

(19)



(11)

EP 3 241 536 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:

30.12.2020 Bulletin 2020/53

(51) Int Cl.:

A61H 1/02 (2006.01)

A61G 7/015 (2006.01)

A61H 9/00 (2006.01)

A61G 7/008 (2006.01)

A61G 7/075 (2006.01)

(21) Application number: **17169593.5**

(22) Date of filing: **04.05.2017**

(54) **BED WITH MOVABLE PANELS FOR REHABILITATION**

BETT MIT BEWEGBAREN PLATTEN ZUR REHABILITATION

LIT AVEC DES PANNEAUX MOBILES POUR LA RÉÉDUCATION

(84) Designated Contracting States:

**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

(30) Priority: **04.05.2016 IT UA20166740 U**

(43) Date of publication of application:

08.11.2017 Bulletin 2017/45

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Description

[0001] The present invention relates to a rehabilitation unit. In particular, the present invention relates to a rehabilitation unit comprising a bed provided with movable parts. In more detail, the present invention relates to a rehabilitation unit comprising a bed provided with movable parts that can be actuated in order to train immobilized patients to move again.

BACKGROUND TO THE INVENTION

[0002] As it is well known, in the field of rehabilitation of paraplegic and quadriplegic patients whose disease results from an ictus or a trauma, it is crucial to induce the movement of the immobilized limbs and to control the blood pressure distribution, provided that this is possible without worsening the patient's conditions. The more immediate the intervention and the longer the time the muscles, no longer physiologically actuated, are kept in motion, the better the recovery of patient's muscle functionality and of patient's control of physiological functions.

[0003] On the other hand, it is clearly apparent that continuously moving the limbs of an immobilized patient is particularly onerous, as the physical therapy and blood pressure controls shall be performed very carefully by specialized staff, with a millimetre precision. Moreover, these operations shall be done repetitively according to plans specifically defined for each patient. It is easily understood that, in order to do this, a plurality of trained therapists shall be available to be associated to each patient in more work shifts. If the therapy shall be performed for more days, as in most cases, the cost are obviously very high. In case there are many patients to be treated contemporaneously and the number of available therapists is limited - due to the needed specialization requirements and the affordable costs from a service feasibility viewpoint - it could be necessary to limit the number of patients admitted to the rehabilitation treatments described above.

[0004] In view of what above, the problem of having a unit for immobilized patients rehabilitation allowing to perform the operations described above without the intervention of an operator is actually unsolved, and represents an interesting challenge for the Applicant.

[0005] In view of the situation described above, it would be desirable to have available a rehabilitation unit that, in addition to allow limiting and possibly overcoming the drawbacks of the prior art, defines a new standard for this kind of units. Rehabilitation units according to the state of the art are known from documents US 3 450 132 A, CN 204 484 679 U, EP 0 705 091 B1, US 2010/313897 A1, US 2015/004577 A1 and US 4 768 249 A.

SUMMARY OF THE PRESENT INVENTION

[0006] The present invention relates to a rehabilitation unit. In particular, the present invention relates to a re-

habilitation unit comprising a bed provided with movable parts. In more detail, the present invention relates to a rehabilitation unit comprising a bed provided with movable parts that can be actuated in order to train immobilized patients to move again.

[0007] The object of the present invention is to provide a rehabilitation unit allowing to move the limbs of an immobilized patient and to control the blood pressure of different body areas in a physiologically proper manner for periods that can be defined at will.

[0008] According to the present invention a rehabilitation unit is provided, whose main features will be described in at least one of the appended claims.

BRIEF DESCRIPTION OF DRAWINGS

[0009] Further characteristics and advantages of the rehabilitation unit of the invention will be more apparent from the description below, set forth with reference to the attached drawings, that illustrate some examples of embodiment, where identical or corresponding parts of the system are identified by the same reference numbers. In particular:

- figure 1 is a schematic perspective view of a rehabilitation unit according to the present invention;
- figure 2 is a perspective side elevation view of figure 1;
- figure 3 is a front perspective view of figure 1;
- figure 4 is a plan view of figure 1;
- figure 5 is a bottom view of figure 1, with some parts removed for the sake of clarity;
- figure 6 is derived from figure 4, with some parts removed for the sake of clarity;
- figure 7 is an exploded view of figure 1 in reduced scale and with some parts removed for the sake of clarity;
- figure 8 is a perspective schematic view of figure 1, with some parts removed for the sake of clarity.

DETAILED DESCRIPTION OF THE PRESENT INVENTION

[0010] In figure 1, number 1 indicates, as a whole, a rehabilitation unit shaped like a bed on which a patient can be laid for stay or care. The unit 1 comprises a base 10 provided with wheels and supporting a platform 30 through a lifting device 12 that is provided with two telescopic actuating members 120 and with a U-shaped plate 122 that is provided with two coupling portions 123 for heads 124 of the two actuating members 120 (Fig. 8). With particular reference to Fig. 4, the platform 30 extends along a longitudinal direction DL, and the unit 1 comprises a central panel 300 rigidly coupled to the platform 30. The central panel 300 is so designed as to support a patient's pelvis. The unit 1 further comprises two adjacent lower panels 302, each of which is coupled to the platform 30 in a rotatable manner around a first axis

