 21 to properly slide along front guide means 16, 17. In effect, rollers 20, 21 run along front guide means 16, 17, with each guide 16, 17 comprising a "C" profile member, as shown in Figure 3, firmly affixed to a front end of the chassis 2. Guides of

front guide means 16 and 17 are respectively facing to each other by their open sides to slidably receive the end roller 20 with its opposite roller (not shown), and roller 21 with its opposite roller (not shown), of each bracket 18, 19.

[0022] In addition to the movement in a longitudinal direction of the walking bars 9, 10 along front guide means 16, 17, the rear ends 11, 12 of the walking bars 9, 10 move along a circular path or closed loop, not necessarily circular as long as it copies the walking movement, under the action of said motor means 13. Motor means 13 preferably comprise a crank and connecting rod mechanism driven by an electric motor 22, or a motor and speed reducing gearbox, mounted in a base member 23, forming part of the chassis 2. Motor 22 actuates a pulley 24, a belt 25 and a pulley 26 which in turn moves a crank connecting rod comprising a couple of rods 27, 28 which are preferably extensible and regulated through a regulating assembly formed by orifices 29 and knob 30, as it is well known. Connecting rods 27, 28 are connected to ends 11, 12 of the walking bars 9, 10 by respective journalled or bearing connection with only one of them, namely connection 31, being shown. The length of connecting rods 27, 28 defines the walking step distance or path, which would be regulated according to the kind of dysfunction, age and size of the patient, by means of the regulating means 29, 30. The height of pulley 26 may be also regulated by extensible arms 32 with regulating means that can be like means 29, 30.

[0023] While ends 11, 12 are shown as cut and made of a hollow rectangular metal profile, the ends and the entire walking bars 9, 10 may be made of solid bars, and other design, with no cuts, is possible. While a crank-connecting-rod mechanism has been shown to provide a circular or looped movement, it will be apparent to any person skilled in the art that other mechanisms may be employed. For example, this mechanism may be replaced by a couple of gears, a leading gear and a rear gear, and at least one chain running around them, along an elliptical or ovoid path, with ends 11, 12 of bars 9, 10 being connected to both sides of the chain, to particular links of the chain, by respective journalled connection, in order to follow the elliptical loop of the chain. The closed path defined by the chain will be as close as possible like a walking movement.

[0024] The front guide means 16, 17, at the front end of the apparatus 1, and motor means 13, at a rear end of the apparatus, are properly covered by respective front and rear caps 33, 34 fixed at appropriate parts of the chassis 2, preferably by means of easily removable means to permit access to the corresponding mechanisms for servicing purposes. Caps 33, 34 may be made of any suitable material to protect the covered mechanisms, such as a plastic, resistant and light material.

[0025] The patient will step on the walking bars 9, 10 in a left and a right foot retaining means 35, 36 pivotally connected to left and right walking bars 9, 10 respectively. As it will be explained below, foot retaining means 35, 36

move together with the walking bars 9, 10 along the closed loop or step distance path, to copy the movement of a walking step. Left and right foot retaining means 35, 36 comprise a left and a right foot plate assemblies 37, 38 pivotally connected to left and right walking bars 9, 10 respectively. As it is better shown in Figures 9-13, each foot plate assembly 37, 38 is comprised of two foot plates pivotally connected to each other, namely an upper foot plate 39 for receiving the left foot of the patient, and upper foot plate 40 for receiving the right foot of the patient, as well as a lower foot plate 44, in the left side, see Figures 9, 10, and a lower foot plate 45, in the right side, see Figures 11, 12. Each foot of the patient must be firmly affixed to each upper foot plate 39, 40 and, for that purpose, a left boot 41 and a right boot 42 may be provided in the upper foot plates 39, 40 to receive the feet of the patient comfortably. Alternatively, the patient's feet with their own shoes, may be retained in the upper foot plates 39, 40 by other fastening means. In this case, for illustrative purposes, boots 41, 42 may represent the feet of the patient and the fastening means may comprise respective ribbons 43 affixed at the upper foot plates 39, 40 for embracing the feet of the patient and retaining the feet in the upper foot plates 39, 40. Ribbons 43 may be provided, as it is well known, with any adherence means such as hook-and-loop retaining means. Ribbons 43 have been shown only for one boot 42 representing a foot in Figure 5, for clarity purposes, but it is evident that the same will be provided for both feet.

[0026] Upper foot plates 39, 40 and lower foot plates 44, 45, as mentioned above, are pivotally connected to each other and to the respective walking bar 9, 10 by double hinged means. Reference will be made first to left foot retaining means 35 as long as right foot retaining means 36 is similarly constructed. Left lower foot plate 44 has a front edge hinged, by a hinge 46, see Figure 9, to walking bar 9, thus being capable of pivoting at hinge 46 and moving to a position as shown in Figures 12, 13. In addition, lower foot plate 44 has a rear edge hinged, by a hinge 47, see Figures 7, 8, 12, 13, to a rear edge of upper foot plate 39, forming a rear hinged connection, to be capable of pivotally moving around hinge 47 to have a position as shown in Figures 9, 10. As indicated before, right upper and lower foot plates 40, 45 are pivotally connected in like manner by a leading hinge 50, see Figure 11, and a rear hinge 51, see Figure 13. Upper foot plates 39, 40 have respective front curved edges 48, 49 to be guided and slidably move along and onto front guide stops 52, 53 as detailed disclosed below.

[0027] While upper and lower foot plates 39, 44 and 40, 45 have been disclosed as being connected to each other and to the walking bars 9, 10 by means of a double-hinge mechanism, it will be apparent to any skilled person in the art that any other tilting or oscillating mechanism may be adopted. For example, upper foot plates 39, 40 may be mounted in respective central transverse axis, placed at a distance above the walking bars 9, 10, or onto a semicircular block onto the walking bars 9, 10, to

force the patient to keep the feet as horizontal as possible at least until the upper foot plate 39, 40 is tilted under the action of the front and rear guide stops 52, 53, 54, 55 reference to which is made below.

[0028] Front and rear guide stops 52, 53, 54, 55 are provided in the chassis 2 and associated to the walking bars 9, 10 to force the foot plates to tilt according to the walking movement. Thus, the apparatus 1 is provided with front guide stop 52 for the left foot and front guide stop 53 for the right foot, in each walking bar 9, 10. Front guide stops 52, 53 are adjustably placed at a front end of step distance path "SD", see Figure 10. In addition, a rear guide stop 54 for the left foot and rear guide stop 55 for the right foot, in each walking bar 9, 10, are adjustably placed at a rear end of step distance path "SD". Guide stops 52-55 will cause foot plates 39, 40, 44, 45 move up and down when reaching the ends of the step distance path in order to copy as close as possible the natural walking movements. Thus, the foot will be forced to move in the articulations or joints of the heel and the ankle.

[0029] For clarity purposes only front guide stop 52 for the left foot will be described in detail as long as the front guide stop 53 for the right side is identical. Front guide stop 52 comprises a curved front guide stop plate 56, made of any resistant material, such as steel or any other suitable metal. Front guide stop plate 56 is firmly affixed to respective rear ends of a couple of extensible arms 57, 58 which have their leading ends pivotally connected at joint 59, 60, to any convenient part of the chassis 2, by any appropriate bearing means well known in the art. Arms 57, 58 may include adjusting means to regulate the length of the arms in order to move front guide stop plate 56 back and forth to a desired position to adjust the step distance according to the particular treatment or patient. Adjusting means indicated by reference 61 may be a well known mechanism of a plurality of orifices and knob to move and fix a relative position between two arm lengths 62, 63.

[0030] Front guide stop plate 56 must accompany the up and down movement of walking bar 9 while permitting the back and forth movement of the walking bar 9. Thus, a transverse roller 64, see Figure 6, is connected to arm lengths 62 of extensible arms 57, 58 to roll onto walking bar 9 and a spring 65, 66, see Figures 5, 10, is connected to each extensible arm 57, 58, preferably in arm length 62. Springs 65, 66 keep front guide stop plate 56 under a resilient force urged against walking bar 9 and transverse roller 64 keeps front guide stop plate 56 in position relative to walking bar 9 to guarantee that front curved edge 48, see Figure 10, will always move onto front guide stop plate 56 when reaching the plate 56 in the forth movement of the walking bar 9.

[0031] As to the movement of the patient's feet at the rear part of the walking movement, reference will be made to the rear guide stops 54, 55, however, for clarity purposes only rear guide stop 54 for the left foot will be described in detail as long as the rear guide stop 55 for the right side is identical. Rear guide stop 54 comprises

two curved rear U-shaped guides, indicated by general references 67, 68, facing to each other by their open sides. Rear guides 67, 68 include respective horizontal guide lengths 69, 70, and curved and upwardly extending guide lengths 71, 72, see Figure 8, 13. Associated with rear guides 67, 68, the rear edge of plate 44 is provided with guide follower ends, such as rollers at the end thereof, which rollers run into the upward guide lengths 71, 72 to cause the patient's foot move upwardly at the rear part of the walking movement as shown in Figures 12, 13 illustrating the left foot in that position. Since the guide follower ends, namely the rollers, of plate 44 do not appear in the drawings, reference is made to the rollers of plate 45, identical to the rollers of plate 44, with one of which being shown in Figures 8, 13 and indicated by reference 73.

[0032] To follow the walking movement of the walking bar 8, rear guide stop 54 is provided with a rear carriage 74 firmly affixed, by welding for example, to rear guide stop 54 and including upper rollers 75, 76 and a lower roller 77, at both upper and lower sides of walking bar 9, to keep rear guide stop 54 and walking bar 9 together during the movement of the walking bar 9. In order to prevent the leading end of rear guide stop 54, and particularly the leading end of horizontal guide length 69, 70 move upwardly during the movement of the walking bar 9, horizontal guide lengths 69, 70 are provided with a lower roller 78. Thus, rear guide stop 54 is pivotally connected to the walking bar 9, with the U-shaped guides being slidably resting onto the walking bar 9.

[0033] With the purpose of keeping the rear guide stop 54 in place, to define the rear end of the walking step distance, the rear guide stop 54, and more particularly carriage 74, is pivotally connected to respective rear ends of side arms 79, 80, see Figures 9, 10, which arms have respective leading ends pivotally connected at a joint 81, only one is shown, at convenient parts of the chassis 2, such as a transverse beam 82. More particularly, arms 79, 80 are extensible arms comprised of arm lengths 83, 85, left arm, and 84, 86, right arm. To adjust the length of side arms 79, 80 respective adjusting means may be provided. For example, a well known orifices and knob adjusting means 87, as generally indicated in Figures 9, 10, may be a good alternative. The rear end of arm length 83 will be pivotally connected to carriage 74 at a joint 88.

[0034] While the leading guide stops 52, 53 and the rear guide stops 54, 55 have been illustrated and disclosed as being different of each other, it is important to remark that the leading and rear guide stops 52-55 may be identical or the leading guide stop 52, 53 may be arranged at the place of the rear guide stop 54, 55, and viceversa. For example, the leading guide stops 52, 53 may comprise, like the rear guide stops 54, 55, a couple of facing "U" shaped guides, such as guides 67, 68, within which a pair of followers or rollers may run, such as rollers 73. Thus, the use of curved leading edges 48, 49 would not be necessary. Also, instead of curved edges 48, 49, upper foot plates 39, 40 may be provided with any kind

of a leading sliding means or rolling cylinder that causes the plate move upwardly onto the guide stop.

[0035] It is clear from the above description that, when the patient's feet are retained at the foot retaining means 35, 36, the feet move together with the walking bars 9, 10 along the closed loop or step distance path, to copy the movement of a walking step. The stroke/run of the step is limited by the length of connecting rods 27, 28 with the front and rear guide stops 52-55 imposing the movements to the joints of the feet at the backward and forward ends of every step. Reference to the feet movements will be made only in connection to the left foot as long as the same description is applied to the right foot. When the foot reaches front guide stop 52, the front guide stop 52 impels the instep (forefoot) upwards because the front curved edge 48, with foot plate assembly 37 moving forth, enters into contact with the front guide stop plate 56 which causes upper foot plate 39 to move upwards and pivot around hinge 47, see Figure 9. In like manner, when the foot reaches rear guide stop 54, rollers of plate 44, see as a reference rollers 73 of the right foot, are guided upwardly along upward guide length 71, 72 which causes foot plate assembly 37, namely plates 39, 44, move upwardly and pivoting together around hinge 46 pivotally fixed to walking bar 9. Thus, the rear guide stop 54 pushes the heel upwards, thus triggering the movement in the symphysis of the foot during walking. To prevent any foot, that may get loose from the foot retaining means 35, 36, from moving to a place between the walking bars 9, 10 and getting trapped under a scissor effect of the walking bars 9, 10 moving up and down, preferably rear guide stops 54, 55 are provided with side panels 54A and 55A, see Figure 8, defining a protection for the feet. Alternatively, the apparatus 1 is provided with a stationary panel affixed to the chassis 2 and located in the gap between the walking bars 9, 10.

