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(54) **Bed.**

(57) A bed (10) comprises a bed frame (50) consisting of four sections (52, 54, 56, and 58) which are interconnected through pivot joints (53, 55, and 57). The bed frame (50) of the bed (10) is adjustable to a 2-part, 4-part or the so-called Trendelenburg position by means of two power-generating motors (44, 46) an engageable and disengageable power-transmitting device and a carrier device as the transition between the 2- and 4-part position is established by disengaging and engaging the engageable and disengageable power-transmitting device. One of the

power-generating motors (44) co-operates with a section of the frame adapted to support the back and/or head of a person lying or sitting on the bed, whereas the other power-generating motor (46) is adapted to raise and lower a section of the bed, which section supports the crurs or feet of the person for adjusting the bed in the Trendelenburg position by means of the carrier device which links the crurs and feet supporting section and the adjacent section of the bed together which adjacent section is adapted to support the thighs of the person.

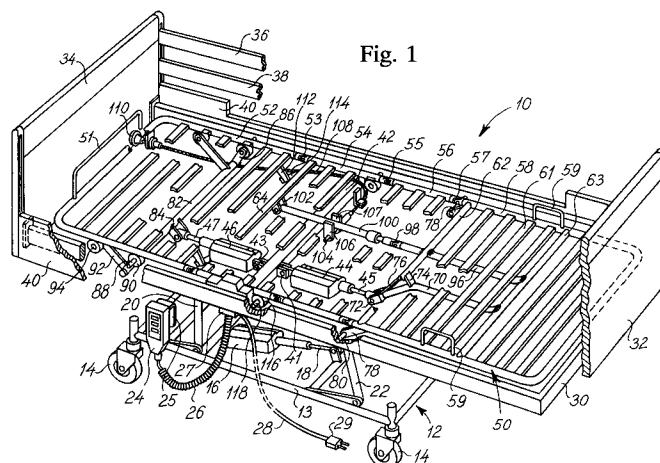


Fig. 1

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The present invention relates to a bed comprising a bed frame divided into four sections, a first section of which constitutes a section for supporting the back or the head of a person lying in or sitting on the bed, a second section of which constitutes a section for supporting the person's buttocks, a third section of which constitutes a section for supporting the person's thighs, and a fourth section of which constitutes a section for supporting the person's crus and feet.

The present invention relates to a piece of furniture of the kind occasionally called a sitting or lying furniture. The piece of furniture is adapted to support a person in a lying or sitting posture. The person may e.g. be a patient who is hospitalized or may e.g. be a person at a rest home or residential home. The person may be supported either directly by the sections of the bed frame or supported by a mattress which is further supported by the sections of the bed frame. A comfortable seating or supporting of the person in question is thus obtained. The sections of the bed frame may preferably be constituted by sections defining substantially planar surfaces. Each section of the bed frame may thus be constituted by a grid structure or a structure comprising lamellae, segments or slats. The structure of the individual section may be of a structure known per se within the art. The sections of the bed frame may further, or alternatively, be ergonomically shaped for providing an improved supporting effect.

A bed of the type in question is often used in hospitals or rest homes or residential homes in connection with persons or patients having reduced motility. The person or patient may use the bed partly for placing himself in a lying, partly in a sitting position in the bed without the necessity of leaving the bed. Beds of the type in question are extensively used in numerous different connections and in connection with persons of varying motility. Beds of the type in question are e.g. often used in connection with the hospitalization of persons having broken one or both legs. A person having broken one or both legs has the bed arranged in a comfortable sitting position by raising the first section of the bed frame by swinging the first section relative to the second section so as to have the first section constitute a support of the person's back in sitting posture.

Persons who have not broken one or both legs do not consider a posture of the above discussed type as perfectly comfortable. Thus, beds of the type in question are known which may produce a raising of the third section of the bed frame, i.e. the section supporting the thighs of the person as the first section of the bed frame, i.e. the section supporting the person's back and head, is raised.

Furthermore, bed structures are known which

render it possible to arrange the bed frame in the so-called Trendelenburg position, i.e. a position in which the bed frame is arranged in a planar position, however, tilting downwardly at the head of the bed and defining an angle of approximately 10-15° relative to the horizontal plane. The Trendelenburg position of the bed is used in connection with the treatment of certain shock conditions, such as bleeding conditions and other acute conditions, in connection with which it has proven to be advantageous to arrange the patient in a planar position supported by a plane supporting surface defining an angle of approximately 10-15° relative to the horizontal plane and having the head turning downwardly.

Numerous patent applications and patents describe bed structures of the type in question which structures allow the positioning of the bed frame in one or more of the above defined positions.

From US Patent No. 4,685,159, a bed is known comprising a 3-segment supporting surface in which the central part or segment, in the description below referred to as the buttocks-supporting part, is supported by a yoke-like structure allowing a tilting of the central parts relative to a transversal axis controlled by a mechanism comprising a rack-and-pinion drive, whereas the end segments or parts are connected in hinged connection to the ends of the central part and are allowed to swing relative to the central part by means of respective actuators which are connected to the central part. The bed according to the above US Patent may be transformed so as to present a horizontal supporting surface, so as to present a sitting posture comprising three surfaces to the patient or person, and so as to present a Trendelenburg position. The structure is extremely complex, and the mechanisms involved are not adapted to be readily cleaned. The operation is furthermore extremely complex due to the numerous degrees of freedom. As the supporting surface is divided into no more than three segments or parts, the bed according to the above US Patent is not adapted to be arranged in a position in which a person or patient is in a sitting posture having a horizontal buttocks-supporting segment or part and a raised knee-support.

In Swedish Patent Application No. 89-01122 (corresponding to International Patent Application No. PCT/SE90/00156, Publication No. WO 90-11748) a bed is disclosed comprising a support surface comprising four parts or segments. A buttocks-supporting part is rigidly fixated to a frame of the bed, whereas a thigh-supporting part is hinged to the buttocks-supporting part. A crus-supporting part is hinged to the thigh-supporting part. By means of a mechanism comprising guiding pins guided in curved guides, the back-supporting part may be raised as the part in question is

initially rotated relative to an axis which is stationary relative to the frame of the bed and thereupon parallelly displaced along the longitudinal axis of the bed away from the buttocks-supporting part. The structure serves the purpose of eliminating the risk that the mattress is compressed in an area in which the mattress is bent as the back-supporting part is raised. The bed further comprises a system of levers and arms, one lever of which system brings about the swinging of the back-supporting part and a different set of arms of which system raises the thigh-supporting part as the back-supporting part is raised. The crus-supporting part is supported at its outermost end by a roller which is supported on a horizontal guide.

In published German Patent Application DE-OS 33 09 580, a bed is disclosed comprising a supporting surface including two parts or segments, of which a back-supporting part may be raised. An actuator causes a lever to rotate which through a guideway displaces an axle of the back-supporting part. A second rod simultaneously causes the back-supporting part to be raised, causing the back-supporting part to be gradually displaced outwardly as the back-supporting part is raised.

An object of the present invention is to provide a bed of the above described type, which bed is of a simple structure and renders it possible to position the frame of the bed in any appropriate position among the above described positions and thus in a simple manner renders it possible to adapt the bed to different kinds of persons or patients. Thus, the bed may e.g. be adapted to persons who may sit or lie comfortably in the bed, having the back- and hip-supporting part or section raised relative to the remaining part of the support surface or adapted to persons who have broken one or both legs, or alternatively to persons who are to be positioned in the above discussed Trendelenburg position for treatment of a shock condition.

The above object and numerous other objects, features and advantages which will be evident from the below description are obtained by means of the bed of the type discussed above, which bed according to the present invention is characterized in that the four sections of the bed frame are linked together through pivot joints, a first pivot joint connecting the first and second sections of the bed frame to one another, a second pivot joint connecting the second and third sections of the bed frame to one another, and a third pivot joint connecting the third and fourth sections of the bed frame to one another, in that the bed comprises a first and a second power-generating means adapted to transmit power to the first and the fourth section, respectively, of the bed frame for generating a pivoting of the first and the fourth section, respectively, of the bed frame relative to the second and third

section, respectively, of the bed frame round the first and the third pivot joint, respectively, of the bed frame, in that the bed comprises an engageable and disengageable power-transmitting means adapted to, in a first engaged position, connect the first and the third section of the bed frame to one another and generate a pivoting of the third section of the bed frame relative to the second section of the bed frame round the second pivot joint coincident with a pivoting of the first section of the bed frame relative to the second section of the bed frame round the first pivot joint, however, in a direction opposite to the pivoting direction of the pivoting of the first section of the bed frame relative to the second section of the bed frame and further adapted to, in a second disengaged position, allow that the first section of the bed frame may pivot relative to the second section of the bed frame round the first pivot joint without simultaneously generating a pivoting of the third section of the bed frame relative to the second section of the bed frame round the second pivot joint, and in that the bed comprises a carrier means adapted to cooperate with the third and fourth sections of the bed frame and allow that the fourth section of the bed frame is lowered relative to the third section of the bed frame through pivoting relative to the third section round the third pivot joint, however, adapted to prevent that the fourth section of the bed frame is raised relative to the third section of the bed frame by pivoting relative to the third section round the third section round the third pivot joint beyond a position in which the third and fourth sections of the bed frame are positioned in the same plane.