304 transverse to the longitudinal direction DL, and is of suitable position and shape for supporting a patient's lower limb. The unit 1 also comprises an upper panel 306 hinged to the central panel 300 around a second axis 308 transverse to both the longitudinal direction DL and the first axis 304. The upper panel 306 carries, at opposite side from a longitudinal median plane M (Fig. 4) of the unit 1, a pair of side panels 310, each of which is coupled to a respective side 306' of the panel 306 in a rotatable manner with respect to a third axis 307 transverse to the upper panel 306 for adduction and abduction movements. Each side panel 310 is carried in a rotatable manner with respect to a fourth axis 309 parallel to the second axis 308 so as to be suitable to support and lift a patient's arm. Moreover, the unit 1 comprises a headboard panel 312 carried by the upper panel 306 through a hinged coupling 312' in correspondence of a transverse fifth axis 312'' parallel to the second axis 308. All the panels described above are stably positioned and can be moved around the respective rotation axes by means of an electromechanical actuating group 60 comprising a plurality of members actuating the linear motion and the rotary motion so as to be suitable to move, individually or in combination, the upper panel 306 and each of the lower panels 302 and side panels 310 with respect to the platform 30. In particular, the actuating group 60 comprises linear actuators 302A, each of which is arranged at a side of the median plane M and is coupled to the platform 30 and to a lower panel 302 in order to drive it into rotation around the respective first axis 304; linear actuators 310A, each of which is arranged at a side of the median plane M and is carried by the platform 30 in order to rotate a respective side panel 310 with respect to the third axis 307; linear actuators 310B, each of which is arranged between a L-shaped bracket 311, connected to the side panel 310, and the upper panel 306 in order to lift the corresponding side panel 310; a linear actuator 306A, which is arranged between a bracket 3066, rigidly coupled to the platform 30, and the upper panel 306 through a slot 22 provided in the platform 30; a linear actuator 312A, which is arranged between a bracket 306S', carried at the bottom by the upper panel 306, and the headboard panel 312 through the slot 22.

[0011] The actuating group 60 further comprises a linear actuator 300A, which is arranged between the plate 122 and the platform 30, in order to adjust the inclination of the platform 30 around an axis transverse to the actual orientation of the longitudinal direction DL.

[0012] With only reference to Fig. 3, the unit 1 comprises a rest device 90 provided with a plurality of vacuum cushions. These cushions can be used for stabilizing the patient's body parts and to adjust the pressure exchanged on the rest surfaces, in order to optimize the blood pressure distribution of the patient's body areas resting against the panels described above. In particular, the resting device 90 comprises a first cushion 91 coupled to the central panel 300, a second cushion 92 for each lower panel 302, a third cushion 93 coupled to the upper

panel 306, a fourth cushion 93' and a fifth cushion 93'' that are respectively associated to one of the two side panels 310, and a sixth cushion 94 coupled to the headboard panel 312.

[0013] In view of the above description, the resting device 90 comprises a fluid-dynamic group 96 (Fig. 4) that can be electronically controlled and is provided with a plurality of solenoid valves, each of which is coupled to one of the cushions 91-94 in a fluid-tight manner, so as to control the inside pressure thereof in order to adjust the static conditioning of a patient subjected to rehabilitation by means of the unit 1. In particular, the fluid-dynamic group 96 comprises a first solenoid valve 91V, coupled to the first cushion 91, a second solenoid valve 92V, coupled to the second cushion 92, a third solenoid valve 93V, coupled to the third cushion 93, a fourth solenoid valve 93'V, coupled to the fourth cushion 93', a fifth solenoid valve 93''V, coupled to the fifth cushion 93'', a sixth solenoid valve 94V, coupled to the fourth cushion 94. For the sake of drawing economy, the connections between the fluid-dynamic group 96 and the solenoid valves 91V, 92V, 93V, 93'V, 93''V, and 94V have not been represented in the Figures.

[0014] With reference to Figs. 1 and 4, the unit 1 comprises a processing and control device 70 carried by the base 10 inside a casing 14. The device 70 is electronically coupled to the actuating group 60 in a known manner, not shown for the sake of drawing economy. In particular, the processing and control device 70 is electronically connected to the actuators 302A, the actuators 310A, the actuators 310B, to the linear actuator 306A; to the actuator 312A; to the first cushion 91, to the second cushions 92, to the third cushion 93, and to the fourth cushion 94 of the vacuum cushion device 90 and to the lifting device 12 in order to perform a given rehabilitation program, that can be defined at will based on the patient's needs, in order to move and/or to direct at will the patient's body parts and/or to adjust the blood pressure distribution in the patient's body. With particular reference to Figs. 1, 2, 7, and 8, the unit 1 comprises a containment group 50 whose function is to isolate, laterally and longitudinally, the patient treated on the unit 1. To this end, the containment group 50 comprises a first plate 51, which is transverse to the longitudinal direction DL and delimits the platform 30 at the side of the headboard panel 312, a second plate 52, which is transverse to the longitudinal direction DL and delimits the platform 30 at the side beyond the lower panels 302, a pair of third plates 53, which are parallel to the longitudinal direction DL and each of which delimits the upper panel 306 outside the side 306', and a pair of fourth plates 54, which are parallel to the longitudinal direction DL and each of which is aligned with a corresponding third plate 53. Each fourth plate 54 externally delimits a lower panel 302 at opposite side with respect to the other lower panel 302. The first plate 51, the second plate 52 and each third plate 53 and each fourth plate 54 are carried by a respective articulated four-bar linkage 55 that is coupled to a lower face of the

platform 30. In particular, the first plate 51, the second plate 52 and each fourth plate 54 are the rods of the respective articulated four-bar linkages 55. Each four-bar linkage 55 comprises a rocker arm 56, with which a blocking member 57 is associated for blocking the angular position thereof in order to block the respective connecting rod at a given height with respect to the platform 30.

[0015] With reference to Fig. 5, it should be noted that the four-bar linkages 55 carrying the fourth plates 54 (arranged at the side of the lower panels 302) are carried movable by longitudinal guides 55' through linear actuators 55'', so that the respective longitudinal position can be adjusted at will according to the needs of the patient treated on the unit 1.

[0016] The use of the rehabilitation unit 1 is clearly apparent from the description above and does not require further explanations. However, in view of the above description, it is clearly apparent that the unit 1 can be validly used for performing physical rehabilitation and for controlling the blood and lymphatic system pressure distribution over the time for partially or totally immobilized patients. Moreover, through an adequate adjustment of the inclination of the platform 30, done through the actuator 300A, it is possible to put the patient's head in lowered or raised position with respect to the body, according to the patient's actual clinical situation.