[0036] Considering that the patient is not in conditions to keep itself in a stand up position, the apparatus 1 may be provided with patient's supporting means for supporting and keeping the patient in a desired position. These means may comprise parallel bars, if the patient is in conditions to keep his/her body sustained by the arms, or, preferably, may comprise a supporting harness, generally indicated at 89 only in Figure 14 for clarity purposes, pending from the upper end 4 of the apparatus 1 and/or connected to columns 5-8. Harness 89 may be of any type capable of appropriately sustaining and supporting the patient and placing him in the desired position but preferably, the harness 89 is connected to upper belts 90 to keep the patient sustained from the shoulders and torso belts 91 to be affixed to the patient's torso, from the waist and/or groin and/or hips.

[0037] The harness 89 is connected to harness motor means 92, which may comprise a crank handle, as illustrated or an electric motor capable of moving the harness up and down. Thus, the weight of the patient actuating on the patient's legs will be regulated as desired. According to this embodiment, upper belts 90 are connected to

a rotating shaft 93, operated by the crank handle, to roll up the belts. A longitudinal and lateral adjustment of the patient position may be carried out by means of rear torso belts 94, 95 and leading torso belts 96, 97. By operating these belts the patient, depending of the disorder to be corrected, may be forced more or less to adopt a standing up, vertical position, or may be permitted to be slightly bent if the patients naturally walks with a stoop. Motor means 92 and shaft 93 also may move along guide bars 98, 99, by supports 100, 101, to further correct the position of the harness 89 longitudinally.

[0038] According to another embodiment of the invention, the apparatus 1, in addition to chassis 2, has a side chassis or side portion 102 for receiving patients in wheel chairs. Side portion 102 also is comprised of columns 103, 104 and a base 105 open to define an entrance 106 for a wheelchair, stretcher and the like. The upper end 4 of the apparatus 1 has a pair of guide beams 107, 108 and a frame 109 which is capable of moving along the guide beams 107, 108 to be placed in a position to receive a patient, shown in Figure 14, and a position to support the patient during treatment, shown in Figure 15. Harness motor means 110, such as an electrical motor, is mounted in frame 109 to actuate a rotary shaft 111, to move the harness up and down. Harness motor means 110 and rotary shaft 111, move with frame 109 along the guide beams 107, 108 which thus define a motor guide for moving the harness motor means 110 between the above described positions.

[0039] In Figure 16, an apparatus 1 according to even another embodiment of the invention is shown, wherein all the apparatus 1 components and parts that are common to those ones of the embodiments shown in Figures 1-15 have been indicated by the same reference number. Thus, the apparatus 1, preferably designed to support higher weights in a shorter design, is also comprised of a chassis 2 with a base member 23 and with a left walking bar 9 and a right walking bar 10 with their respective leading ends having rollers 20, 21 running along front guide means 16, 17. The walking bars 9, 10 are also provided with the same front guide stops 52, 53 and rear guide stops 54, 55, as well as the foot plate assemblies 37, 38. Distinct from the above described embodiment, in the present one, rear ends 11, 12 of the walking bars 9, 10 are pivotally connected to a respective left intermediate walking bar 112 and a right intermediate walking bar 113, both moving up and down and back and forth along a closed movement loop.

[0040] Each intermediate walking bar 112, 113 has a respective rear end 114, 115 connected to motor means 116 that may be like the one shown in Figure 4 or may comprise a motor 117 connected to a speed reducing gear box 118 to move a gear box 119 which in turn is connected to connecting rods 120, 121. Connecting rods 120, 121 are preferably extensible rods with length adjusting means 122, 123 of the type well known in the art. Connecting rods 120, 121 are pivotally connected at joints 124, 125 to rear ends 114, 115 of intermediate bars

112, 113.

[0041] The connection between walking bars 9, 10 to their respective intermediate walking bars 112, 113 is through pivoting connections 126, 127 including respective brackets 128, 129 provided with respective adjusting means 130, 131 to permit the movement of the brackets 128, 129 along intermediate walking bars 112, 113 to adjust the relative position between walking bars 9, 10 and intermediate walking bars 112, 113 with the result that the closed movement loop to copy a natural step movement is adapted to the patient biometric parameters. Finally, front ends 132, 133 of intermediate bars 112, 113, respectively, are provided with rolling means, such as rollers 134, 135, shown in phantom lines in Figure 16, running along and into respective front intermediate guide means, of which only one intermediate guide means 136, for left intermediate walking bar 112, is shown.

[0042] The apparatus of the invention provides a range of services in treating patients suffering motor dysfunctions, neurological disorders, standing disorders and the like that is superlative as compared to other devices of the prior art. The new design and combination of components provides a wider range of movements and adjustments to different patients, also stimulating the standing equilibrium. No rods or complex retaining means are necessary to affix to the legs of the patient but only simple straps for example, are necessary to brace the patient's feet to firmly retain the same in the walking bars.

[0043] Since only the feet are affixed to the walking bars, the feet follow the movement of the walking bars along the closed loop copying the natural walking movement thus causing the feet, with all their joints, to move accordingly. Thus, the movement to the legs is imposed at the feet and not to the entire extension of the legs. As a result, the patient, after some treatment sessions, feels that he/she can move the legs to accompany the feet movement.

[0044] While preferred embodiments of the present invention have been illustrated and described, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the scope of the invention as defined in the appended claims.

Reference list

[0045]

1 apparatus
2 chassis
3 base
4 upper end
5 column
6 column
7 column
8 column
9 walking bar

10 walking bar
11 rear end
12 rear end
13 motor means
5 14 front end
15 front end
16 front guide means
17 front guide means
18 bracket
10 19 bracket
20 roller
21 roller
22 electric motor
23 base member
15 24 pulley
25 belt
26 pulley
27 rod
28 rod
20 29 orifices
30 knob
31 connection
32 extensible arm
33 front cap
25 34 rear cap
35 foot retaining means
36 foot retaining means
37 foot plate assembly
38 foot plate assembly
30 39 upper foot plate
40 upper foot plate
41 left boot
42 right boot
43 ribbons
35 44 lower foot plate
45 lower foot plate
46 hinge
47 hinge
48 front curved edge
40 49 front curved edge
50 leading hinge
51 rear hinge
52 front guide stop
53 front guide stop
45 54 rear guide stop
54A side panel
55 rear guide stop
55A side panel
56 front guide stop plate
50 57 extensible arm
58 extensible arm
59 joint
60 joint
61 adjusting means
55 62 arm length
63 arm length
64 transverse roller

65 spring
 66 spring
 67 rear guide
 68 rear guide
 69 horizontal guide length
 70 horizontal guide length
 71 upward guide length
 72 upward guide length
 73 roller
 74 rear carriage
 75 upper roller
 76 upper roller
 77 lower roller
 78 lower roller
 79 side arm
 80 side arm
 81 joint
 82 transverse beam
 83 arm length
 84 arm length
 85 arm length
 86 arm length
 87 orifice and knob adjusting means
 88 joint
 89 harness
 90 upper belts
 91 torso belts
 92 harness motor means
 93 shaft
 94 rear torso belt
 95 rear torso belt
 96 leading torso belt
 97 leading torso belt
 98 guide bar
 99 guide bar
 100 support
 101 support
 102 side portion
 103 column
 104 column
 105 base
 106 entrance
 107 guide beam
 108 guide beam
 109 frame
 110 harness motor means
 111 rotary shaft
 112 intermediate walking bar
 113 intermediate walking bar
 114 rear end
 115 rear end
 116 motor means
 117 motor
 118 gearbox
 119 gearbox
 120 connecting rod
 121 connecting rod
 122 length adjusting means

123 length adjusting means
 124 joint
 125 joint
 126 pivoting connection
 5 127 pivoting connection
 128 bracket
 129 bracket
 130 adjusting means
 131 adjusting means
 10 132 front end
 133 front end
 134 roller
 135 roller
 136 intermediate guide means
 15

Claims

1. An apparatus (1) for rehabilitation of patients with motor disorders, particularly patients suffering motor dysfunction in the legs, the apparatus (1) comprising:
 - a support structure such as a chassis (2);
 - a left and right walking bars (9, 10) mounted at the bottom part of the chassis (2);
 - a left and a right foot retaining means (35, 36) pivotally connected to the left and right walking bars (9, 10) respectively, for moving with the walking bars (9, 10) along a step distance path (SD) moving up and down and back and forth along a closed movement loop;
 - the left and a right foot retaining means (35, 36) comprising respective left and right foot plate assemblies (37, 38), and
 - a patient's supporting means for supporting the patient,
- characterized in that,**
 - the apparatus comprising a front guide stop (52, 53) associated to each walking bar (9, 10), at a front end of the step distance path (SD), and a rear guide stop (54, 55) associated to each walking bar (9, 10), at a rear end of the step distance path, to cause the foot plate assemblies (37, 38) move up and down in the ends of the step distance path (SD), wherein each foot plate assembly (37, 38) comprises a lower foot plate (44, 45) having a front edge hinged to the walking bar (9, 10) and a rear edge hinged to a rear edge of an upper foot plate (39, 40), forming a rear hinged connection, wherein the rear edge of the lower foot plate (44, 45) has guide followers (73) that are guided in the rear guide stop (54, 55).
2. The apparatus (1) of claim 1 further comprising:
 - fastening means (41, 42, 43) in the left and right foot plate assemblies (37, 38) for retaining the feet of a patient during a treatment.

3. The apparatus (1) of claim 1 or 2, wherein each walking bar (9, 10) has a rear end (11, 12) connected to motor means (13) and a front end (14, 15) slidably connected to front guide means (16, 17). 5
4. The apparatus of claim 3, wherein the motor means (13) comprise a crank and connecting rod mechanism. 10
5. The apparatus (1) of claim 3 or 4, further comprising a chassis (2) with the front guide means (16, 17) for the walking bars (9, 10) being fixed to a front end of the chassis (2), and with the motor means (13) being mounted at a rear end of the chassis (2).
6. The apparatus (1) of claim 1, the upper foot plate (39, 40) having a front curved edge (48, 49) to slidably move onto the front guide stop (52, 53). 20
7. The apparatus (1) of claim 6, further comprising a chassis (2) wherein the front guide stop (52, 53) is pivotally connected to the chassis (2).
8. The apparatus (1) of claim 7, wherein the front guide stop (52, 53), in each walking bar (9, 10), comprises a curved front guide stop plate (56) slidably resting onto the walking bar (9, 10). 25
9. The apparatus (1) of claim 1, wherein the rear guide stop (54, 55), in each walking bar (9, 10), comprises two curved rear U-shaped guides (67, 68) facing to each other and pivotally connected to the walking bar (9, 10), with the rear U-shaped guides (67, 68) being slidably resting onto the walking bar (9, 10) and with the rear U-shaped guides (67, 68) receiving said guide followers (73). 30 35
10. The apparatus (1) of claim 2, wherein the fastening means (41, 42, 43) comprise ribbons (43) fixed at the foot plate assemblies (37, 38) for embracing the feet of the patient. 40
11. The apparatus (1) of claim 1, wherein the patient's supporting means comprises a supporting harness (89) pending from a harness motor means (92), at an upper end (4) of the apparatus (1), for moving the harness (89) up and down. 45
12. The apparatus (1) of claim 11, wherein the apparatus (1) has a side portion (102) for entering patients in wheel chairs, stretcher and the like. 50
13. The apparatus (1) of claim 12, wherein the upper end (4) of the apparatus (1) and the side portion (102) have a motor guide (107, 108) for moving the harness motor means (92) between a position for receiving a patient at a wheelchair, stretcher and the like, and a position above the walking bars (9, 10). 55

14. The apparatus (1) of any one of claims 1 to 13, wherein the left and right walking bars (9, 10) have respective rear ends (11, 12) pivotally connected to respective left and right intermediate walking bars (112, 113) moving up and down and back and forth along a closed movement loop.