The above-mentioned carrier means, thus, serves the purpose of ensuring that the entire bed frame is raised in its entirety for positioning the bed frame in the above-mentioned Trendelenburg position as the fourth section of the bed frame, i.e. the section supporting the crus or feet of the person is raised as the raising or elevation of the fourth section is transmitted to the third section of the bed frame. The engageable and disengageable power-transmitting means renders it possible that the bed frame of the bed according to the present invention is arranged as a 2-part bed, or alternatively a 4-part bed. A particular feature of the bed according to the present invention originates from the fact that the fourth section of the bed frame, i.e. the section supporting the crus or feet of the person may be lowered freely, even in case the bed is positioned in four parts, i.e. when the engageable and disengageable power-transmitting means is in the above-mentioned first engaged position. A further particular feature of the bed according to the present invention originates from the fact that solely two power-generating means

render it possible to adjust or position the bed in any appropriate position among the above-mentioned positions, i.e. in 2-part, 4-part, or Trendelenburg position, and further, as discussed above, having the fourth section of the bed frame in any lowered position relative to the third section of the bed frame in the above-mentioned 4-part position of the bed frame.

The engageable and disengageable power-transmitting means may be implemented in numerous ways, e.g. by means of levers, rack-and-pinion transmissions, etc. which may be engaged and disengaged from cooperating with each other for transferring the power-transmitting means from the first engaged position to the second disengaged position.

The presently preferred embodiment of the bed according to the present invention is characterized in that the engageable and disengageable power-transmitting means is constituted by a lever system comprising a first lever which is rigidly connected to the first section of the bed frame and has an end projecting from the first section of the bed frame, and an ejector arm, a first end of which is connected to the third section of the bed frame through a pivot joint, and the second end of which is connected to said projecting end of the lever through a pivot joint, in that the ejector arm is locked in a position in the first position of the engageable and disengageable power transmission means, in which locked position the ejector arm is positioned parallel to and abutting the third section of the bed frame, and in that the ejector arm is disengaged from said position arranged parallel to and abutting the third section of the bed frame in the second position of the engageable and disengageable power transmission means.

It is to be realized that the above described, presently preferred embodiment of the engageable and disengageable power-transmitting means may be modified by shifting the elements of the power-transmitting means between the first and third sections of the bed frame.

The locking of the ejector arm in the said first position of the engageable and disengageable power-transmitting means, in which position the ejector arm is arranged parallel to and abutting the third section of the bed frame may be generated by means of any appropriate locking means such as a locking cam, a locking pin, a locking bolt, a locking latch or the like. In the presently preferred embodiment of the bed according to the present invention, the ejector arm is locked in the said position arranged parallel to and abutting the third section of the bed frame by means of a locking spigot or dowel which is connected to a handle through a Bowden wire. In the presently preferred embodiment of the bed according to the present

invention, the shifting of the engageable and disengageable power-transmitting means from the first, engaged position to the second, disengaged position is carried out in an extremely simple manner without disassembling the bed or without the necessity of lifting the bed frame relative to a supporting structure, e.g. an exterior supporting frame, as is the situation in connection with certain known bed structures. The above described embodiment of the bed, consequently, makes the bed according to the present invention extremely easily operable by the staff, e.g. the hospital orderly staff, the nursing staff or the care staff of a hospital or a rest home or residential home, which staff operate the bed of the above discussed type.

The carrier means for locking the third section of the bed frame to the fourth section of the bed frame as the fourth section is raised relative to the first section for positioning the bed frame in the above-mentioned Trendelenburg position may be constituted by any appropriate co-operating means, such as means comprising rack-and-pinions, locking cams, locking rods, locking spigots, carrier arms or levers, guide cams, etc. In the presently preferred embodiment of the bed according to the present invention, the carrier means comprises two sets of brackets which are fastened to the lower side surfaces of the third and fourth sections, respectively, of the bed frame, and which in a simple manner provides an interconnection of these sections, as the fourth section of the bed frame is raised from a position in which the fourth section is lowered relative to the third section of the bed frame to a position in coplanar arrangement with the third section of the bed frame and subsequently raised relative to the third section of the bed frame by the activation of the second power-generating means.

The power-generating means of the bed according to the present invention may be constituted by any appropriate power-generating means, such as hydraulic, pneumatic, or electric motor-driven, power-generating means. In the presently preferred embodiment of the bed according to the present invention, the power-generating means is constituted by electric motors comprising linearly displaceable rods or arms transmitting the power generated by the power-generating means to the first and fourth sections, respectively, of the bed frame.

The bed according to the present invention further preferably comprises an additional, exterior frame relative to the above described bed frame, which exterior frame, like a conventional exterior frame of a bed, preferably comprises a head and a footboard. The exterior frame is preferably further journaled or supported on a supporting frame, such as an underframe which is mounted on wheels. The underframe may further, like certain

conventional beds of the type in question, comprise a power-generating means co-operating with the frame of the underframe and the exterior frame of the bed for raising and lowering the exterior frame relative to the underframe.

The bed frame of the bed according to the present invention is preferably journalled relative to the said exterior frame by means of pivot joints journalling two of the sections of the bed frame pivotally relative to the exterior frame, e.g. the first section of the bed frame, i.e. the section supporting the back and the head of the person, or the second section of the bed frame, i.e. the section supporting the buttocks of the person, and further the third section of the bed frame, i.e. the section supporting the thighs of the person, or the fourth section of the bed frame, i.e. the section supporting the crus and feet of the person, relative to the exterior frame. The bed frame may further additionally and advantageously be journalled relative to the exterior frame on rollers allowing that the sections of the bed frame may be displaced and raised or lowered relative to the exterior frame by positioning the bed in any of the above described positions, i.e. the 2-part position, the 4-part position, or the Trendelenburg position, and any intermediate positions in which the fourth section of the bed frame is raised relative to the third section of the bed frame, or in which any other section of the bed frame of the bed according to the present invention is pivoted, i.e. raised or lowered relative to an adjacent section of the bed frame of the bed.

The invention is now to be described in greater detail with reference to the drawings, in which

Fig. 1 is a perspective, schematical and partly cut-away view of a first embodiment of a bed according to the present invention,

Fig. 2 is an elevational, schematical and partly cut-away view of the first embodiment of the bed according to the present invention, illustrating the bed in a planar or horizontal position,

Fig. 3 is an elevational, schematical and partly cut-away view similar to the view of Fig. 2, illustrating the bed in a 4-part position,

Fig. 4 is an elevational, schematical and partly cut-away view similar to the view of Fig. 2, illustrating the bed in a 2-part position,

Fig. 5 is an elevational, schematical and partly cut-away view similar to the view of Fig. 2, illustrating the bed in a so-called Trendelenburg position,

Fig. 6 is a horizontal, sectional view of a second embodiment of the bed according to the present invention, the bed being positioned in a horizontal position, the line of section being indicated by VI-VI in Fig. 7,

Fig. 7 is a vertical, sectional view of the second embodiment of the bed also shown in Fig. 6, the

bed being positioned in a horizontal position, the line of section being indicated by VII-VII in Fig. 6,

Fig. 8 is a vertical, sectional view similar to the view of Fig. 8, the bed being positioned in a 4-part position,

Fig. 9 is a horizontal sectional view of a third embodiment of the bed according to the present invention, the bed being positioned in a horizontal position, the line of section being indicated by IX-IX in Fig. 10,

Fig. 10 is a vertical, sectional view of the third embodiment of the bed according to the present invention, the bed being positioned in a horizontal position, the line of section being indicated by X-X in Fig. 9,

Fig. 11 is a vertical, sectional view similar to the view of Fig. 9 of the third embodiment of the bed according to the present invention, the bed being positioned in a 4-part position,

Fig. 12 is a vertical, sectional view similar to the views of Figs. 10 and 11 of the third embodiment of the bed according to the present invention, the bed being in a 2-part position, and

Fig. 13 is a vertical, sectional view similar to the views of Figs. 10-12 of the third embodiment of the bed according to the present invention, the bed being positioned in the Trendelenburg position.

A first and presently preferred embodiment of a bed implemented in accordance with the teaching of the present invention is shown schematically in Figs. 1-5, and is in its entirety designated the reference numeral 10. The bed 10 comprises an underframe designated the reference numeral 12 in its entirety and comprising a frame component 13 of a substantially rectangular configuration. At the four corners of the frame component 13, wheels are mounted, one of which is designated the reference numeral 14. The frame component 13 constitutes a support which by means of the wheels 14 renders it possible to move the bed 10 in its entirety from one place to another, as it is customary in e.g. a hospital. The frame component 13 further supports a motor 16 which serves the purpose of raising and lowering a frame 30 of the bed 10 by means of levers 20 and 22 in a manner not illustrated in any great detail, of which levers the lever 22 constitutes a rod connected to an actuator rod 18 of the motor 16. By energizing the motor 16, the levers 20 and 22 may raise the frame 30 in order to render it possible to adjust the height of the frame 30 relative to a supporting floor, taking into consideration the height of the person using the bed 10.

The frame 30 is rigidly connected to a head 32 and a footboard 34 which are further connected to one another through two side members 40 and

adapted to receive and guide an upper and a lower bedstaff 36 and 38, respectively, which may be of any appropriate structure, however, preferably of the type described in Applicant's pending Danish Patent Application No. 1773/91 to which reference is made. The side members 40 are further rigidly connected to one another through a transversal bar 42 which, apart from the purpose of connecting the side members 40 of the frame 30 of the bed to one another, serves the purpose of supporting two motors 44 and 46 constituting actuators having actuator rods 45 and 47 which are linearly displaceable in a direction longitudinally and reciprocating relative to a housing of the motor in question, i.e. the motor 44 and 46, respectively.

The motor 44 is pivotally fastened relative to the transversal bar 42 by means of a pivot joint 41. The motor 46 is similarly connected pivotally to the transversal bar 42 through a pivot joint 43.

Apart from the frame 30 constituting an exterior supporting frame mounted on the above discussed underframe 12, the bed 10 comprises a bed frame 50 constituting a 4-part bed frame comprising a first part or section 58 of the bed frame, a second part or section 56 of the bed frame, a third part or section 54 of the bed frame, and a fourth part or section 52 of the bed frame. A mattress 60 is arranged on top of the bed frame 50.