[0017] Lastly, it is clearly apparent that variants and modifications can be done to the rehabilitation unit described and illustrated herein. The invention is defined by the claims.

[0018] Therefore, the unit 1 described above represents an evolved form of hospital bed thanks to the construction features and the technical solutions implemented in order to operate in a coordinated manner, and allows to perform rehabilitation programs for patients immobilized due to various causes and, more in general, for patients whose mobility shall be restored.

Claims

1. Rehabilitation unit (1) comprising a base (10) supporting a platform (30) through a telescopic lifting device (12); a central panel (300) for supporting a patient's pelvis; wherein said platform (30) extends along a longitudinal direction (DL) and stably supports said central panel (300); said longitudinal direction (DL) substantially corresponding to a longitudinal extension of a patient lying on the rehabilitation unit (1); two lower panels (302), for supporting a patient's lower limbs, adjacent to each other, each of which is coupled to said platform (30) in a rotatable manner around a substantially vertical first axis (304) transverse to said longitudinal direction (DL); an upper panel (306) hinged to said central panel (300) around a second axis (308) transverse to said longitudinal direction (DL) and to said first axis (304); said upper panel (306) carrying, for each respective side (306'), a side panel (310), for supporting a patient's arm, in a rotatable manner with respect to a third axis (307) transverse to said upper panel (306) and in a rotatable manner with respect to a fourth axis (309) parallel to said second axis (308); a headboard panel (312) being carried by said upper panel (306) in a rotatable manner around a fifth axis (312'') parallel to said second axis (308); an electro-mechanical actuating group (60) being provided in order to move said upper panel (306), said lower panels (302), with respect to said platform (30) and in order to move said side panels (310) with respect to said upper panel (306).
2. Unit according to claim 1, **characterized by** comprising controlled-pressure support means (90) associated with said central panel (300), lower panels (302), side panel (310), headboard panel (321) in order to control the blood pressure distribution of body areas resting onto said panels.
3. Unit according to any one of the previous claims, **characterized by** comprising processing and control means (70) electronically connected to said actuating group (60) in order to actuate, individually and/or in succession, each of said lower panels (302), side panel (310), headboard panel (321), said resting means (90) and said lifting device (12) in a manner definable at will, in order to move and/or to direct at will the patient's body parts and/or to adjust the blood pressure distribution in the patient's body according to the current configuration of said panels so as to perform a rehabilitation program.
4. Unit according to claim 2 or 3, **characterized in that** said resting means (90) comprise a first cushion (91) coupled to said central panel (300), a second cushion (92) for each said lower panel (302), a third cushion (93) coupled to said upper panel (306), at least one fourth cushion (93')(93'') coupled to a said side panel (310), and a fifth cushion (94) coupled to said headboard panel (312).
5. Unit according to claim 4, **characterized in that** said resting means (90) comprise a fluid-dynamic group (96) provided with a first solenoid valve (91V), coupled to said first cushion (91) in a fluid-tight manner, at least one second solenoid valve (92V), coupled to said second cushion (92) in a fluid-tight manner, a third solenoid valve (93V), coupled to said third cushion (93) in a fluid-tight manner, at least one fourth solenoid valve (93'V)(93''V), coupled to a said fourth cushion (93')(93''), a fifth solenoid valve (94V), coupled to said fifth cushion (94) in a fluid-tight manner.
6. Unit according to any one of claims 1 to 5, **characterized in that** said telescopic lifting device (12) is

provided with a pair of linear actuators (120) that can be actuated by means of said processing and control means (70) in order to adjust the angular position of said platform (30) around said longitudinal direction (DL).

Patentansprüche

1. Rehabilitationseinheit (1), umfassend ein Untergerüst (10), das eine Plattform (30) über eine teleskopische Hebevorrichtung (12) stützt; eine mittlere Platte (300) zum Unterstützen des Beckens eines Patienten; wobei sich die Plattform (30) entlang einer Längsrichtung (DL) erstreckt und die mittlere Platte (300) stabil stützt; wobei die Längsrichtung (DL) im Wesentlichen einer Längserstreckung eines auf der Rehabilitationseinheit (1) liegenden Patienten entspricht; zwei untere Platten (302), die nebeneinander liegen, zum Unterstützen der unteren Gliedmaßen eines Patienten, wobei jede von denen mit der Plattform (30) in einer um eine im Wesentlichen senkrechte erste Achse (304) quer zu der Längsrichtung (DL) drehbaren Weise verbunden ist; eine obere Platte (306), die um eine zweite Achse (308) quer zu der Längsrichtung (DL) und zu der ersten Achse (304) schwenkbar an der mittleren Platte (300) angebracht ist; wobei die obere Platte (306) für jede entsprechende Seite (306') eine Seitenplatte (310) trägt, um den Arm eines Patienten zu unterstützen, die drehbar in Bezug auf eine dritte Achse (307) quer zu der oberen Platte (306) und drehbar in Bezug auf eine vierte Achse (309) parallel zu der zweiten Achse (308) ist; eine Kopfteilplatte (312), die von der oberen Platte (306) drehbar um eine fünfte Achse (312'') parallel zu der zweiten Achse (308) getragen wird; eine elektromechanische Betätigungsgruppe (60), welche vorgesehen ist, um die obere Platte (306), die unteren Platten (302) in Bezug auf die Plattform (30) zu bewegen und um die Seitenplatten (310) in Bezug auf die obere Platte (306) zu bewegen.
2. Einheit nach Anspruch 1, **dadurch gekennzeichnet, dass** sie eine Unterstützungseinrichtung (90) mit kontrolliertem Druck umfasst, die mit der mittleren Platte (300), den unteren Platten (302), der Seitenplatte (310) und der Kopfteilplatte (321) verbunden ist, um die Blutdruckverteilung der auf den Platten ruhenden Körperbereiche zu kontrollieren.
3. Einheit nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sie eine Verarbeitungs- und Steuereinrichtung (70) umfasst, die elektronisch mit der Betätigungsgruppe (60) verbunden ist, um einzeln und/oder nacheinander jede der unteren Platten (302), der Seitenplatte (310), der Kopfteilplatte (321), der Auflageeinrichtung (90) und der teleskopischen Hebevorrichtung (12) in einer nach

Belieben definierbaren Weise zu betätigen, um die Körperteile des Patienten nach Belieben zu bewegen und/oder, um die Blutdruckverteilung in dem Körper des Patienten entsprechend der aktuellen Konfiguration der Platten einzustellen, um so ein Rehabilitationsprogramm durchzuführen.