15. The apparatus (1) of claim 14, wherein each intermediate walking bar (112, 113) has a rear end (114, 115) connected to said motor means (116) and a front end (132, 133) slidably connected to front intermediate guide means (136).

15 Patentansprüche

1. Vorrichtung (1) zur Rehabilitation von Patienten mit motorischen Störungen, insbesondere von Patienten, die an motorischen Störungen in den Beinen leiden, mit:

einer Unterstützungsstruktur, wie beispielsweise einem Rahmen (2);

einem linken und einem rechten Gehbalken (9, 10), die am unteren Teil des Rahmens (2) montiert sind;

einem linken und einem rechten Fußhaltemittel (35, 36), die jeweils für eine Bewegung mit den Gehbalken (9, 10) durch Auf- und Abbewegen und Vor- und Zurückbewegen entlang eines Schrittlängenweges (SD) einer geschlossenen Bewegungsschleife, schwenkbar mit dem linken und rechten Gehbalken (9, 10) verbunden sind;

dem linken und dem rechten Fußhaltemittel (35, 36), die entsprechende linke und rechte Fußplattenanordnungen (37, 38) aufweisen und einem Patientenhilfsmittel zur Unterstützung des Patienten,

dadurch gekennzeichnet, dass

die Vorrichtung einen vorderen Führungsanschlag (52, 53), der dem jeweiligen Gehbalken (9, 10) an einem vorderen Ende des Schrittlängenweges (SD) zugeordnet ist, und einen hinteren Führungsanschlag (54, 55) aufweist, der den jeweiligen Gehbalken (9, 10) an einem hinteren Ende des Schrittlängenweges zugeordnet ist, um zu bewirken, dass die Fußplattenanordnungen (37, 38) sich an den Enden des Schrittlängenweges (SD) auf und ab bewegt, wobei jede Fußplattenanordnung (37, 38) eine untere Fußplatte (44, 45) aufweist, die mit einer Vorderkante gelenkig an dem Gehbalken (9, 10) gelagert ist, und mit einer Hinterkante gelenkig an einer Hinterkante einer oberen Fußplatte (39, 40) gelagert ist, die eine Schwenkverbindung bilden, wobei die Hinterkante der unteren Fußplatte (44, 45) Führungsschienen (73) auf-

- weist, die im hinteren Führungsanschlag (54, 55) geführt werden.
2. Vorrichtung (1) nach Patentanspruch 1, des Weiteren mit:
Befestigungselementen (41, 42, 43) in der linken und in der rechten Fußplattenanordnung (37, 38) zum Halten der Füße des Patienten während einer Behandlung. 5
 3. Vorrichtung (1) nach Patentanspruch 1 oder 2, wobei beide Gehbalken (9, 10) jeweils ein hinteres Ende (11, 12), das mit einer Motoreinheit (13) verbunden ist, und ein vorderes Ende (14, 15) aufweisen, das gleitend mit einer vorderen Führung (16, 17) verbunden ist. 10
 4. Vorrichtung (1) nach Patentanspruch 3, wobei die Motoreinheit (13) eine Kurbelwelle und einen Pleuelmechanismus aufweist. 15
 5. Vorrichtung (1) nach Patentanspruch 3 oder 4, des Weiteren mit einem Rahmen (2), wobei die vordere Führung (16, 17) der Gehbalken (9, 10) an einem vorderen Ende des Rahmens (2) und die Motoreinheit (13) an einem hinteren Ende des Rahmens (2) montiert ist. 20
 6. Vorrichtung (1) nach Patentanspruch 1, wobei die obere Fußplatte (39, 40) eine vordere, geschwungene Kante (48, 49) aufweist, um an dem vorderen Führungsanschlag (52, 53) entlang zu gleiten. 25
 7. Vorrichtung (1) nach Patentanspruch 6, des Weiteren mit einem Rahmen (2), wobei der vordere Führungsanschlag (52, 53) schwenkbar mit dem Rahmen (2) verbunden ist. 30
 8. Vorrichtung (1) nach Patentanspruch 7, wobei der vordere Führungsanschlag (52, 53) beider Gehbalken (9, 10) jeweils eine gebogene vordere Führungsplatte (56), die gleitend auf dem Gehbalken (9, 10) aufliegt, aufweist. 35
 9. Vorrichtung (1) nach Patentanspruch 1, wobei der hintere Führungsanschlag (54, 55) beider Gehbalken (9, 10) jeweils zwei gebogene, hintere U-förmige Führungen (67, 68) aufweist, die sich gegenüber liegen und schwenkbar mit den Gehbalken (9, 10) verbunden sind, wobei die hinteren U-förmigen Führungen (67, 68) gleitend auf dem Gehbalken (9, 10) aufliegen und wobei die hinteren U-förmigen Führungen (67, 68) die Führungsschienen (73) aufnehmen. 40
 10. Vorrichtung (1) nach Patentanspruch 2, wobei die Befestigungselemente (41, 42, 43) Bänder (43) aufweisen, die an der Fußplattenanordnung (37, 38) befestigt sind, um die Füße des Patienten zu halten. 45
 11. Vorrichtung (1) nach Patentanspruch 1, wobei die Patientenhilfsmittel einen Stützgurt (89) aufweisen, der von einem Gurtantrieb (92) an einem oberen Ende (4) der Vorrichtung (1) herabhängt, um den Stützgurt (89) auf und ab zu bewegen. 5
 12. Vorrichtung (1) nach Patentanspruch 11, wobei die Vorrichtung (1) einen Seitenabschnitt (102) für den Einstieg von Patienten in Rollstühlen, Krankentragen oder Ähnlichem aufweist. 10
 13. Vorrichtung (1) nach Patentanspruch 12, wobei das obere Ende (4) der Vorrichtung (1) und der Seitenabschnitt (102) eine Motorführung (107, 108) aufweisen, um den Gurtantrieb (92) zwischen einer Position zur Aufnahme eines Patienten aus einem Rollstuhl, einer Krankentrage oder Ähnlichem und einer Position oberhalb der Gehbalken (9, 10) zu verfahren. 15
 14. Vorrichtung (1) nach einem der vorhergehenden Patentansprüche, wobei der linke und der rechte Gehbalken (9, 10) jeweilige hintere Enden (11, 12) aufweisen, die für Auf- und Abbewegungen und Vor- und Zurückbewegungen entlang einer geschlossenen Bewegungsschleife zu jeweiligen linken und rechten Zwischenbalken (112, 113) schwenkbar verbunden sind. 20
 15. Vorrichtung (1) nach Patentanspruch 14, wobei die jeweiligen Zwischenbalken (112, 113) ein hinteres Ende (114, 115), das mit einer Motoreinheit (116) verbunden ist, und ein vorderes Ende (132, 133) aufweisen, das gleitend mit vorderen Zwischenführungen (136) verbunden ist. 25

Revendications

1. Appareil (1) pour la réhabilitation de patients souffrant de troubles moteurs, en particulier de patients souffrant d'un dysfonctionnement moteur des jambes, l'appareil (1) comprenant :

une structure de support telle qu'un châssis (2) ;
des barres d'appui gauche et droite (9, 10) montées sur la partie basse du châssis (2) ;
des moyens de retenue de pieds gauche et droit (35, 36) reliés de façon à pouvoir pivoter aux barres d'appui gauche et droite (9, 10), respectivement, pour se déplacer avec les barres d'appui (9, 10) le long d'une voie de parcours (SD) montant et descendant et allant et venant le long d'un circuit de déplacement fermé ;
les moyens de retenue de pieds gauche et droit (35, 36) comprenant des assemblages de plaques de pieds gauche et droit respectifs (37, 38), et

un moyen de support du patient pour supporter le patient,

caractérisé en ce que

- l'appareil comprend une butée de guidage avant (52, 53) associée à chaque barre d'appui (9, 10), à une extrémité avant de la voie de parcours (SD), et une butée de guidage arrière (54, 55) associée à chaque barre d'appui (9, 10), à une extrémité arrière de la voie de parcours, pour entraîner la montée et la descente des assemblages de plaques de pied (37, 38) aux extrémités de la voie de parcours (SD), dans lequel chaque assemblage de plaques de pied (37, 38) comprend une plaque de pied inférieure (44, 45) ayant un bord avant articulé avec la barre d'appui (9, 10) et un bord arrière articulé avec un bord arrière d'une plaque de pied supérieure (39, 40), en formant une liaison arrière articulée, dans lequel le bord arrière de la plaque de pied inférieure (44, 45) a des suiveurs de guidage (73) qui sont guidés dans la butée de guidage arrière (54, 55).
2. Appareil (1) selon la revendication 1, comprenant en outre :
des moyens d'attache (41, 42, 43) dans les assemblages de plaques de pied gauche et droit (37, 38) pour retenir les pieds d'un patient pendant un traitement.
 3. Appareil (1) selon la revendication 1 ou 2, dans lequel chaque barre d'appui (9, 10) a une extrémité arrière (11, 12) reliée à un moyen moteur (13) et une extrémité avant (14, 15) reliée, de façon à pouvoir coulisser, à un moyen de guidage avant (16, 17).
 4. Appareil selon la revendication 3, dans lequel le moyen moteur (13) comprend un mécanisme de biellette-manivelle.
 5. Appareil (1) selon la revendication 3 ou 4, comprenant en outre un châssis (2) comportant le moyen de guidage avant (16, 17) pour les barres d'appui (9, 10) qui est fixé à une extrémité avant du châssis (2), et comportant le moyen moteur (13) qui est monté à une extrémité arrière du châssis (2).
 6. Appareil (1) selon la revendication 1, la plaque de pied supérieure (39, 40) ayant un bord avant courbé (48, 49) pour se déplacer de façon à coulisser sur la butée de guidage avant (52, 53).
 7. Appareil (1) selon la revendication 6, comprenant en outre un châssis (2) dans lequel la butée de guidage avant (52, 53) est reliée de façon à pouvoir pivoter au châssis (2).
 8. Appareil (1) selon la revendication 7, dans lequel la

butée de guidage avant (52, 53), dans chaque barre d'appui (9, 10), comprend une plaque de butée de guidage avant courbée (56) reposant de façon à pouvoir coulisser sur la barre d'appui (9, 10).

9. Appareil (1) selon la revendication 1, dans lequel la butée de guidage arrière (54, 55), dans chaque barre d'appui (9, 10), comprend deux guides arrière en forme de U courbés (67, 68), tournés l'un face à l'autre et reliés de façon à pouvoir pivoter à la barre d'appui (9, 10), les guides arrière en forme de U (67, 68) reposant de façon à pouvoir coulisser sur la barre d'appui (9, 10) et les guides arrière en forme de U (67, 68) recevant lesdits suiveurs de guidage (73).
10. Appareil (1) selon la revendication 2, dans lequel les moyens d'attache (41, 42, 43) comprennent des bandes (43) fixées aux assemblages de plaques de pied (37, 38) pour entourer les pieds du patient.
11. Appareil (1) selon la revendication 1, dans lequel le moyen de support du patient comprend un harnais de support (89) suspendu depuis un moyen moteur de harnais (92), à une extrémité supérieure (4) de l'appareil (1), pour faire monter et descendre le harnais (89).
12. Appareil (1) selon la revendication 11, dans lequel l'appareil (1) a une partie latérale (102) pour l'entrée de patients en fauteuils roulants, sur civière et similaires.
13. Appareil (1) selon la revendication 12, dans lequel l'extrémité supérieure (4) de l'appareil (1) et la partie latérale (102) ont un guide de moteur (107, 108) pour déplacer le moyen moteur de harnais (92) entre une position destinée à recevoir un patient sur un fauteuil roulant, une civière et similaires, et une position au-dessus des barres d'appui (9, 10).
14. Appareil (1) selon l'une quelconque des revendications 1 à 13, dans lequel les barres d'appui gauche et droite (9, 10) ont des extrémités arrière respectives (11, 12) reliées de façon à pouvoir pivoter aux barres d'appui gauche et droite intermédiaires respectives (112, 113) montant et descendant et allant et venant le long d'un circuit de déplacement fermé.
15. Appareil (1) selon la revendication 14, dans lequel chaque barre d'appui intermédiaire (112, 113) a une extrémité arrière (114, 115) reliée audit moyen moteur (116) et une extrémité avant (132, 133) reliée de façon à pouvoir coulisser au moyen de guidage intermédiaire avant (136).