The fourth part or section 52 of the bed frame 50 constitutes a part of the bed frame adapted to support the crus or feet of a person or patient resting on the mattress 60 supported on the bed frame 50. A handle 51 is fastened to the fourth part or section 52 of the bed frame, which handle 51 renders it possible that a person positioned outside the bed may lift the fourth part or section 52 relative to the exterior frame 30 which circumferentially encloses the bed frame 50 as the fourth part or section 52 of the bed frame is connected to the third part or section 54 of the bed frame through an articulate joint or pivot joint 53.

The third part or section 54 of the bed frame 50 constitutes a part of the bed frame adapted to support the underside of the thighs of the person or patient resting or sitting on the bed 10.

The second and first parts or sections 56 and 58, respectively, of the bed frame 50 constitute parts of the bed frame adapted to support the buttocks and the back or head, respectively, of the patient or person when the patient or person is resting or lying on the mattress 60 of the bed 10.

The first part or section 58 of the bed frame 50 is further provided with two handles 59 serving the purpose, like the handle 51 of the fourth part or section 52 of the bed frame, of allowing that a person positioned outside the bed 10, e.g. a hospital orderly, a male or female nurse, may raise or lower the first part or section 58 manually. Between

the third and second parts or sections 54 and 56, respectively, of the bed frame 50, an articulate joint or pivot joint 55 is provided. Between the second and first parts or sections 56 and 58, respectively, of the bed frame 50, an articulate joint or pivot joint 57 is provided, rendering it possible that the adjacent parts or sections of the bed frame may pivot or rotate relative to one another round the pivot joint in question.

As is evident from Fig. 1, a total of six slats are provided in the fourth part or section 52 of the bed frame. In the third and second parts or sections 54 and 56, respectively, of the bed frame 50, three slats are provided in each of these parts or sections.

In the first part or section 58 of the bed frame 50, a total of seven slats are similarly provided, one of which slats is designated the reference numeral 61. In the first part or section 58 of the bed frame 50, two transversal tubes 62 and 63 are provided which serve the purpose, apart from constituting supporting tubes corresponding to the slats, of constituting components of a power-transmitting lever system serving the purpose of transferring power generated by the motors 44 and 46 to the four parts or segments 52, 54, 56, and 58 of the bed frame, dependent on the adjustment or position of the bed 10 for raising or lowering and mutually pivoting or rotating the parts or sections of the bed frame for allowing that the bed frame 50 of the bed 10 is positioned in a specific required position.

The bed frame 50 of the bed 10 is adjustable in basically four positions, a first horizontal position shown in Fig. 2, a 4-segment position shown in Fig. 3 in which the raising of the first part or section 58 is mechanically linked to the third part or section 54 of the bed frame 50 for adjusting the bed frame 50 in so-called 4-part position, a third position shown in Fig. 4 in which the first part or section 58 is raised exclusively, whereas the remaining parts or sections 56, 54, and 52 are positioned in a horizontal position, which third position is primarily used when a person or patient lying in the bed 10 has broken one or both legs and is unable to bend the broken leg or legs in conformity with the 4-part position shown in Fig. 3, and finally a position shown in Fig. 5, in which the bed frame 50 in its entirety is tilted or pivoted having the head tilted downwardly and the foot of the bed frame raised, defining an angle of approximately 10-15° relative to the horizontal plane or the supporting surface. The bed frame shown in Fig. 5 is in the so-called Trendelenburg position or the so-called shock supporting position. The position shown in Fig. 5 is used in the treatment of patients being in a state of shock or possibly in bleeding condition or different or similar critical condition, which condition may

need the treatment or is counteracted or neutralized by the positioning of the patient in a position having the patient's head turned downwardly in an angle of approximately 10-15° relative to the horizontal position and having the patient's body supported on a planar supporting surface.

For positioning the bed frame in the positions shown in Figs. 3-5 relative to the planar, original position shown in Fig. 2, the bed structure is provided with two power-transmitting components or systems which transmit or transfer the power generated by the motors 44 and 46 to the first part or section 58 and the fourth part or section 52, respectively, of the bed frame 50, and further an engageable and disengageable coupling device which couples or links the first part or section 58 and the third part or section 54 of the bed frame together in an engaged position so that a raising of the first part or section 58 of the bed frame generates a raising of the third part or section 54 of the bed frame, and which allows in a disengaged position that the first part or section 58 of the bed frame is raised without simultaneously raising the third part or section 54 of the bed frame and further independent of the other three parts or sections 56, 54, and 52 of the bed frame as shown in Fig. 4. The power-transmitting components or systems comprise the following components. The power-transmitting components or system of the motor 44 comprise an angular arm 70 connecting the actuator rod 45 of the motor 44 to the tube 63 through a pivot joint 72. The angular arm 70 is further through a small plate-shaped component connected to the tube 62 which further through a rod 76 is connected directly to the pivot joint 72.

The first part or section 58 of the bed frame 50 is further supported relative to the exterior frame 30 by means of joining plates or brackets 78 which are fastened to the lower side surface of the first part or section 58 of the bed frame adjacent to the pivot joint 57 and further by means of pins 80 which are provided at the lowermost ends of the brackets 78 and which are received in bushings of the exterior frame 30. The first part or section 58 of the bed frame 50 may thus rotate round a rotational axis defined by the pins 80 which are aligned relative to one another.

The power-transmitting components or system of the motor 46 similarly comprise a transversal bar 82 which is connected to the actuator rod 47 of the motor through a pivot joint 84. The transversal bar 82 is at its outermost end connected to pins 88 which are fastened to the exterior frame 30 through joining plates or brackets 86. The pins 88 further support rotatable rollers 90 serving the purpose of supporting the fourth part or section 52 of the bed frame 50, provided the fourth part or section 52 is in its horizontal position shown in Figs. 1, 2, and 4.

Adjacent to the outermost ends of the transversal bar 82, two additional joining plates or brackets 92 are fastened to the transversal bar, which joining plates or brackets 92 define an angle of approximately 90° in a plane perpendicular to the transversal bar 82 together with the adjacent joining plate or bracket 86. At the outermost end of each of the joining plates or brackets 92, rollers 94 are rotatably mounted. The angle defined between the joining plates or brackets 86 and 92 generates a lever system which is fixated relative to the exterior frame 30 by means of the pins 88.

The coupling device between the first part or section 58 and the third part or section 54 of the bed frame 50 comprises a bar 96 which is fastened to the transversal tubes 62 and 63 of the first part or section 58 of the bed frame, and the protruding free end of which bar is connected to an ejector rod 100 through a pivot joint 98, which ejector rod is fastened to a slat 64 of the third part or section 54 of the bed frame 50 through a pivot joint 102 similar to the pivot joint 84.

The ejector rod 100 is fixatable in a position parallel to the third part or section 54 of the bed frame by means of a latch or locking pin 104 which is engageable below the ejector rod 100 as the latch or locking pin 104 is lockable in engagement with two plate-shaped components 106 and 107 protruding from the lower side surface of the slat of the third part or section 54 of the bed frame 50.

The latch or locking pin 104 is engageable and disengageable from the position shown in Fig. 1, i.e. from a position engaging below the ejector rod 100 and locking the ejector rod 100 in a position parallel to the lower side surface of the third part or section 54 of the bed frame by means of a Bowden wire 108 which is operable by means of a handle 110 which is arranged adjacent to the footboard 34 of the bed 10.

The length of the protruding free end of the bar 96 and the length of the ejector rod 100 establish the factor of transmission of the transmission from the rotational motion of the first part or section 58 of the bed frame in a first direction, e.g. in the counter-clockwise direction to a smaller rotational motion in the opposite direction, e.g. in the clockwise direction of the third part or section 54 of the bed frame. The factor of transmission or gear ratio is preferably less than 1, which means that a rotation of the first part or section 58 of the bed frame an angle A° from the horizontal position generates a rotation in the opposite direction of the order of $\alpha \times A^\circ$ of the third part or section 54 of the bed frame, wherein α constitutes the factor of transmission or gear ratio.

Apart from the coupling device for coupling or linking the first part or section 58 of the bed frame and the third part or section 54 of the bed frame

together, the bed 10 according to the present invention comprises a coupling device comprising two sets of brackets 112 and 114 which are fastened to slats of the fourth part or section 52 of the bed frame 50 and the third part or section 54 of the bed frame 50, respectively, and which are adapted to allow that the fourth part or section 52 of the bed frame 50 is lowered relative to the third part or section 54, however, prevent that the fourth part or section 52 is raised relative to the third part or section 54.

For activating the motors 16, 44, and 46 of the bed, the bed 10 is provided with a hands-operated, portable apparatus 24 which may be suspended on the exterior frame 30 by means of a strap 25. The apparatus 24 is connected to a junction 27 through a coiled wire 26. The junction 27 is further connected to a mains plug 29 through a mains power cord 28. Keys of the apparatus 24 are adapted to connect each of the motors 16, 44, and 46 to the mains supply for energizing the electric motor in question for generating a motion of the corresponding rod of the motor for ejecting or retracting the rod in question relative to the housing of the motor in question.

The bed 10 according to the invention is positioned in one of the positions shown in Figs. 3-4 relative to the initial position shown in Figs. 1 and 2 in the following way. For positioning the bed frame 50 in the 4-part position which is shown in Fig. 3, the first part or section 58 of the bed frame and the third part or section 54 of the bed frame are linked together by means of the coupling device comprising the bar 96, the pivot joint 98, the ejector rod 100, the pivot joint 102, and the latch or locking pin 104 as the latch or locking pin 104 is engaged below the ejector rod 100 by activating the Bowden wire 108 by means of the handle 110 for positioning the latch or locking pin 104 in the position shown in Fig. 1.