4. Einheit nach Anspruch 2 oder 3, **dadurch gekennzeichnet, dass** die Ruheeinrichtung (90) ein erstes Kissen (91), das mit der mittleren Platte (300) verbunden ist, ein zweites Kissen (92) für jede untere Platte (302), ein drittes Kissen (93), das mit der oberen Platte (306) verbunden ist, mindestens ein viertes Kissen (93') (93''), das mit der Seitenplatte (310) verbunden ist, und ein fünftes Kissen (94), das mit der Kopfteilplatte (312) verbunden ist, umfasst.
5. Einheit nach Anspruch 4, **dadurch gekennzeichnet, dass** die Ruheeinrichtung (90) eine fluiddynamische Gruppe (96) umfasst, die mit einem ersten Magnetventil (91V), das mit dem ersten Kissen (91) in einer fluiddichten Weise verbunden ist, und mit mindestens einem zweiten Magnetventil (92V), das mit dem zweiten Kissen (92) in einer fluiddichten Weise verbunden ist, ein drittes Magnetventil (93V), das mit dem dritten Kissen (93) in einer fluiddichten Weise verbunden ist, mindestens ein viertes Magnetventil (93'V) (93''V), das mit dem vierten Kissen (93') (93'') verbunden ist, ein fünftes Magnetventil (94V), das mit dem fünften Kissen (94) in einer fluiddichten Weise verbunden ist, versehen ist.
6. Einheit nach einem der Ansprüche 1 bis 5, **dadurch gekennzeichnet, dass** die teleskopische Hebevorrichtung (12) mit einem Paar von linearen Antriebseinrichtungen (120) versehen ist, die mittels der Verarbeitungs- und Steuereinrichtung (70) betätigt werden können, um die Winkelposition der Plattform (30) um die Längsrichtung (DL) herum einzustellen.

Revendications

1. Unité de rééducation (1) comprenant une base (10) supportant une plate-forme (30) par l'intermédiaire d'un dispositif de levage télescopique (12) ; un panneau central (300) pour supporter le bassin d'un patient ; ladite plate-forme (30) s'étendant le long d'une direction longitudinale (DL) et supportant ledit panneau central (300) de manière stable ; ladite direction longitudinale (DL) correspondant sensiblement à une extension longitudinale d'un patient allongé sur l'unité de rééducation (1) ; deux panneaux inférieurs (302), pour supporter les membres inférieurs d'un patient, adjacents l'un à l'autre, dont chacun est couplé à ladite plate-forme (30) d'une manière rotative autour d'un premier axe sensiblement vertical (304) transversal à ladite direction longitudi-

- nale (DL) ; un panneau supérieur (306) articulé audit panneau central (300) autour d'un deuxième axe (308) transversal à ladite direction longitudinale (DL) et audit premier axe (304) ; ledit panneau supérieur (306) portant, pour chaque côté respectif (306'), un panneau latéral (310), pour supporter un bras d'un patient, d'une manière rotative par rapport à un troisième axe (307) transversal audit panneau supérieur (306) et d'une manière rotative par rapport à un quatrième axe (309) parallèle audit deuxième axe (308) ; un panneau de tête de lit (312) qui est porté par ledit panneau supérieur (306) d'une manière rotative autour d'un cinquième axe (312'') parallèle audit deuxième axe (308) ; un groupe d'actionnement électromécanique (60) qui est disposé afin de déplacer ledit panneau supérieur (306), lesdits panneaux inférieurs (302), par rapport à ladite plate-forme (30) et afin de déplacer lesdits panneaux latéraux (310) par rapport audit panneau supérieur (306).
2. Unité selon la revendication 1, **caractérisée par le fait qu'**elle comprend des moyens de support à pression contrôlée (90) associés audit panneau central (300), auxdits panneaux inférieurs (302), audit panneau latéral (310) et audit panneau de tête de lit (321) afin de contrôler la distribution de pression artérielle de zones corporelles reposant sur lesdits panneaux.
3. Unité selon l'une quelconque des revendications précédentes, **caractérisée par le fait qu'**elle comprend des moyens de traitement et de commande (70) reliés électroniquement audit groupe d'actionnement (60) afin d'actionner, individuellement et/ou en succession, chacun desdits panneaux inférieurs (302), panneau latéral (310), panneau de tête de lit (321), desdits moyens de support (90) et dudit dispositif de levage (12) d'une manière définissable à volonté, afin de déplacer et/ou de diriger à volonté des parties du corps du patient et/ou d'ajuster la distribution de pression artérielle dans le corps du patient en fonction de la configuration actuelle desdits panneaux de façon à réaliser un programme de rééducation.
4. Unité selon la revendication 2 ou 3, **caractérisée par le fait que** lesdits moyens de support (90) comprennent un premier coussin (91) couplé audit panneau central (300), un deuxième coussin (92) pour chaque panneau inférieur précité (302), un troisième coussin (93) couplé audit panneau supérieur (306), au moins un quatrième coussin (93') (93'') couplé à un panneau latéral précité (310), et un cinquième coussin (94) couplé audit panneau de tête de lit (312).
5. Unité selon la revendication 4, **caractérisée par le fait que** lesdits moyens de support (90) comprennent un groupe fluidodynamique (96) comportant une première vanne électromagnétique (91V), couplée audit premier coussin (91) d'une manière étanche aux fluides, au moins une deuxième vanne électromagnétique (92V), couplée audit deuxième coussin (92) d'une manière étanche aux fluides, une troisième vanne électromagnétique (93V), couplée audit troisième coussin (93) d'une manière étanche aux fluides, au moins une quatrième vanne électromagnétique (93'V)(93''V), couplée audit quatrième coussin (93')(93''), une cinquième vanne électromagnétique (94V), couplée audit cinquième coussin (94) d'une manière étanche aux fluides.
6. Unité selon l'une quelconque des revendications 1 à 5, **caractérisée par le fait que** ledit dispositif de levage télescopique (12) comporte une paire d'actionneurs linéaires (120) qui peuvent être actionnés à l'aide desdits moyens de traitement et de commande (70) afin d'ajuster la position angulaire de ladite plate-forme (30) autour de ladite direction longitudinale (DL).