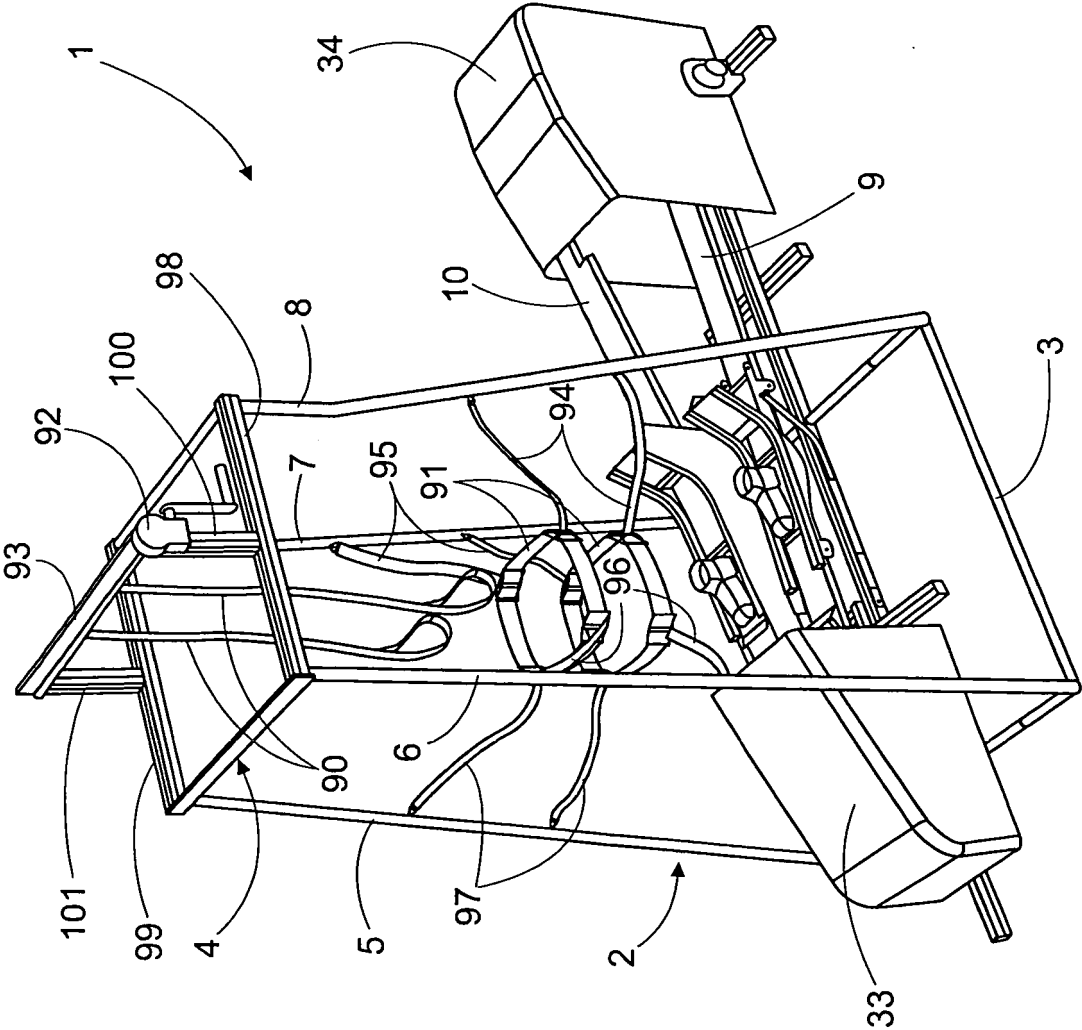


Fig. 1

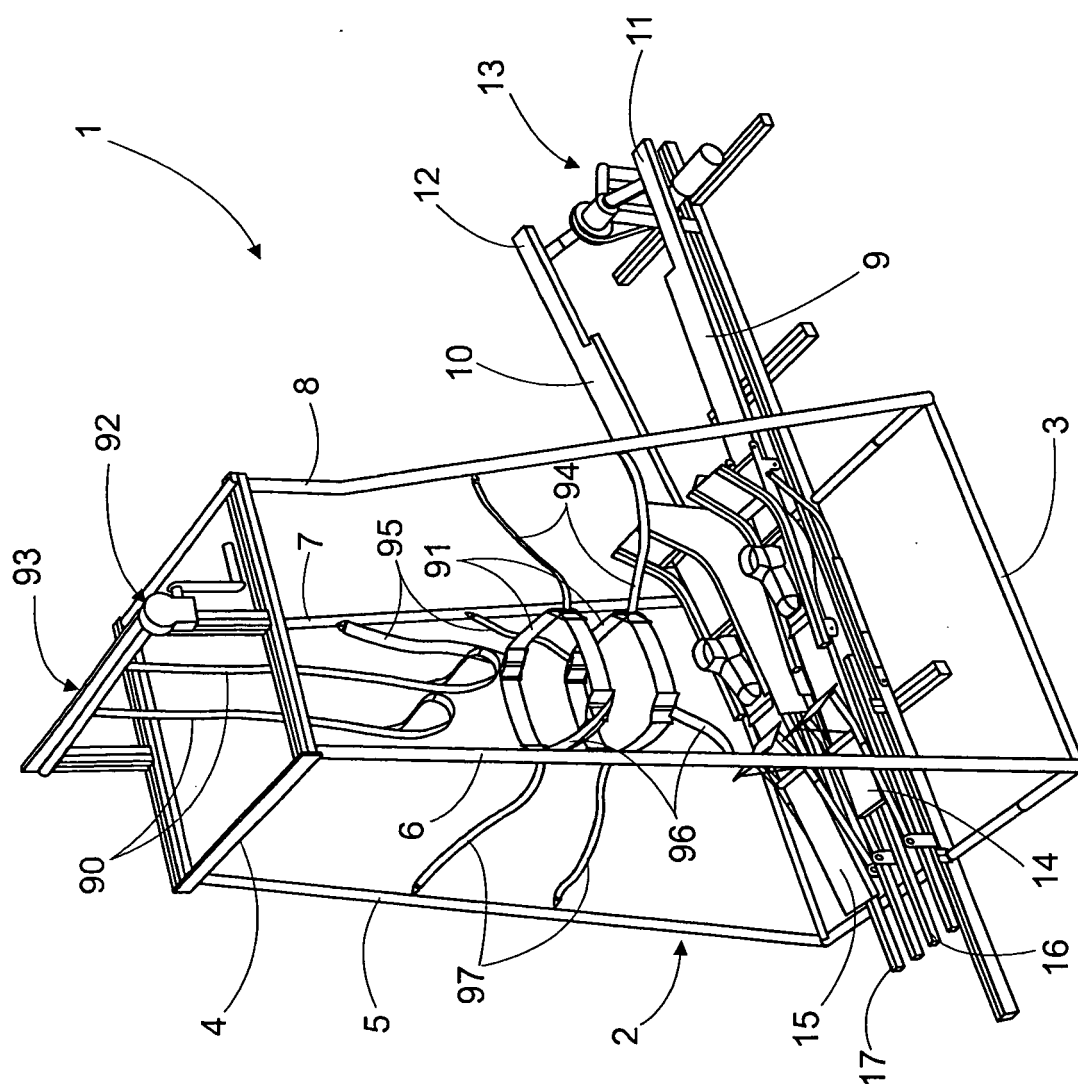


Fig. 2

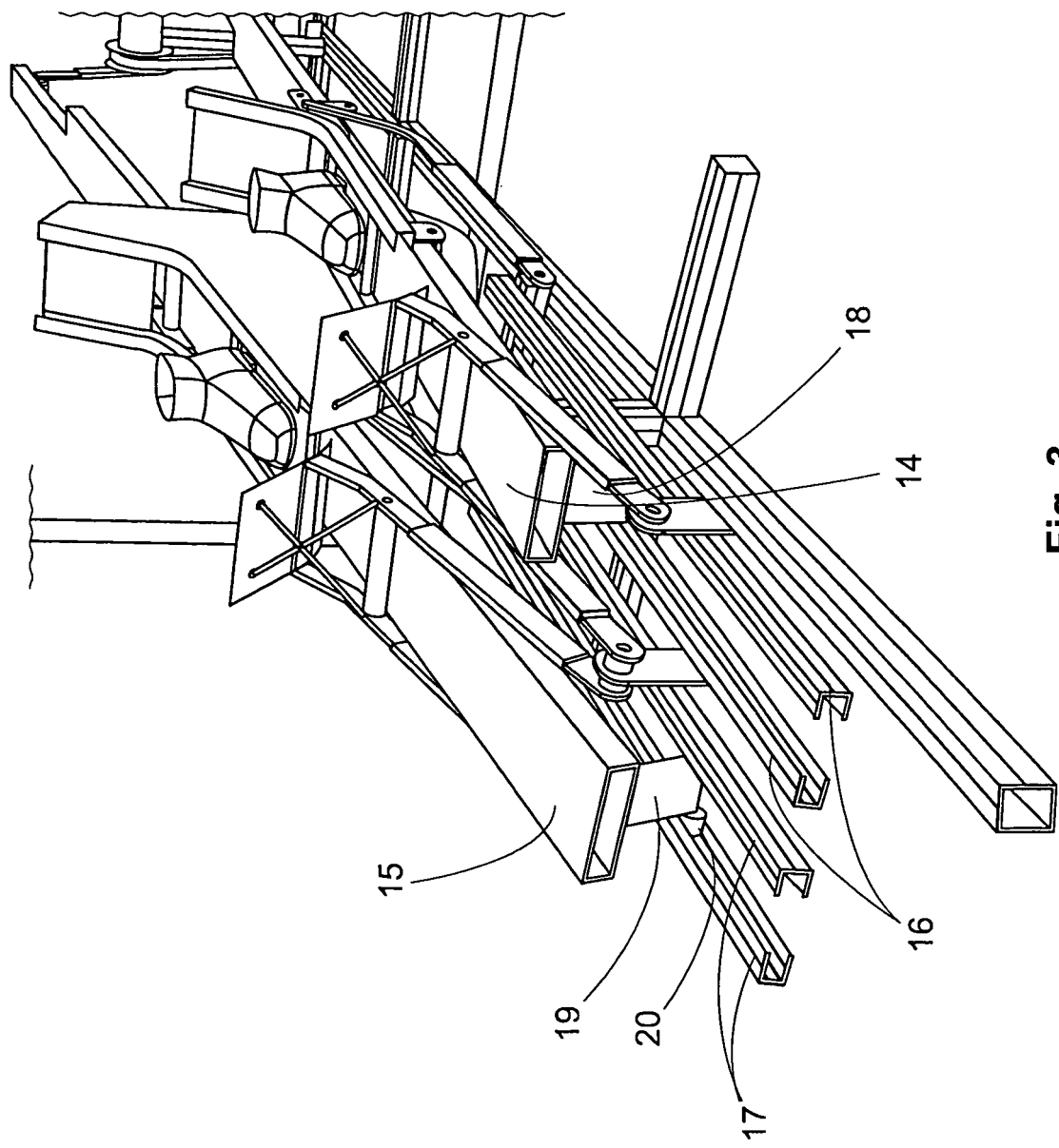


Fig. 3

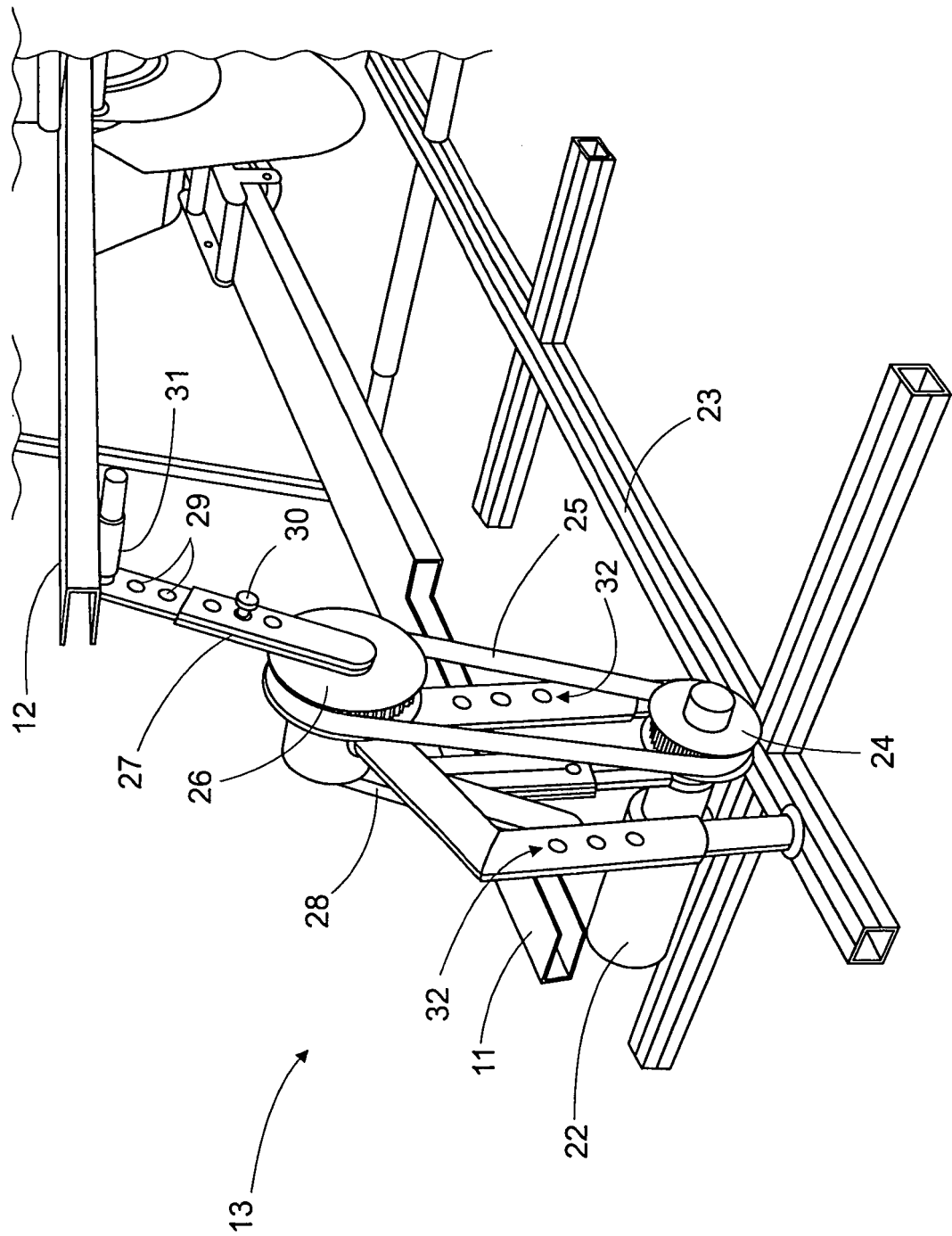