As the motor 44 is activated in the position shown in Fig. 2 for generating an ejection of the rod 45 of the motor 44 relative to the housing of the motor 44, the power-transmitting system co-operating with the motor 44 generates a rotational motion round the rotational axis of the pins 80, as the angular arm 70, the plate-shaped component 74, the rod 76, and the joining plate or bracket 78 constitute a lever system which is rotatable round the rotational axis defined by the pins 80. By ejecting the arm 44, the pivot joint 72 is displaced to the right relative to the position shown in Fig. 2, generating a rotation of the above described lever system round the rotational axis towards the position shown in Fig. 3 or 4.

Provided the latch or locking pin is locked below the ejector rod 100, as shown in Fig. 1, the rotational motion of the first part or section 58 of

the bed frame 50 is transmitted through the bar 96, the pivot joint 98, and the ejector rod 100 to the third part or section 54 of the bed frame, as the overhang of the bar 96 relative to the first part or section 58 of the bed frame forces the end of the ejector rod 100 downwardly, which end is connected to the bar 96 through the pivot joint 98, whereupon the ejector rod is turned round a point or axis defined by the latch or locking pin 104 and consequently forces the opposite end of the ejector rod 100 upwardly, which opposite end is connected to the third part or section 54 of the bed frame through the pivot joint 102. The overhang of the bar 96 determines the factor of transmission of the rotational motion of the first part or section 58 of the bed frame in counter-clockwise direction, vide Fig. 3, to a rotational motion of the third part or section 54 of the bed frame in clockwise direction as the third part or section 54 during its rotational motion or its elevation is supported by two rollers 116 which are journaled on pins 118 relative to the exterior frame 30. During the rotation or pivoting of the first part or section 58 as well as the third part or section 54 which is supported by the pins 80 and the rollers 116, respectively, relative to the exterior frame 30, the second section or part 56 of the bed frame is unsupported and in a cantilever relation suspended between the pivot joints 55 and 57. The motion from the position shown in Fig. 2 to the position shown in Fig. 3 is consequently established by lowering the second part or section 56 of the bed frame, which part or section supports the buttocks of the person or patient resting or sitting on the bed.

Provided the ejector rod 100 is not connected to the third part or section 54 of the bed frame through the latch or locking pin 104's meshing or engagement below the ejector rod 100, the first part or section 58 of the bed frame 50 is freely raisable as the ejector rod 100 is consequently freely movable between the pivot joints 102 and 98, which pivot joints connect the ejector rod 100 with the third part or section 54 of the bed frame and the outermost protruding end of the bar 96, respectively.

In Fig. 3, the bed 10 is shown in two positions, a position shown in solid line and a position shown in dotted line. The position shown in solid line is produced by solely activating the motor 44, whereas the position shown in dotted line is produced by additionally activating the motor 46 for retracting the arm 47, by which activation the supporting roller 94 is caused to rotate in a downward direction relative to the rotational axis defined by the pin 88 of the lever system comprising the joining plates or brackets 96 and 92 and the pivot joint 84. As is evident from Fig. 3, the brackets 102 and 104 are disengaged from engaging with one another, as

the fourth part or section 52 is lowered relative to the third part or section 54.

The bed 10 is shifted to the position shown in Fig. 4 in the following manner.

Provided the motor 46 is activated in the position shown in Fig. 2 for ejecting the arm 47 relative to the housing of the motor 46, a rotation of the lever system is generated by the power transmission system of the motor 46, which rotation is generated in a clockwise direction relative to the rotational axis defined by the pin 88. By the clockwise rotation of the lever system, the rollers 94 are raised, which rollers together with the pins 80 solely support the bed frame 50 as the fourth part or section 52 and the third part or section 54 of the bed frame are disengaged from their meshing with the supporting rollers 90 and 116, respectively. However, the two sets of brackets 112 and 114 prevent that the fourth part or section 52 of the bed frame is raised and caused to rotate relative to the third part or section 54 beyond a position in which the fourth part or section 52 and the third part or section 54 are aligned relative to one another and positioned in co-planar relation. The coupling device coupling the first part or section 58 and the third part or section 54 together simultaneously prevents the first part or section 58, and also the second part or section 56, from rotating relative to the third part or section 54 from a position in co-planar arrangement.

In Figs. 6-8, a second embodiment of a bed according to the present invention is shown. Throughout the views of Figs. 6-8, components of the second embodiment of the bed according to the present invention identical or similar to the components of the first embodiment of the bed according to the present invention shown in Figs. 1-5 and discussed above are designated a 3-digit reference numeral, the first digit being the integer 2, whereas the remaining two digits are identical to the digits referring to the identical or similar component of the first embodiment of the bed according to the present invention. Thus, the second embodiment of the bed 210 comprises an underframe 212 and a frame component 213 on which wheels 214 are mounted. A motor 216 serves the purpose of raising an exterior frame 230 of the bed by means of levers 219, 220, 221, 222, and 223, and by means of an actuator rod 218 of the motor 216. The levers 219-223 define a bed frame supporting lever system of the parallel motion type in which the levers 220 and 223 constitute parallel motion producing components so as to provide a parallel motion of the frame 230 relative to the frame component 213 of the underframe 212 by the activation of the motor 216. In the embodiment shown in Figs. 6-8, the means for operating the motors of the bed are omitted as a component

similar to the hands-operated portable apparatus 24 shown in Fig. 1 is omitted.

The exterior frame 230 of the second embodiment of the bed according to the present invention shown in Figs. 6-8 comprises a head 232 and a footboard 234. Within the frame 230 of the bed, a bed frame 250 is arranged. The bed frame 250 comprises a total of four parts or sections, viz. a first part or section 258, a second part or section 256, a third part or section 254, and a fourth part or section 252 corresponding to the parts or sections 58, 56, 54, and 52, respectively, of the bed 10 discussed above. The first part or section 258 and the second part or section 256 are linked together in an articulate joint 257. Similarly, the third part or section 254 and the second part or section 256 are linked together by means of an articulate joint 255. The fourth part or section 252 and the third part or section 254 are also linked together by means of an articulate joint 253. The articulate joints 253, 255, and 257 allow that the parts or sections in question may rotate relative to one another and further perform a displacement relative to one another as the joints constitute extendable or guideway joints.

The first part or section 258 of the bed frame 250 is journaled relative to the exterior frame 230 on a journalling shaft 268. The third part or section 254 of the bed frame 250 is journaled relative to the exterior frame 230 on a journalling shaft 264, and the fourth part or section 252 of the bed frame 250 is similarly journaled relative to the exterior frame 230 on a journalling shaft 262. As the three parts or sections 252, 254, and 258 are journaled on journalling shafts relative to the exterior frame 230, the linking between the parts or sections has to constitute extendable links allowing a displacement of the joints or links in question as the parts or sections of the bed frame are rotated relative to one another round their journalling shafts. The journalling shaft 264 is further connected to the articulate lever 221 of the under-frame 212 through a supporting arm or lever 267. Similarly, the journalling shaft 268 is rigidly connected to a lever 269 which is connected to an actuator rod 245 of a motor 244 serving the purpose of causing a rotation of the first part or section 258 of the bed frame 250 round the rotational shaft 268 as the actuator rod 245 is extended relative to the housing of the motor 244 for raising the first part or section 258 to the position shown in Fig. 8 relative to the horizontal position shown in Fig. 7.

The third part or section 254 of the bed frame 250 is provided with an extendable rod 286 which is mounted in a parallel, juxtaposed position at the lower side surface of the third part or section 254 of the bed frame 250. The extendable rod 286 is connected to a rod 288 through a pivot joint 287.

The rod 288 is rigidly connected to the lower side surface of the first part or section 258 of the bed frame 250 in a parallel, juxtaposed position and serves the purpose of transmitting the rotational motion of the first part or section 258 of the bed frame caused by the force-generating motor 244 to the third part or section 254 for causing the third part or section 254 to rotate round its journalling shaft 264 in a direction opposite to the rotational direction of the first part or section 258. The length of the rods 286 and 288 defines the transmission factor of the transmission.

In Figs. 9-13, a third embodiment of a bed according to the present invention is shown, designated the reference numeral 310 in its entirety. In Figs. 9-13, components identical or similar to the components of the presently preferred, first embodiment of the bed according to the present invention shown in Figs. 1-5 are designated a 3-digit reference numeral, the first digit being the integer 3, whereas the remaining two digits are identical to the digits of the reference numeral of the identical or corresponding component of the first embodiment of the bed according to the present invention. Furthermore, the third embodiment of the bed according to the present invention shown in Figs. 9-13 comprises the same underframe structure as discussed above with reference to Figs. 6-8, which underframe structure is designated the reference numeral 212 in its entirety.