Fig.1

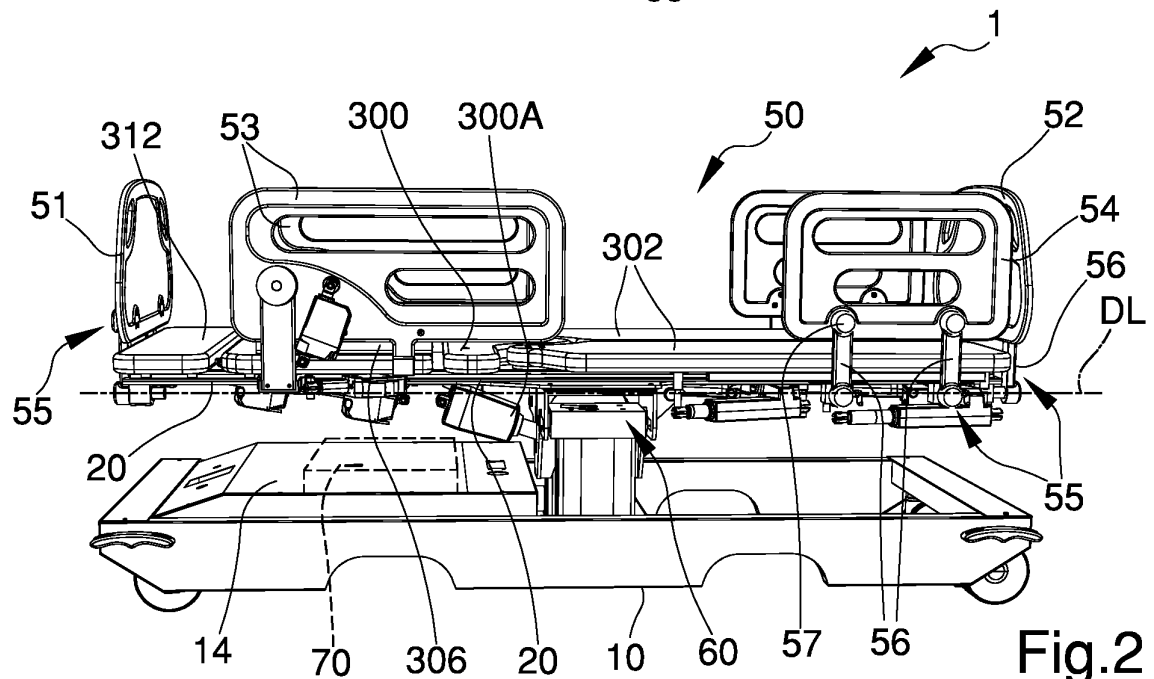
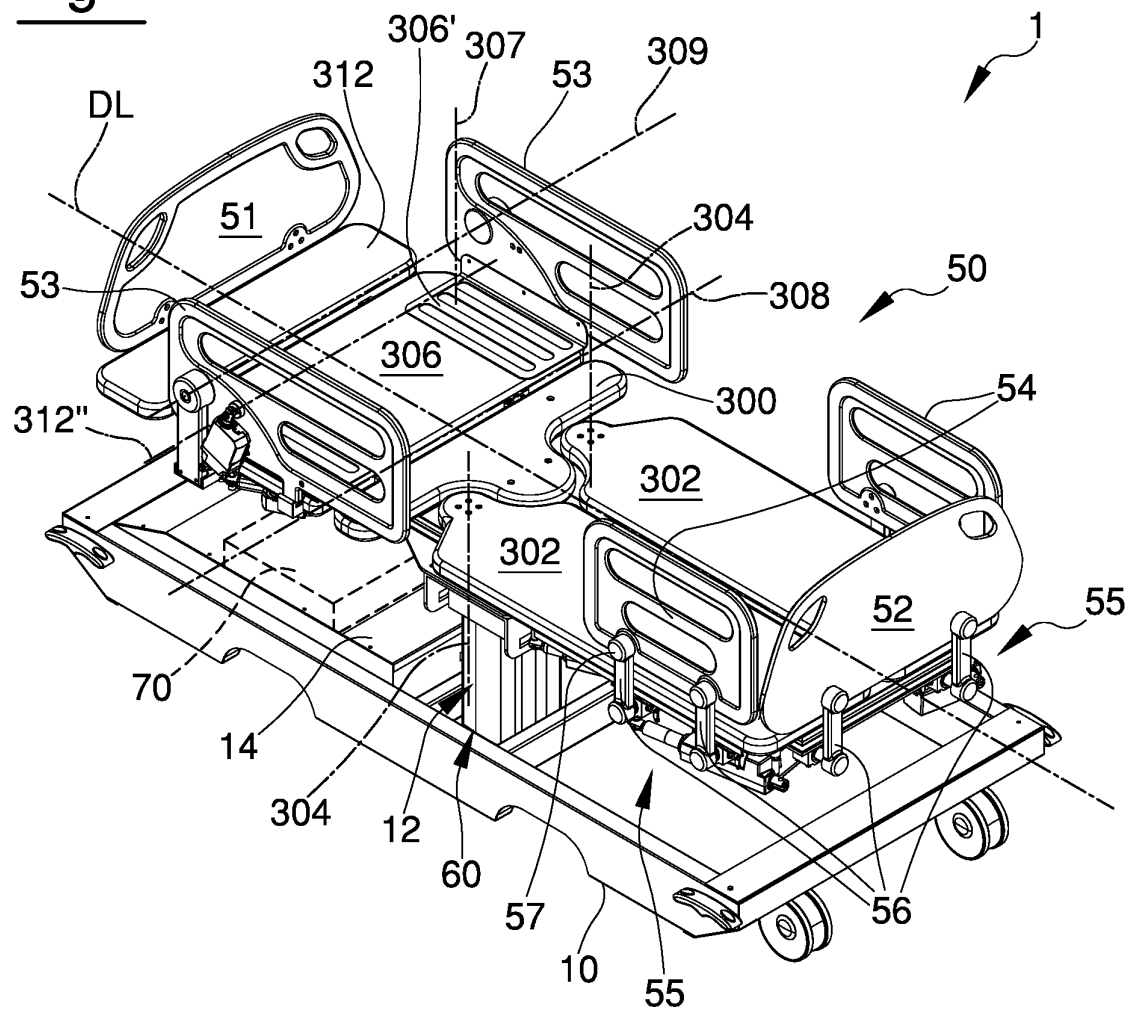