Fig. 4

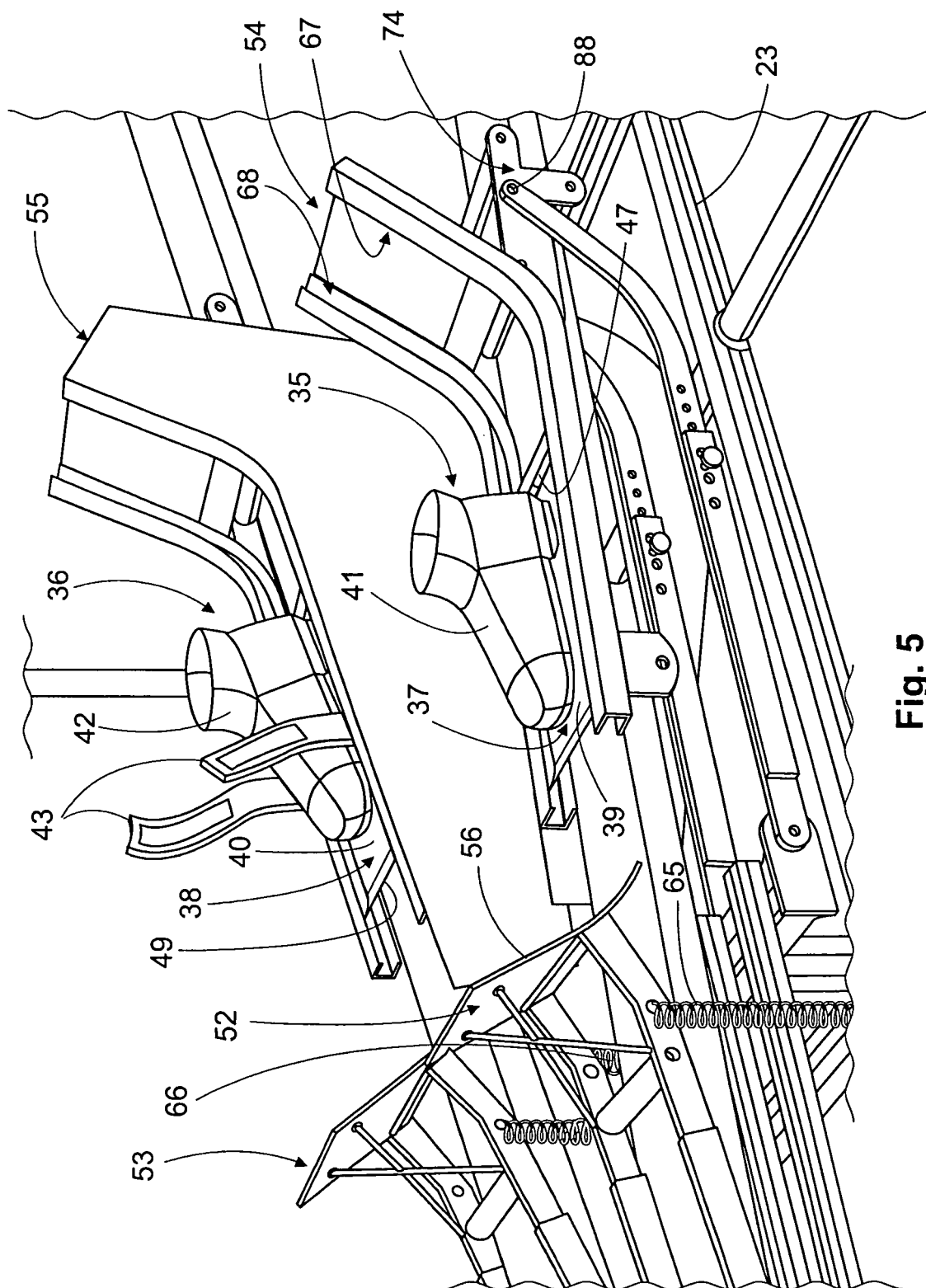


Fig. 5

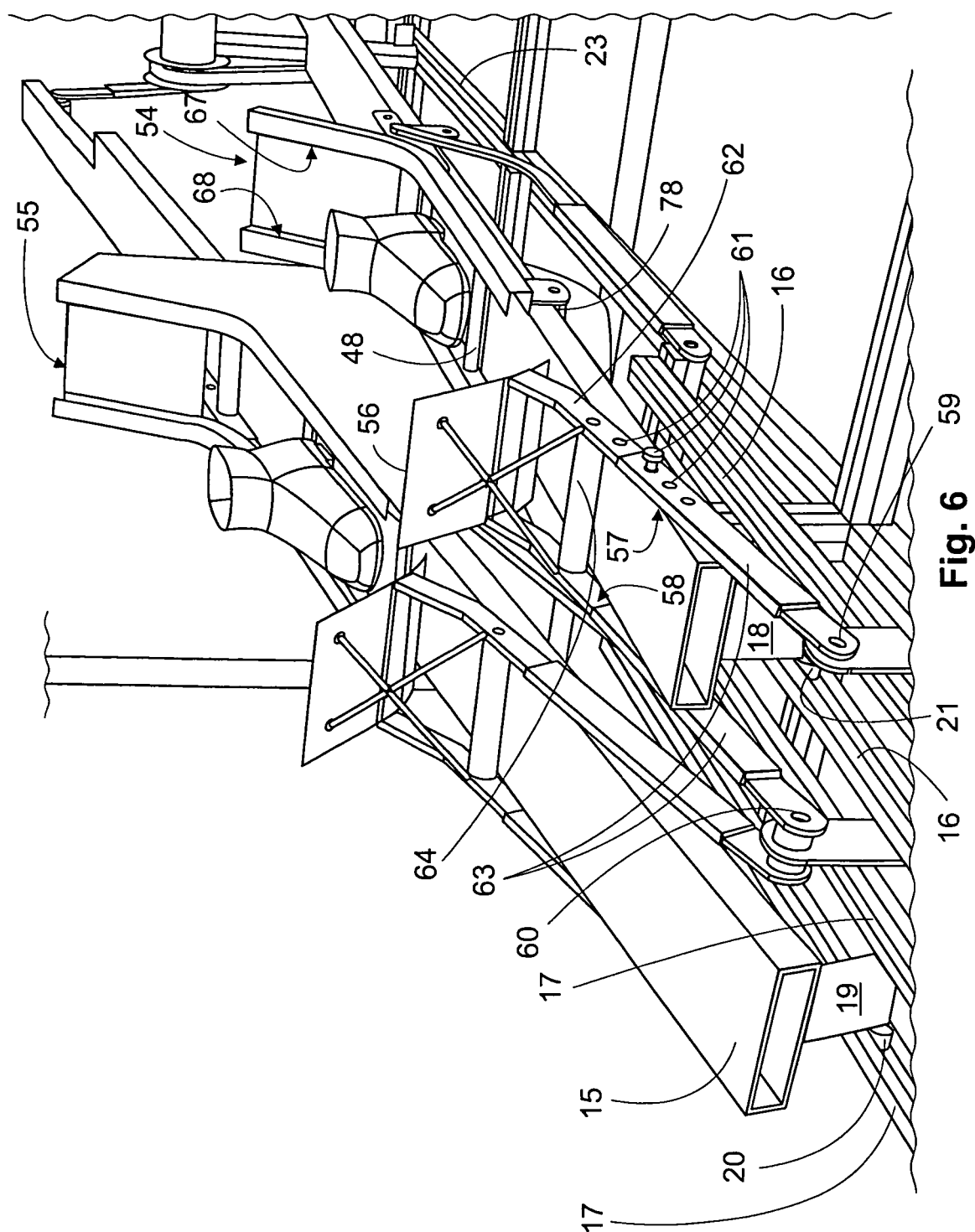


Fig. 6

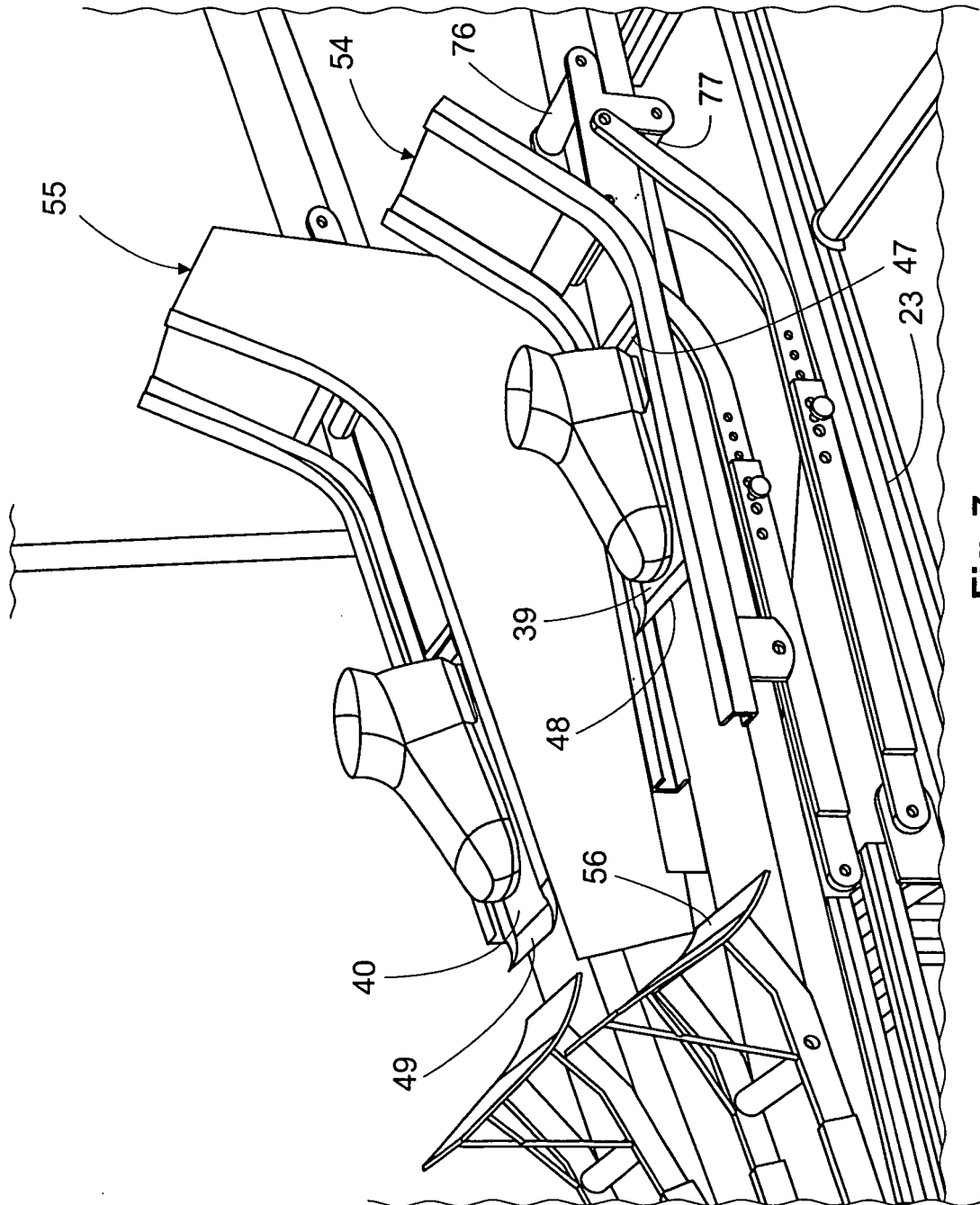


Fig. 7