The third embodiment of the bed 310 according to the present invention comprises an exterior frame 330 including a head 332 and a footboard 334. Within the exterior frame 330, a bed frame 350 according to the present invention is arranged, comprising a first part or section 358, a second part or section 356, a third part or section 354, and a fourth part or section 352. The first and second parts or sections 358 and 356, respectively, are linked together or connected to one another through a pivot joint 357. Similarly, the third part or section 354 and the second part or section 356 are connected through a pivot joint 355, whereas the fourth part or section 352 and the third part or section 354 are linked together through a pivot joint 353. The third embodiment of the bed further comprises two motors 344 and 346 comprising extendable actuator rods 345 and 347, respectively. The second motor 346 co-operates with a lever system comprising a first lever 391 which is rigidly connected to a second lever 392 of the lever system. The first lever 391 is connected to the actuator rod 347 of the motor 346 through a pivot joint 384, whereas the lever system is journalled relative to the exterior frame 330 on a journalling shaft 382. At the outermost end of the second lever 392 of the lever system, a roller 394 is journalled, which roller co-operates with the fourth part or section 352 of

the bed frame 350, serving the purpose of raising the fourth part or section 352 of the bed frame 350 from its horizontal position shown in Fig. 10 to the Trendelenburg position shown in Fig. 13, in which position the fourth part or section 352 and the third part or section 354 of the bed frame are linked together through a catching device 363, serving the same purpose as the brackets 112 and 114 of the first and presently preferred embodiment of the bed according to the present invention, viz. the purpose of preventing that the fourth part or section 352 of the bed frame 350 is rotated counter-clockwise relative to the third part or section 354 of the bed frame past a position in which the fourth part or section 352 is arranged constituting a planar extension of the third part or section 354, however, allowing that the fourth part or section 352 is rotated downwardly relative to the third part or section 354 as shown in Fig. 11.

The first motor 344 acts upon the first part or section 358 of the bed frame 350 through its actuator rod 345 which is connected to a lever 376 through a pivot joint 372. The lever 376 is rigidly connected to a rotational shaft 380 on which the first part or section 358 of the bed frame 350 is journalled through the intermediate of a joining plate or bracket 378 so as to allow that the first part or section 358 of the bed frame 350 may rotate round the rotational shaft 380. As the actuator rod 345 is extended relative to the housing of the motor 344, the first part or section 358 of the bed frame 350 is rotated clockwise round the rotational shaft 380 and raised from its horizontal position shown in Fig. 10 to a raised position shown in Fig. 11 or alternatively shown in Fig. 12.

The third embodiment 310 of the bed according to the present invention also comprises an engageable and disengageable power-transmitting means for transmitting the rotational motion of the first part or section 352 of the bed frame to the third part or section 354 of the bed frame 350, provided the engageable and disengageable power-transmitting means is in its engaged position or alternatively allowing that the first part or section 358 of the bed frame 350 is raised without causing any rotation of the third part or section 354 of the bed frame relative to its journalling shaft 381. The engageable and disengageable power-transmitting means is implemented in the third embodiment 310 of the bed according to the present invention shown in Figs. 9-13 by means of the same components as discussed above with reference to Figs. 6-8 and consequently comprises the extendable rod 286 which is connected to the rod 288 through the pivot joint 287, provided the engageable and disengageable power-transmitting means is in its engaged position as shown in Figs. 10, 11, and 13. In the disengaged position of the engageable and

disengageable power-transmitting means shown in Fig. 12, the extendable rod 286 is disengaged from the rod 288 at the joint 287 which consequently constitutes a disengageable pivot joint.

Claims

1. A bed comprising a bed frame divided into four sections, a first section of which constitutes a section for supporting the back or the head of a person lying in or sitting on the bed, a second section of which constitutes a section for supporting the person's buttocks, a third section of which constitutes a section for supporting the person's thighs, and a fourth section of which constitutes a section for supporting the person's crus and feet, CHARACTERIZED in that the four sections of the bed frame are linked together through pivot joints, a first pivot joint connecting the first and second sections of the bed frame to one another, a second pivot joint connecting the second and third sections of the bed frame to one another, and a third pivot joint connecting the third and fourth sections of the bed frame to one another, in that the bed comprises a first and a second power-generating means adapted to transmit power to the first and the fourth section, respectively, of the bed frame for generating a pivoting of the first and the fourth section, respectively, of the bed frame relative to the second and third section, respectively, of the bed frame round the first and the third pivot joint, respectively, of the bed frame, in that the bed comprises an engageable and disengageable power-transmitting means adapted to, in a first engaged position, connect the first and the third section of the bed frame to one another and generate a pivoting of the third section of the bed frame relative to the second section of the bed frame round the second pivot joint coincident with a pivoting of the first section of the bed frame relative to the second section of the bed frame round the first pivot joint, however, in a direction opposite to the pivoting direction of the pivoting of the first section of the bed frame relative to the second section of the bed frame and further adapted to, in a second disengaged position, allow that the first section of the bed frame may pivot relative to the second section of the bed frame round the first pivot joint without simultaneously generating a pivoting of the third section of the bed frame relative to the second section of the bed frame round the second pivot joint, and in that the bed comprises a carrier means adapted to co-operate with the third and fourth sections of the bed frame and allow that the

fourth section of the bed frame is lowered relative to the third section of the bed frame through pivoting relative to the third section round the third pivot joint, however, adapted to prevent that the fourth section of the bed frame is raised relative to the third section of the bed frame by pivoting relative to the third section round the third section round the third pivot joint beyond a position in which the third and fourth sections of the bed frame are positioned in the same plane.

2. A bed according to Claim 1, CHARACTERIZED in that the engageable and disengageable power-transmitting means is constituted by a lever system comprising a first lever which is rigidly connected to the first section of the bed frame and has an end projecting from the first section of the bed frame, and an ejector arm, a first end of which is connected to the third section of the bed frame through a pivot joint, and the second end of which is connected to said projecting end of the lever through a pivot joint, in that the ejector arm is locked in a position in the first position of the engageable and disengageable power transmission means, in which locked position the ejector arm is positioned parallel to and abutting the third section of the bed frame, and in that the ejector arm is disengaged from said position arranged parallel to and abutting the third section of the bed frame in the second position of the engageable and disengageable power transmission means.
3. A bed according to Claim 2, CHARACTERIZED in that the ejector arm is locked in the said position arranged parallel to and abutting the third section of the bed frame by means of a locking spigot or dowel which is connected to a handle through a Bowden wire.
4. A bed according to any of the Claims 1-3, CHARACTERIZED in that the carrier means comprises two sets of brackets which are fastened to the lower side surfaces of the third and fourth sections, respectively, of the bed frame.
5. A bed according to any of the Claims 1-4, CHARACTERIZED in that the power-generating means are constituted by electric motors comprising linearly displaceable rods or arms transmitting the power generated by the power-generating means to the first and fourth sections, respectively, of the bed frame.
6. A bed according to any of the Claims 1-5,

CHARACTERIZED in that the bed further comprises an additional, exterior frame in which the bed frame is journalled.

7. A bed according to Claim 6, CHARACTERIZED in that the bed frame is journalled relative to the exterior frame by means of pivot joints journalling the first section of the bed frame pivotally relative to the exterior frame and journalling the fourth section of the bed frame pivotally relative to the exterior frame. 5
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8. A bed according to Claim 6 or 7, CHARACTERIZED in that the bed frame is journalled relative to the exterior frame on rollers. 15
9. A bed according to any of the Claims 6-8, CHARACTERIZED in that the exterior frame comprises a head and a footboard and in that the exterior frame is journalled or supported on an underframe. 20
10. A bed according to Claim 9, CHARACTERIZED in that the exterior frame is raisable or lowerable relative to the underframe by means of power-generating means co-operating with the underframe and the exterior frame. 25

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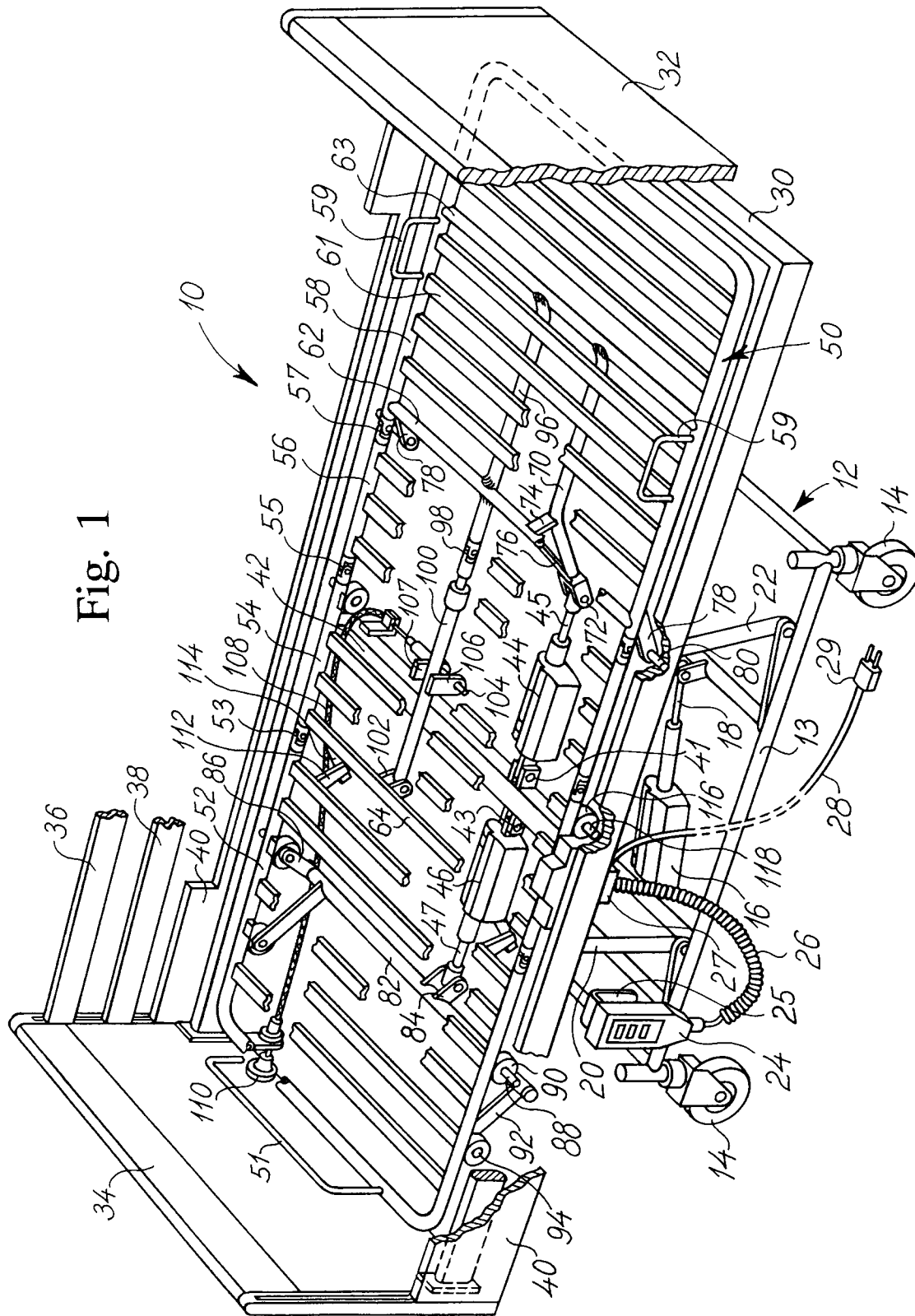