Fig.3

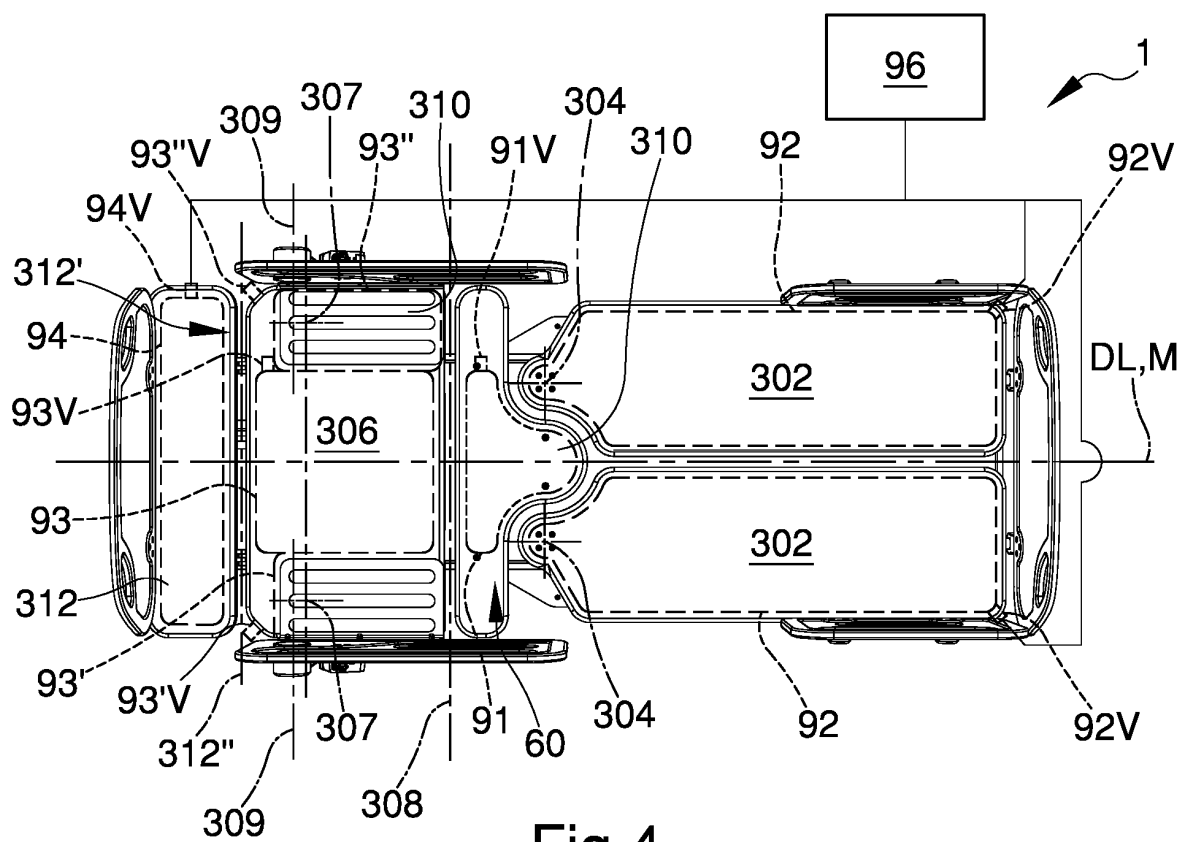
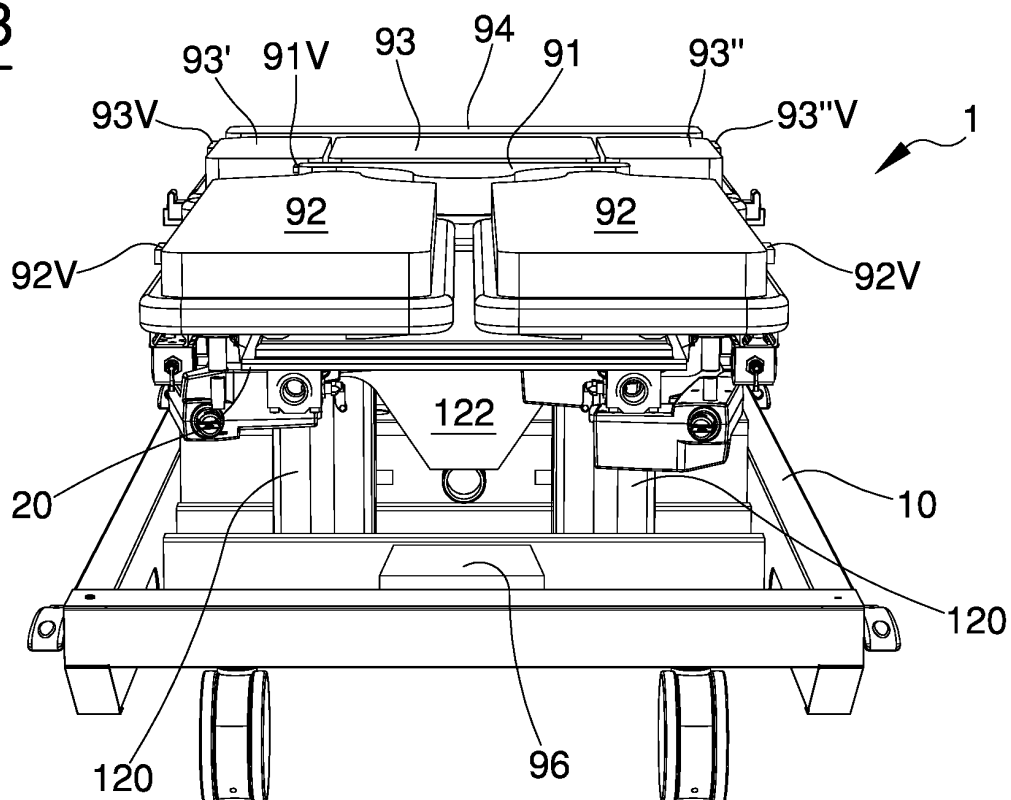