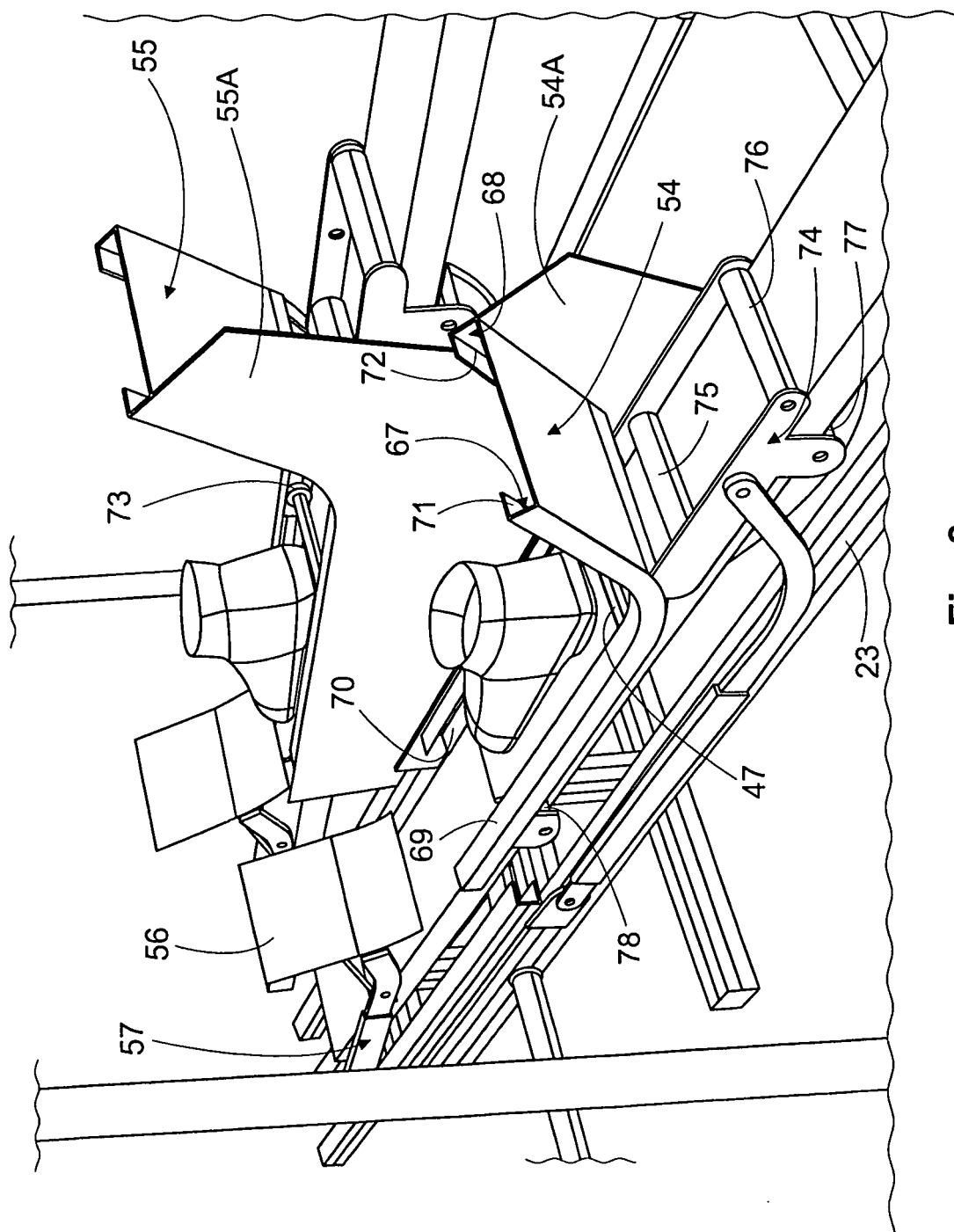


Fig. 8

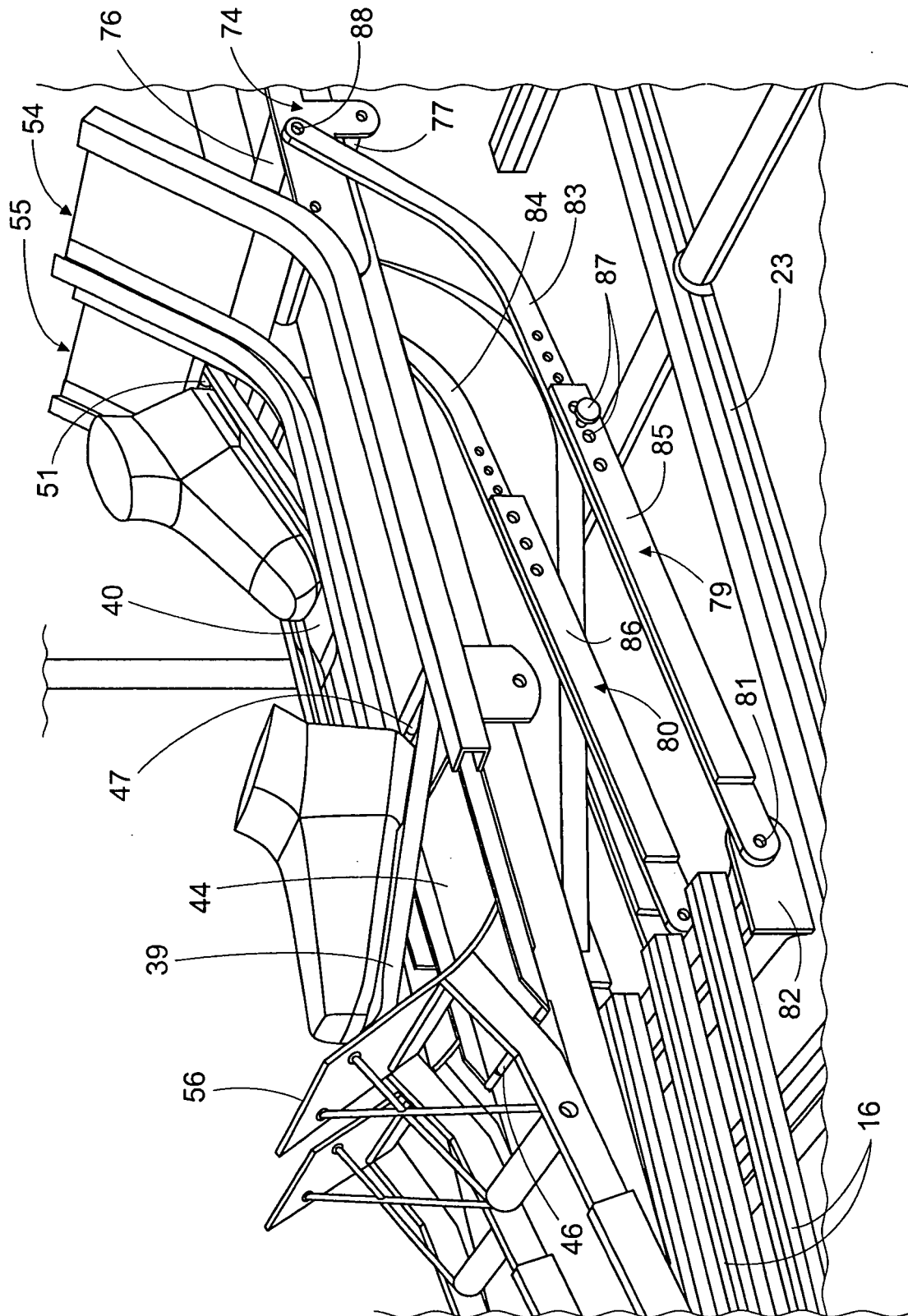


Fig. 9

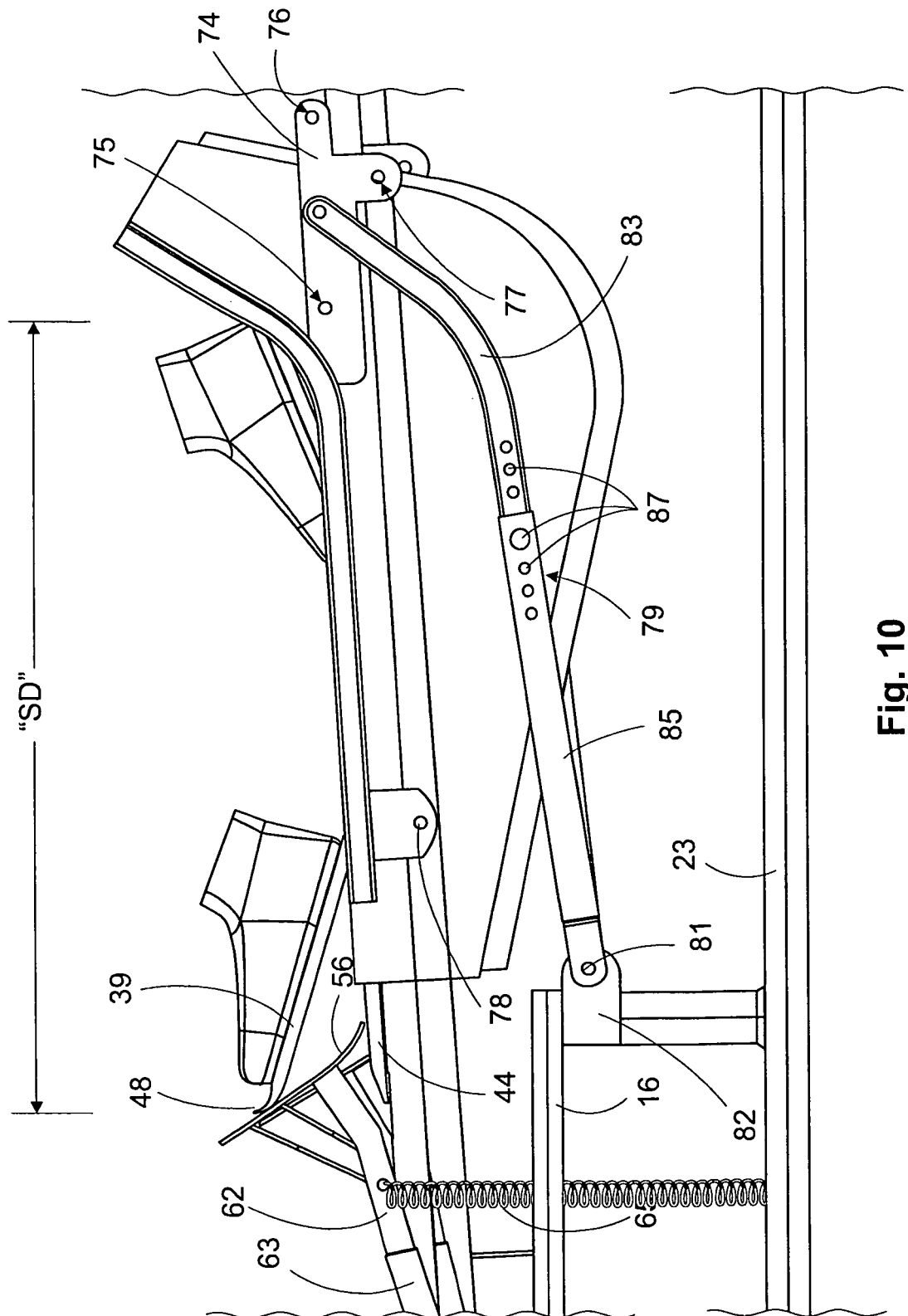


Fig. 10

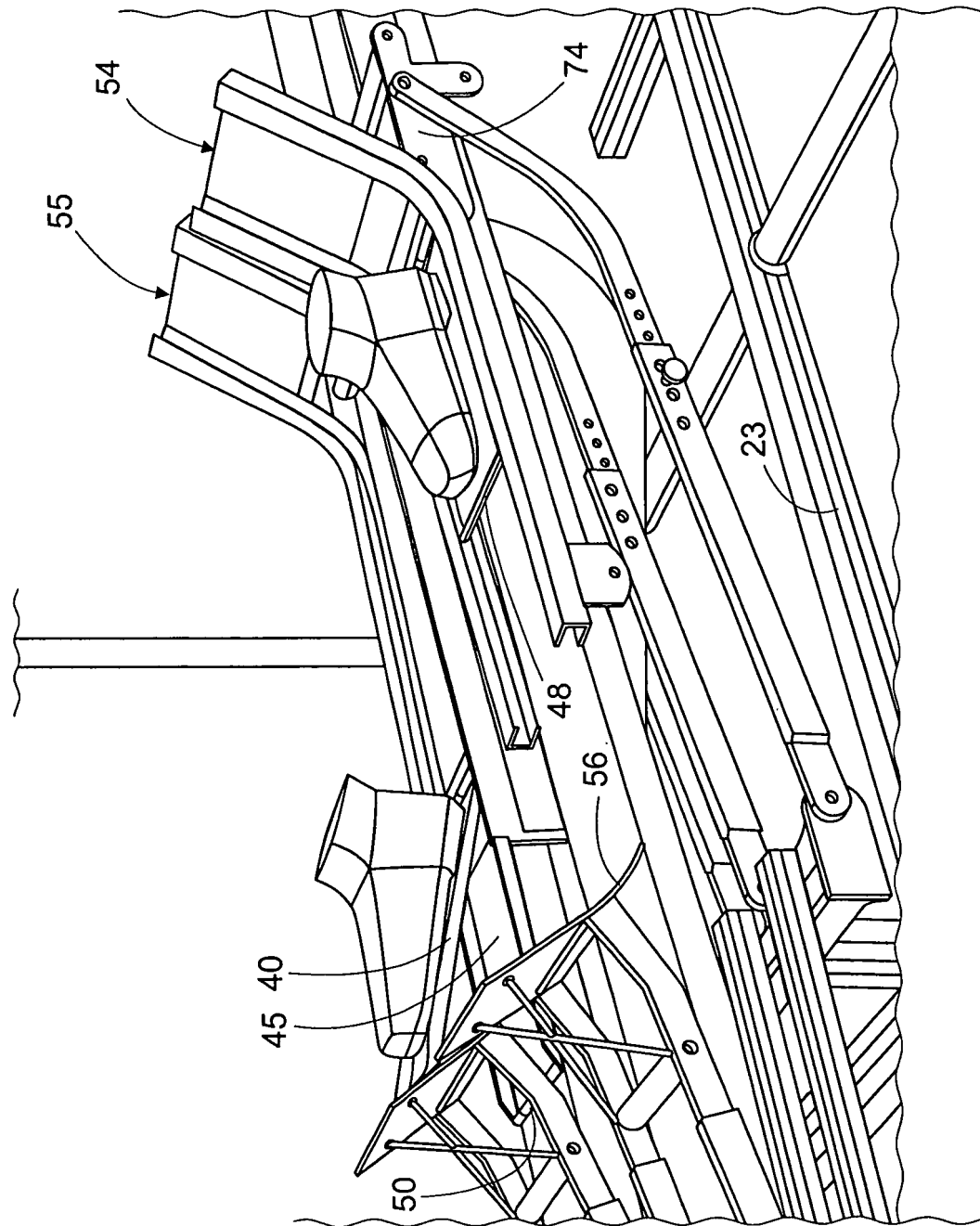