Fig. 2

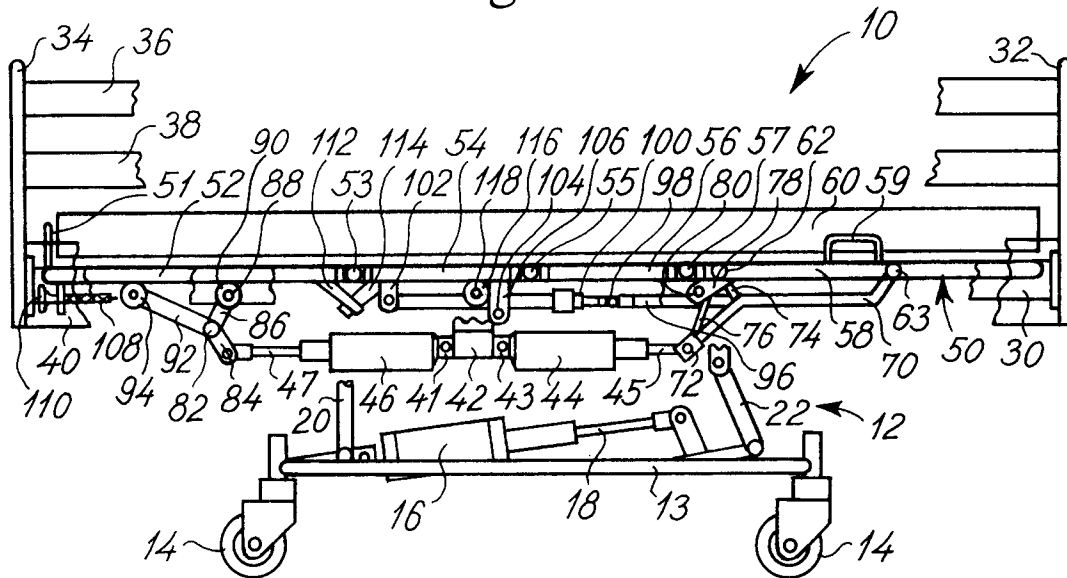


Fig. 3

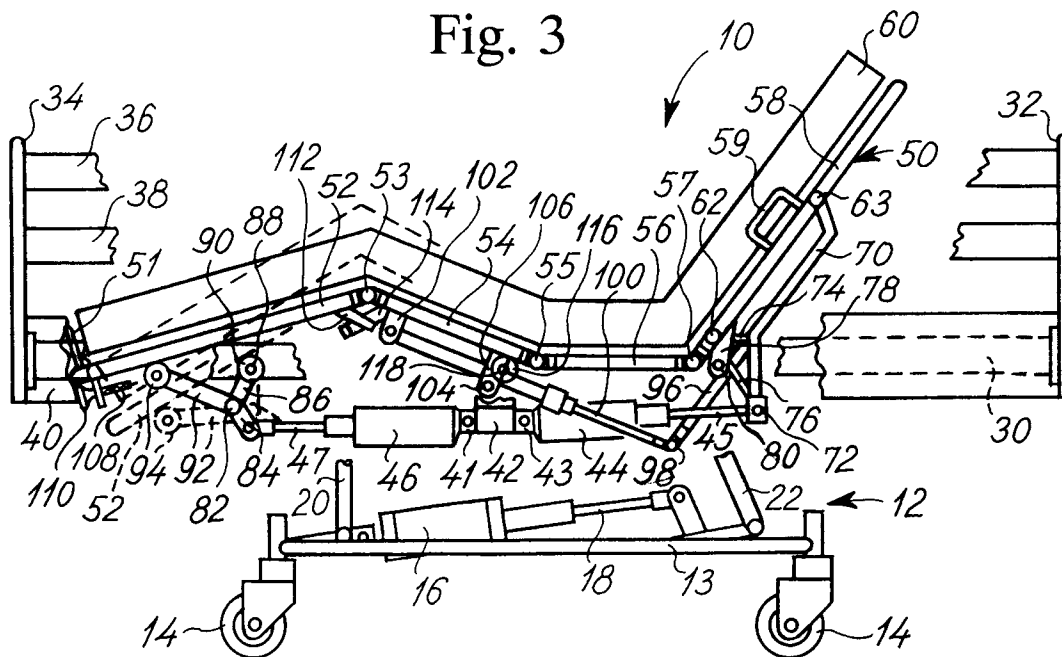


Fig. 4

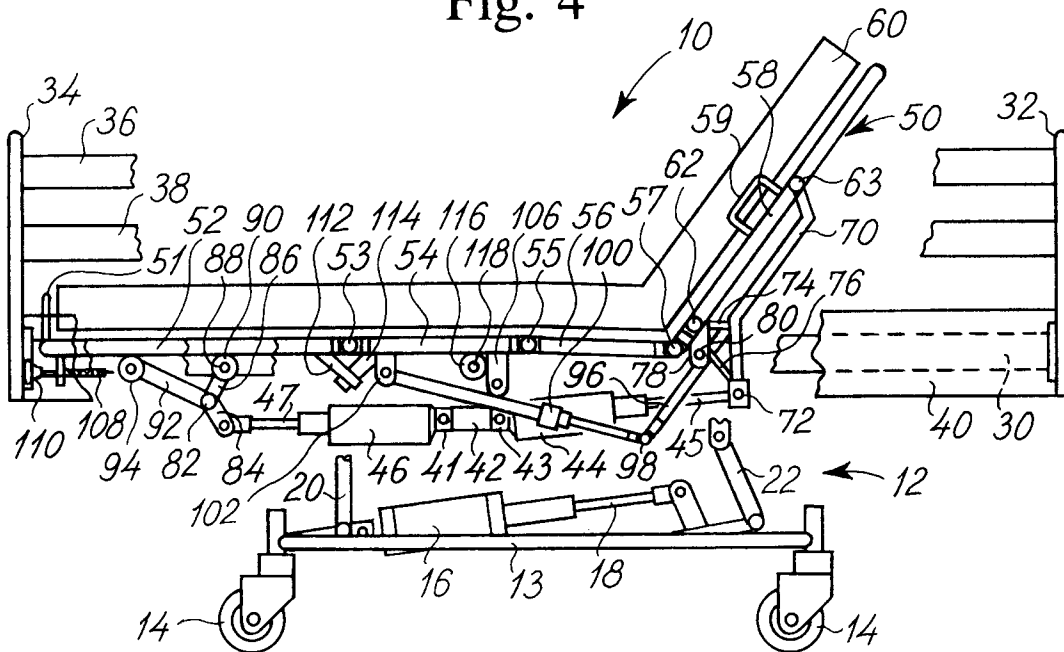