Fig.4

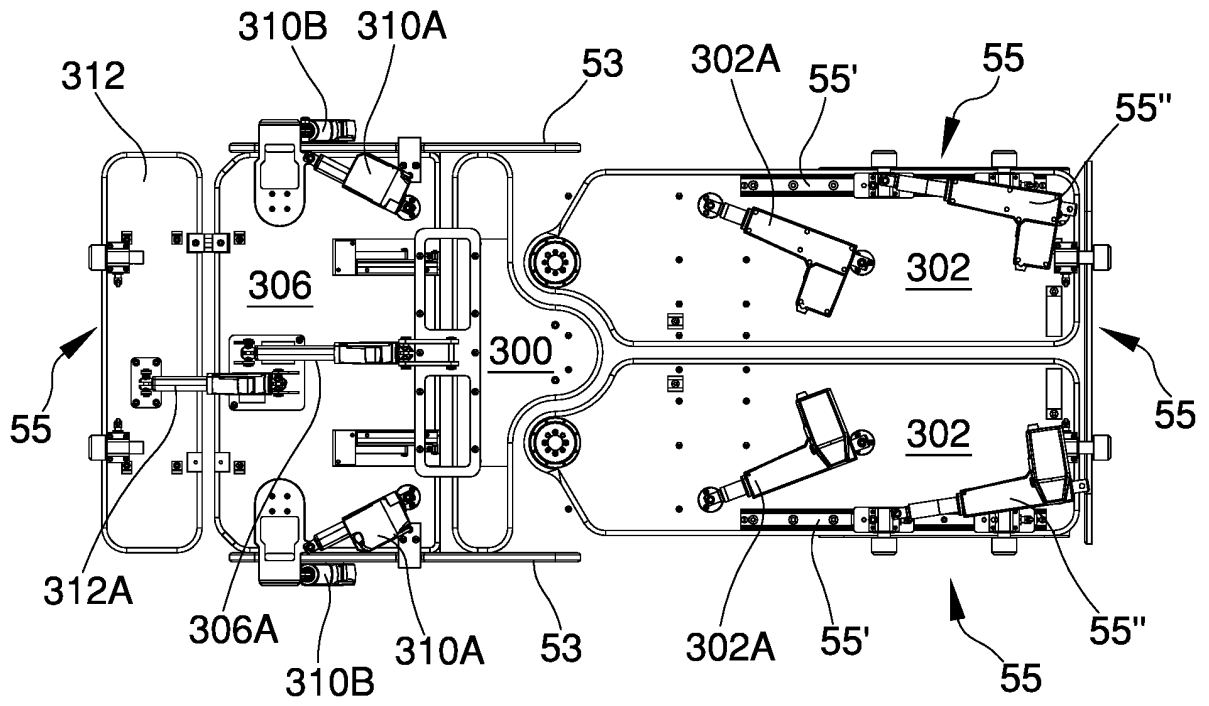


Fig.5

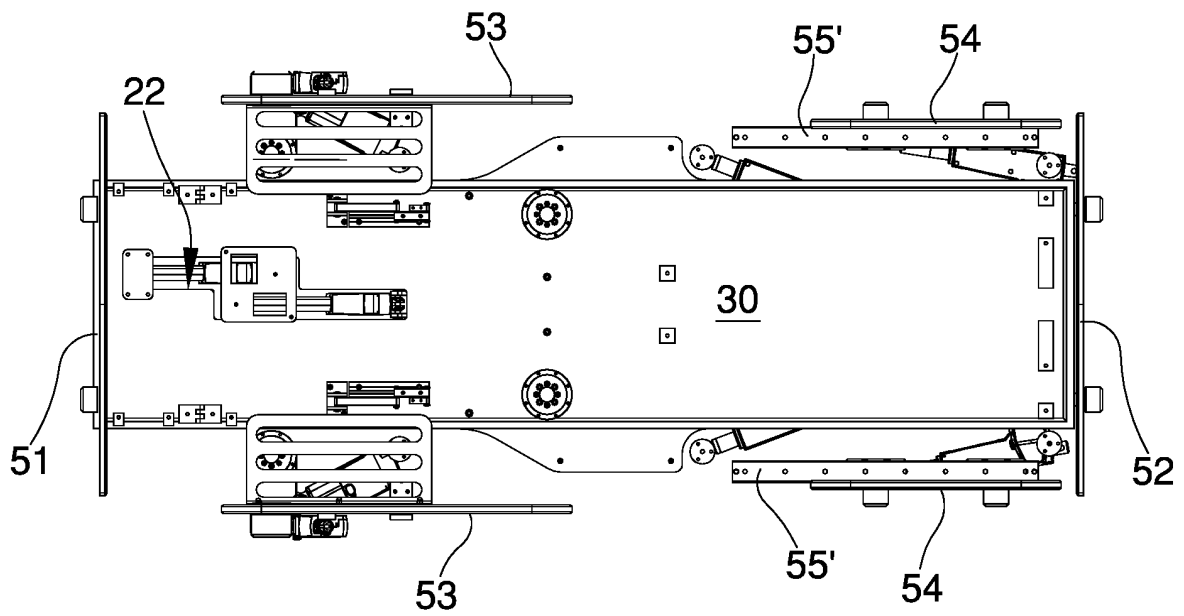


Fig.6

Fig.7

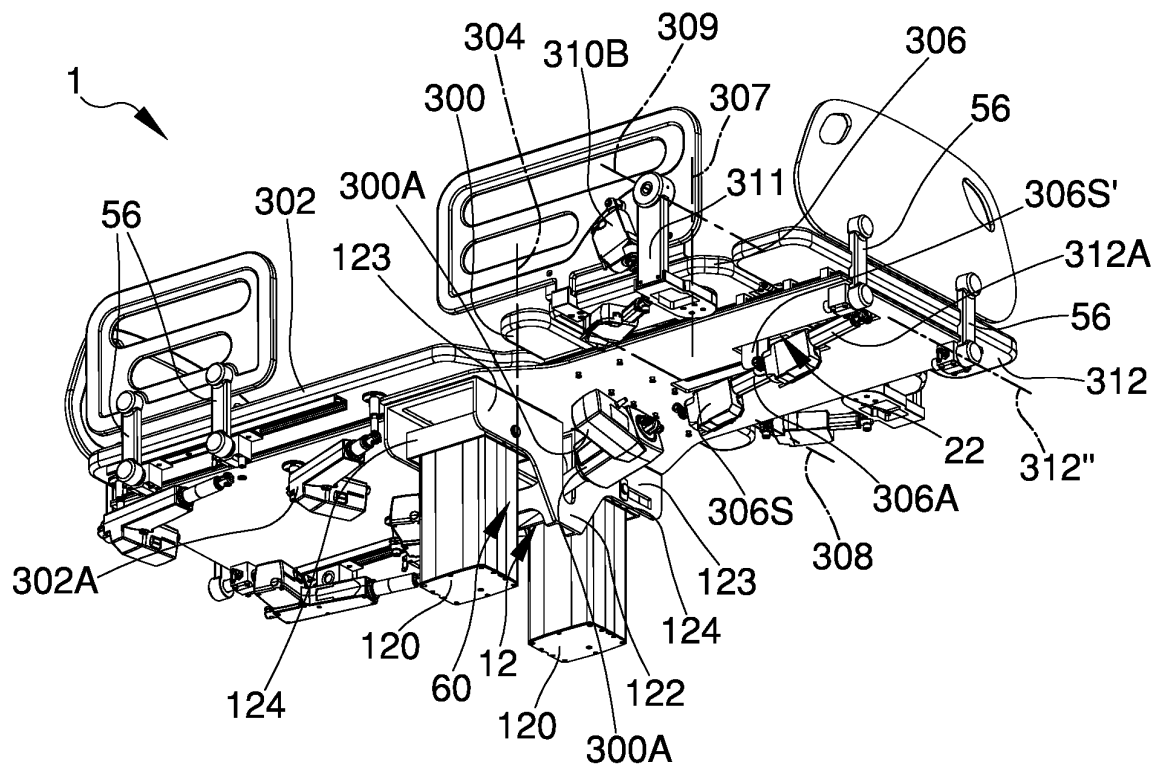