Fig. 11

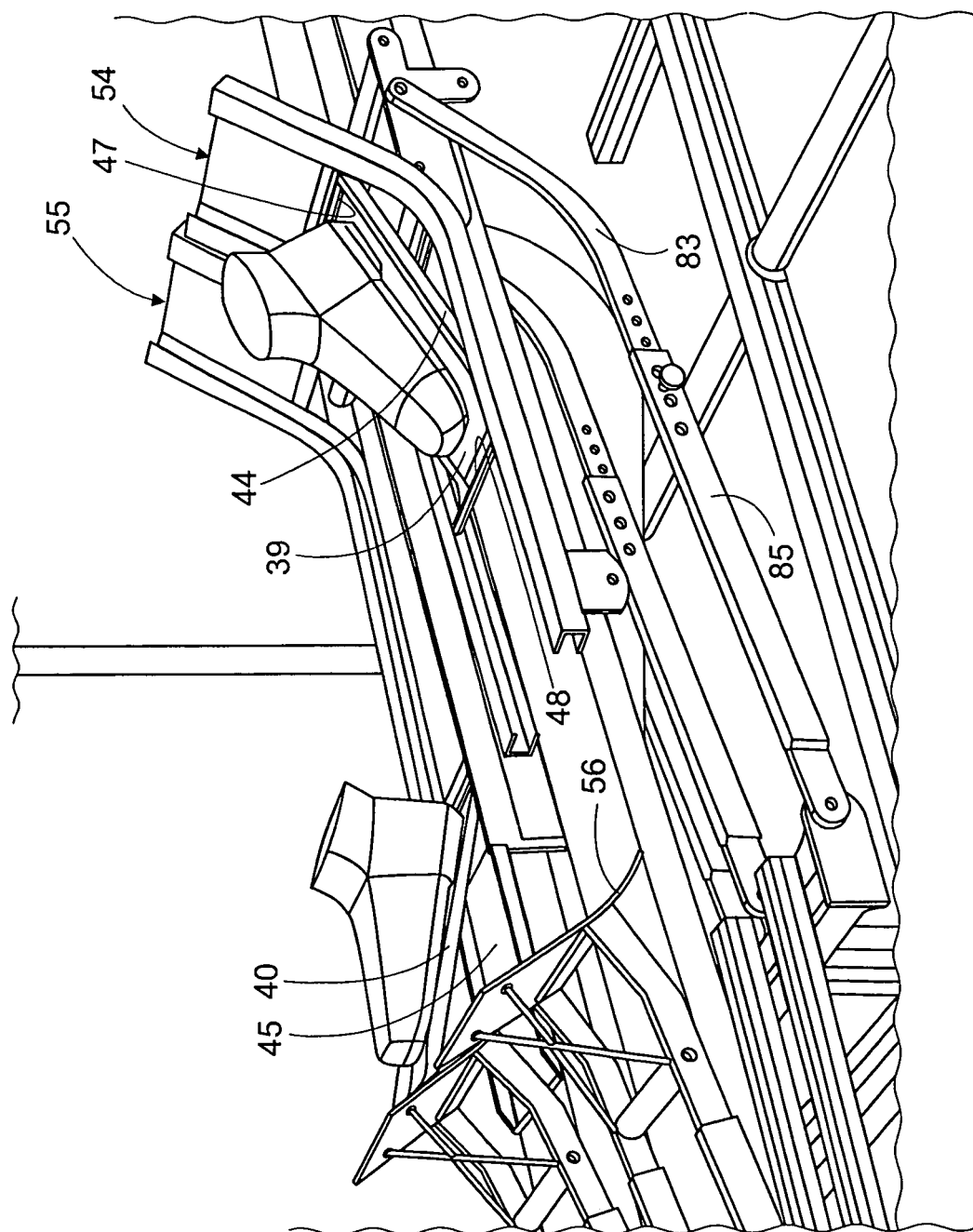


Fig. 12

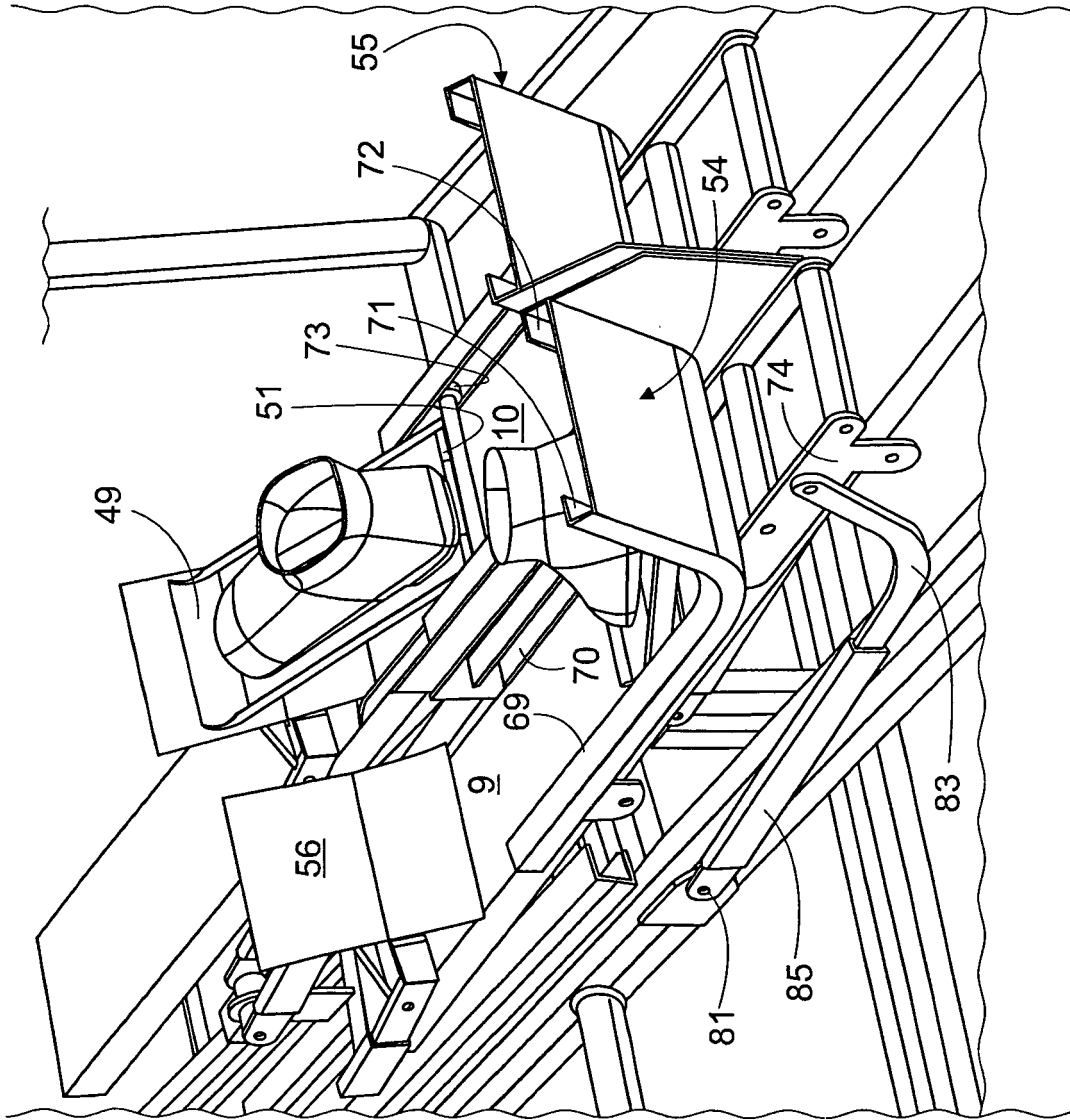


Fig. 13

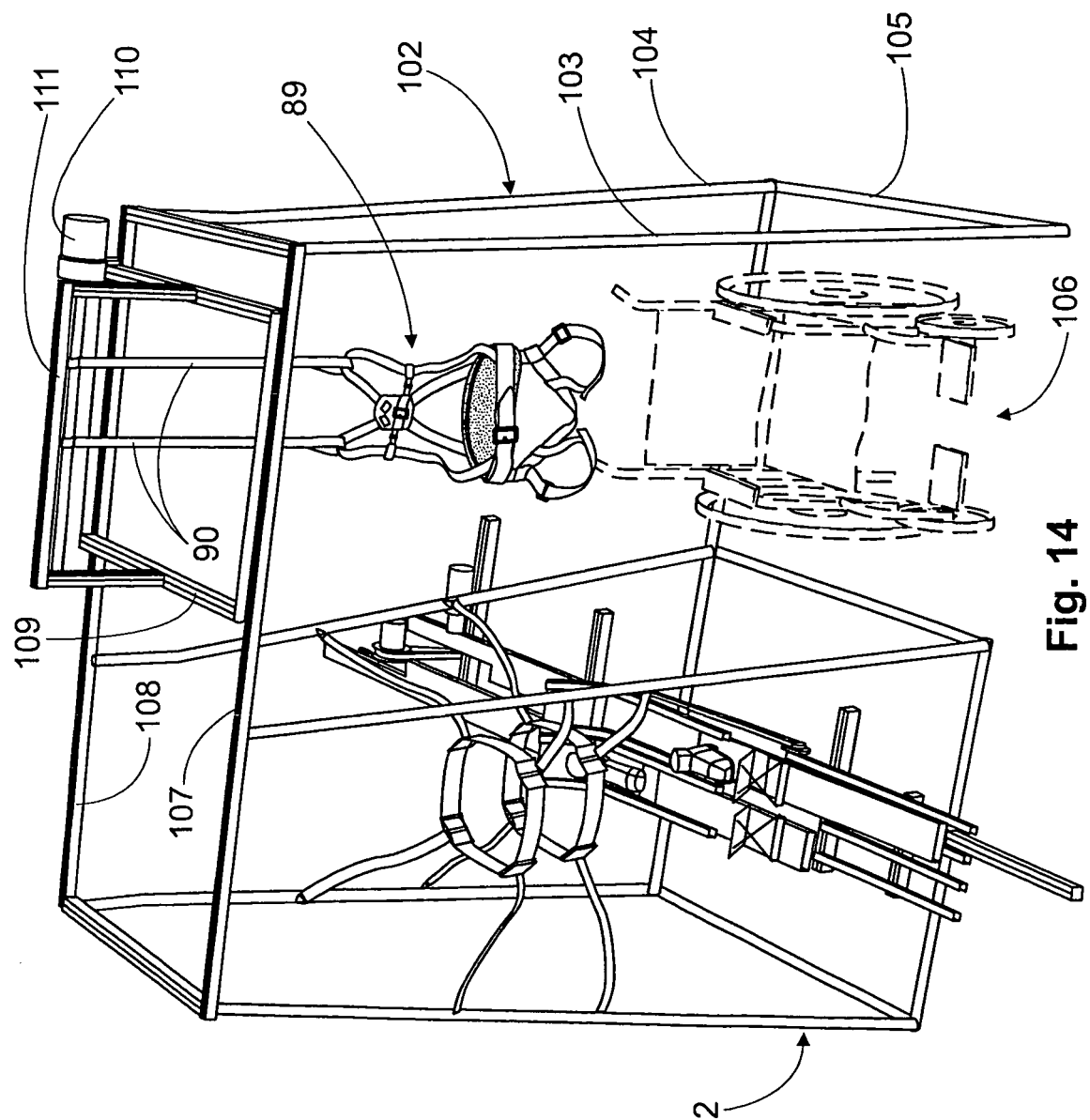


Fig. 14