Fig. 5

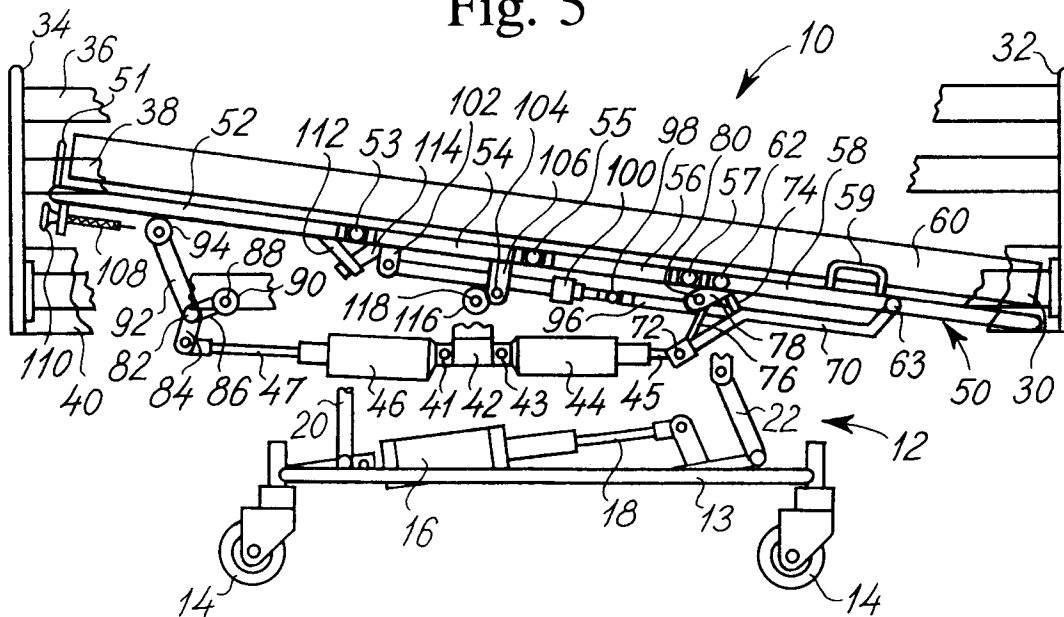


Fig. 6

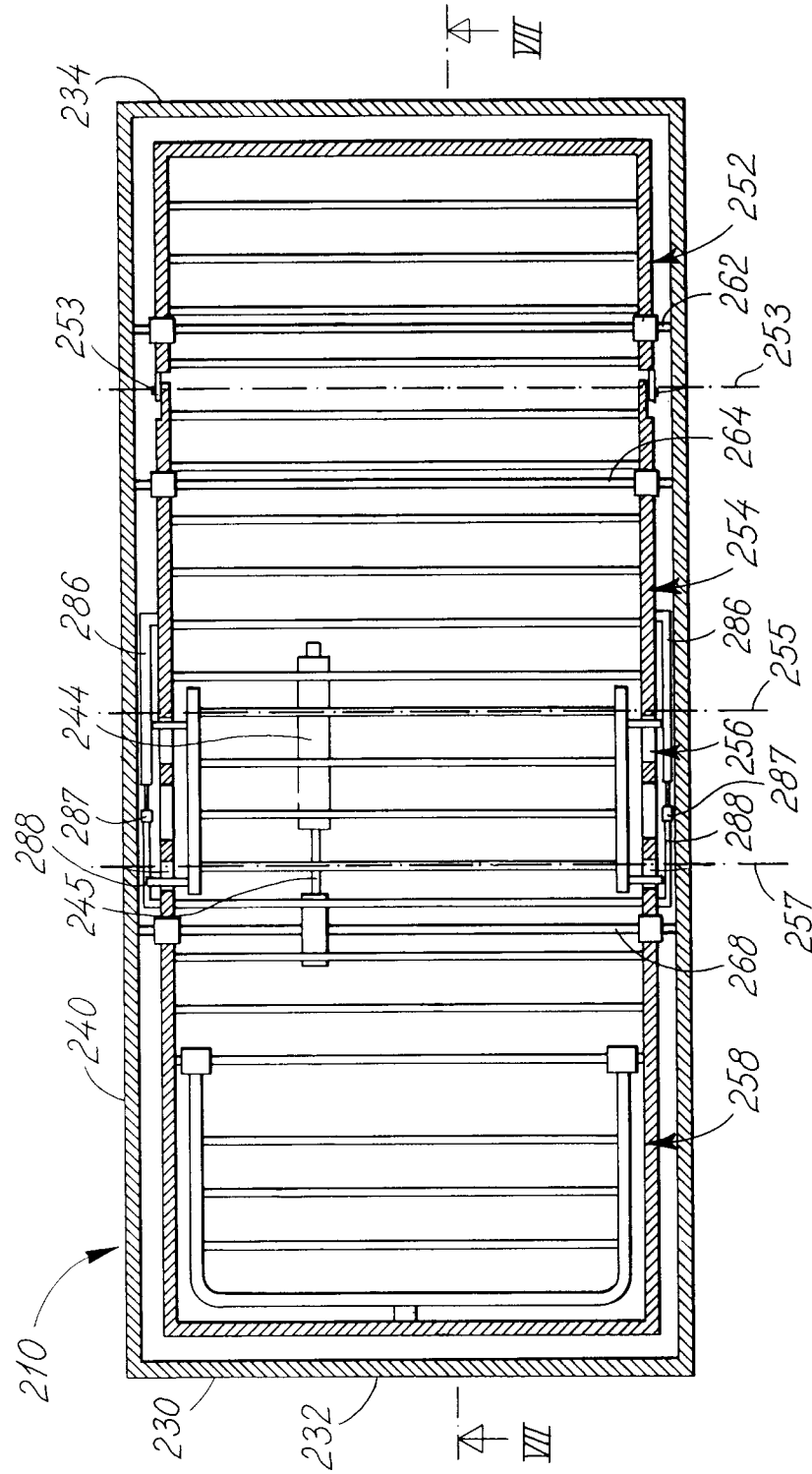


Fig. 7

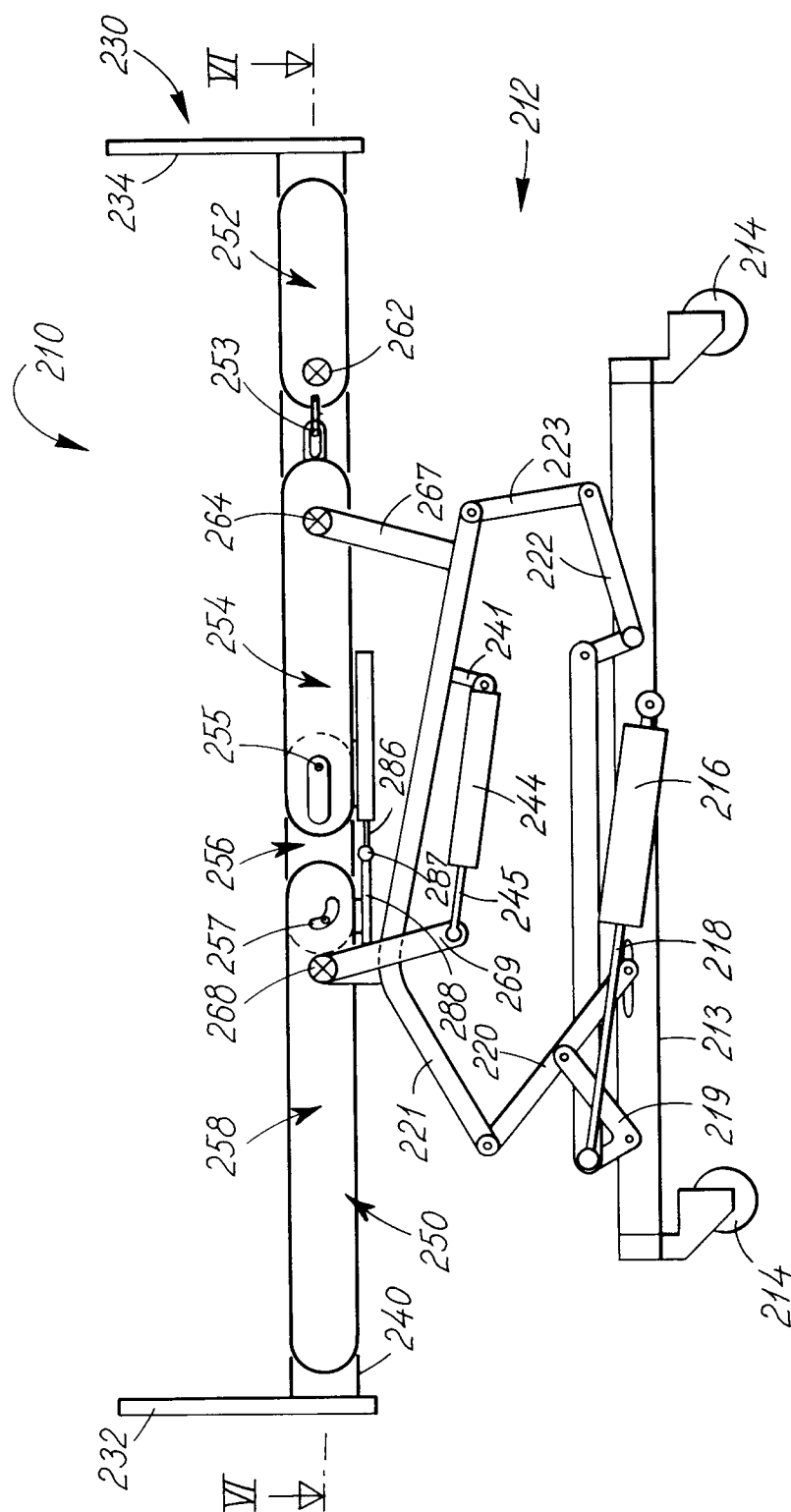