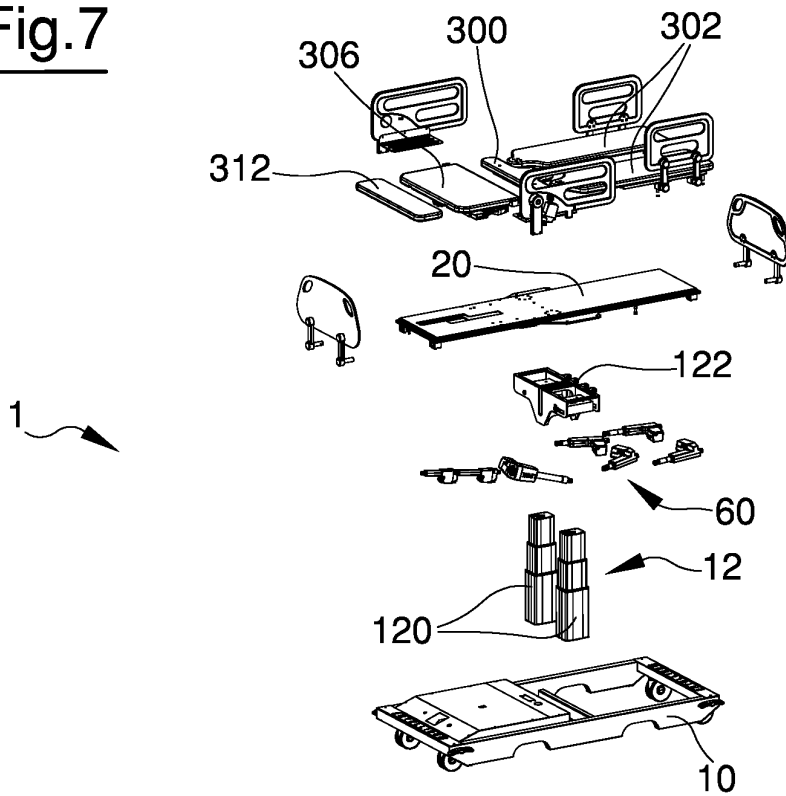


Fig.8

REFERENCES CITED IN THE DESCRIPTION

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