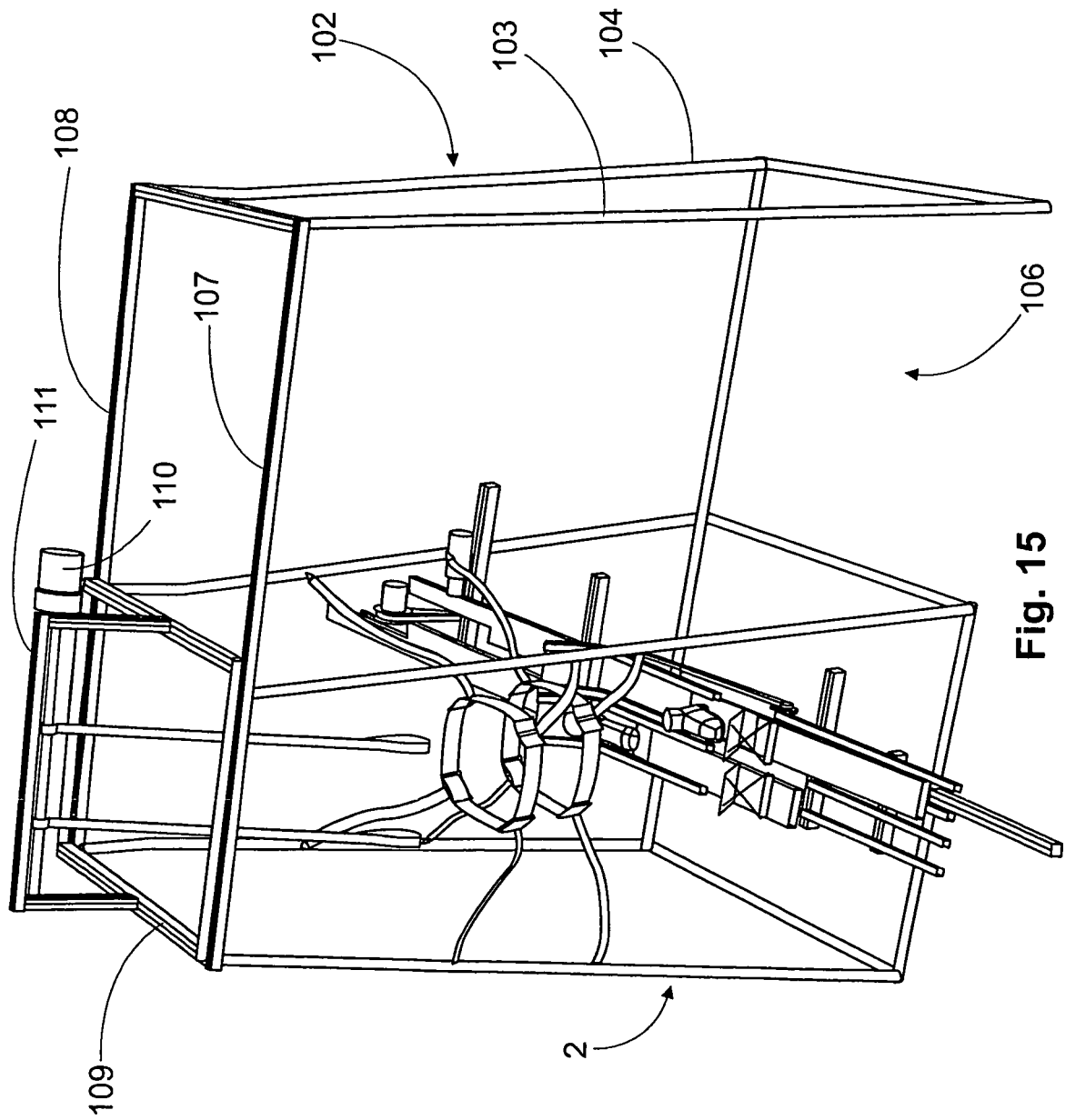


Fig. 15

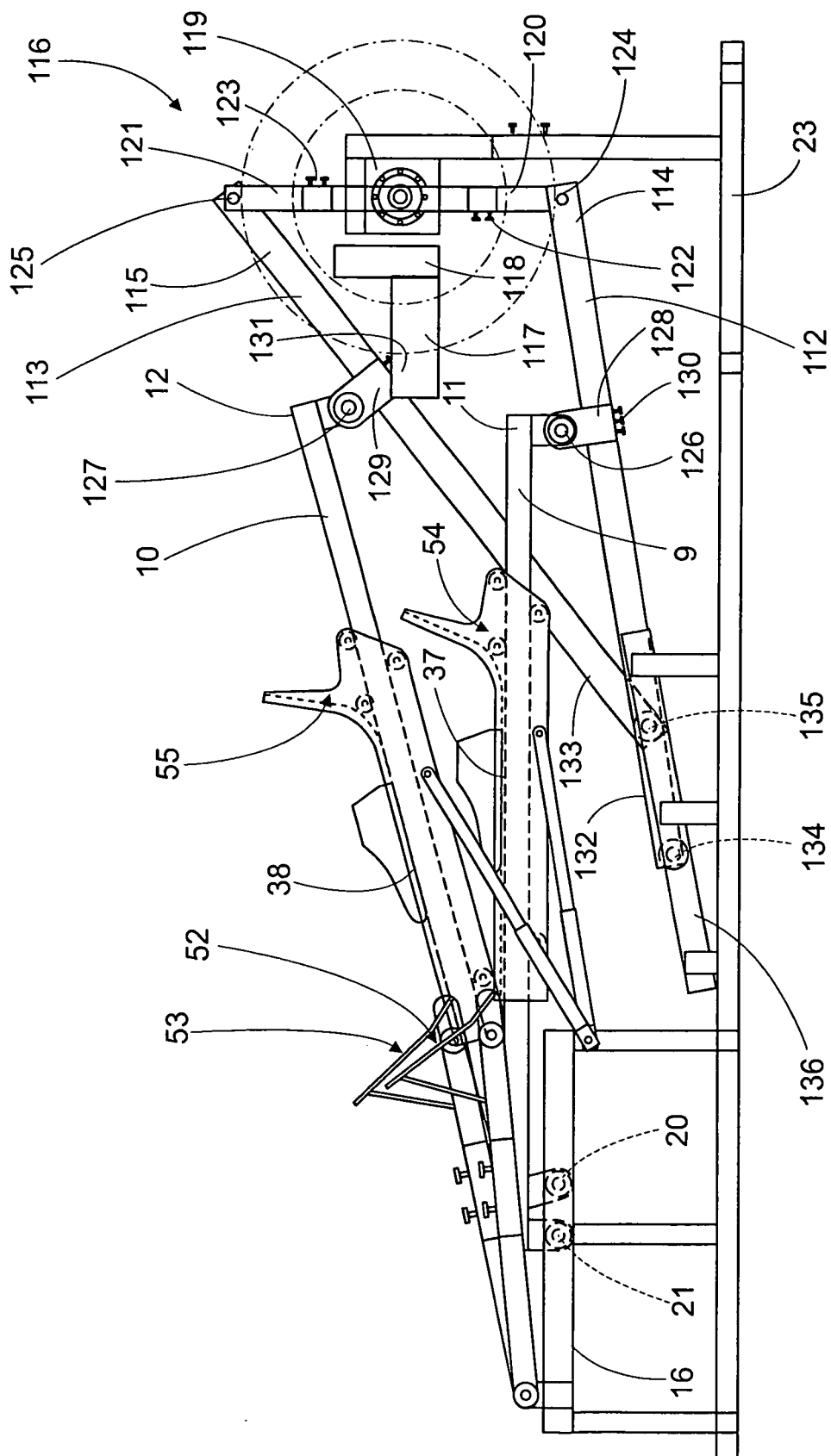


Fig. 16

REFERENCES CITED IN THE DESCRIPTION

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