Fig. 8

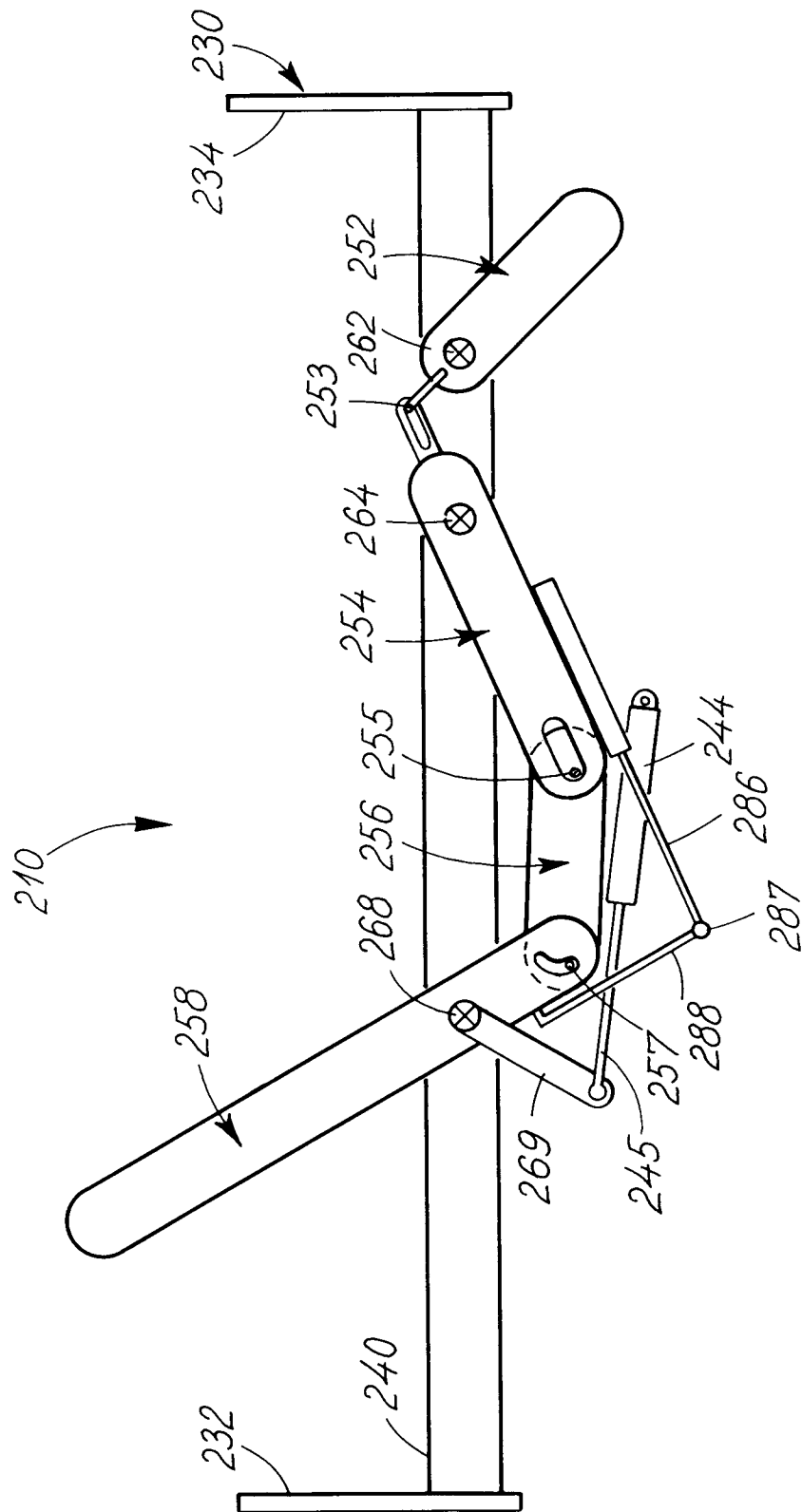


Fig. 9

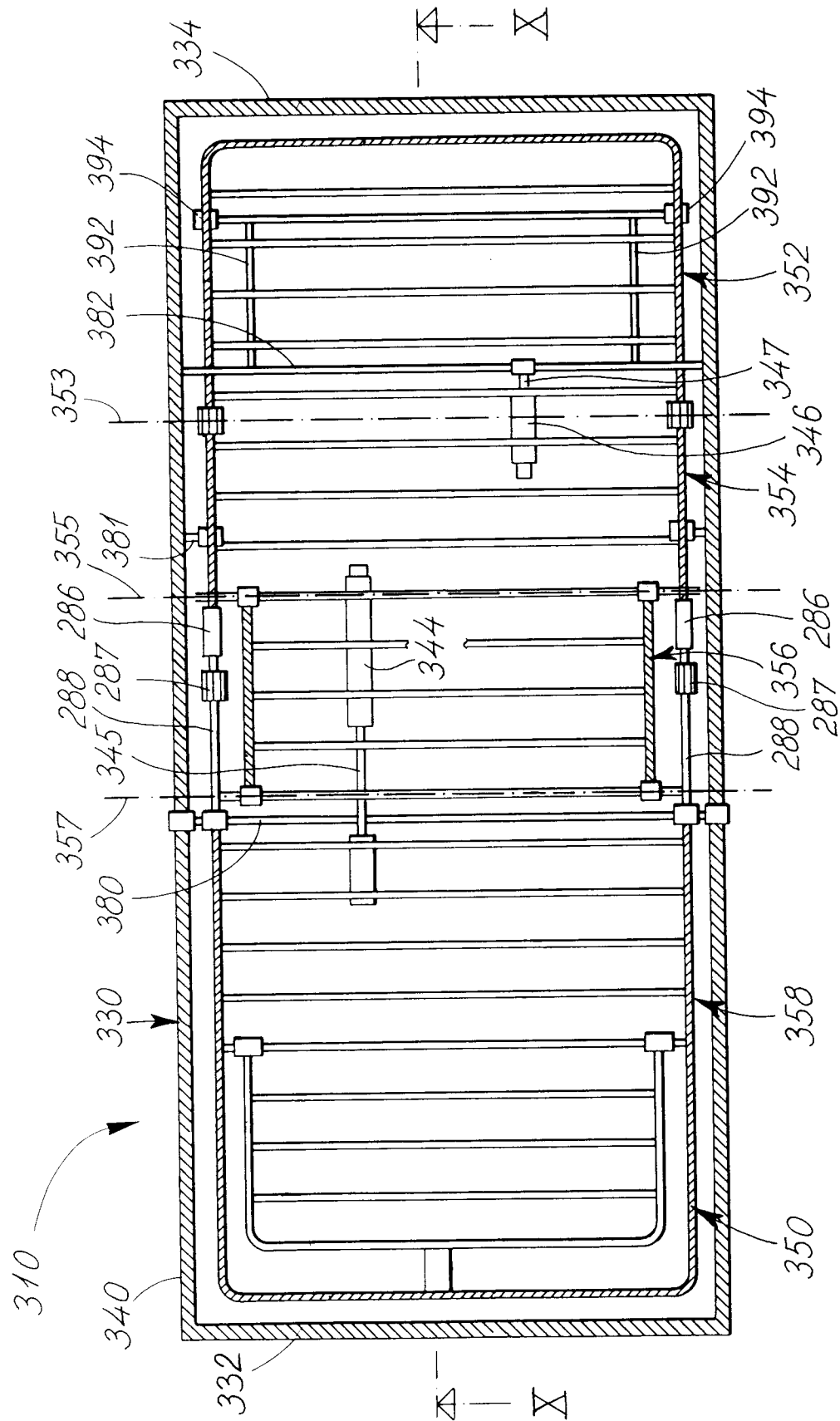


Fig. 10

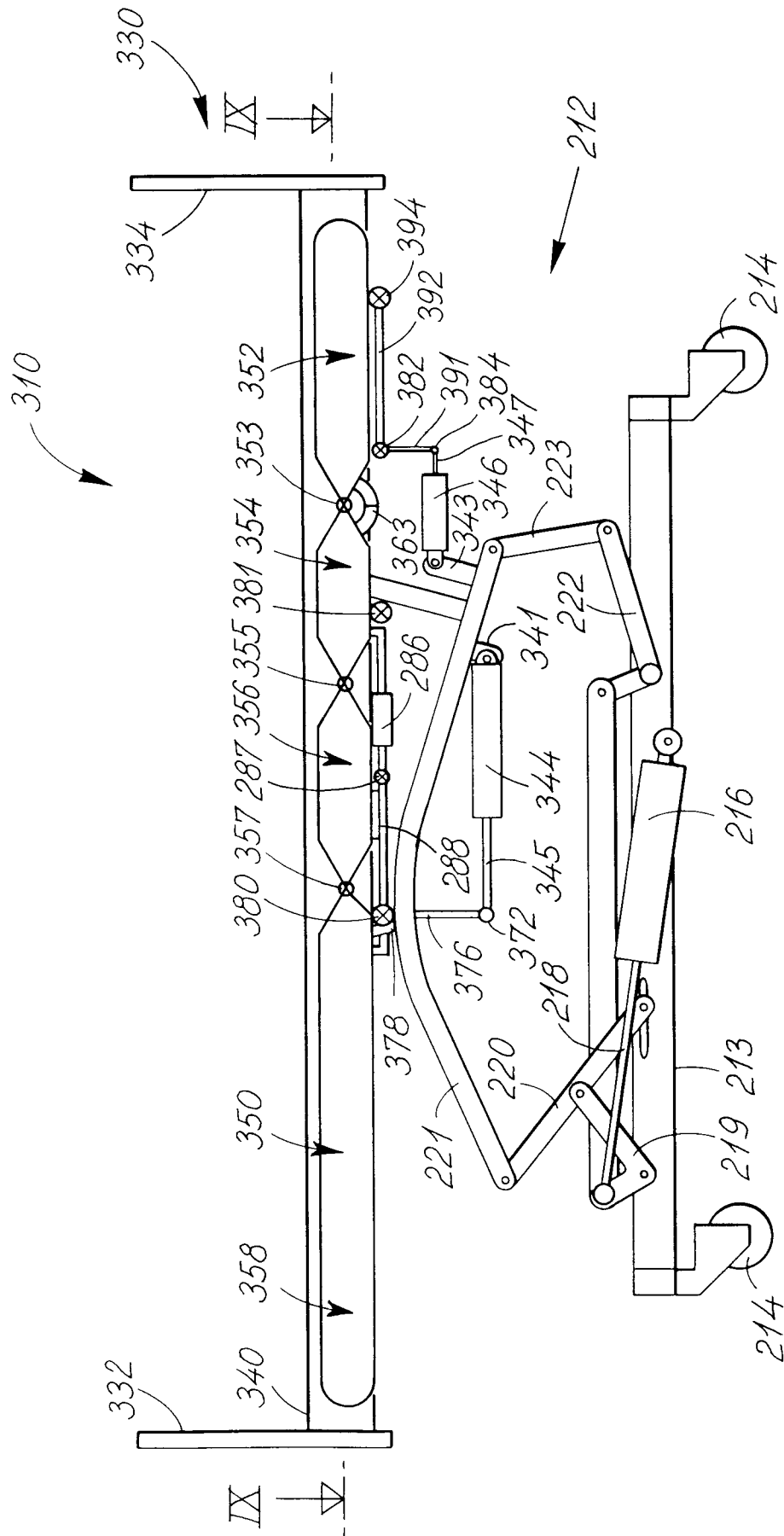
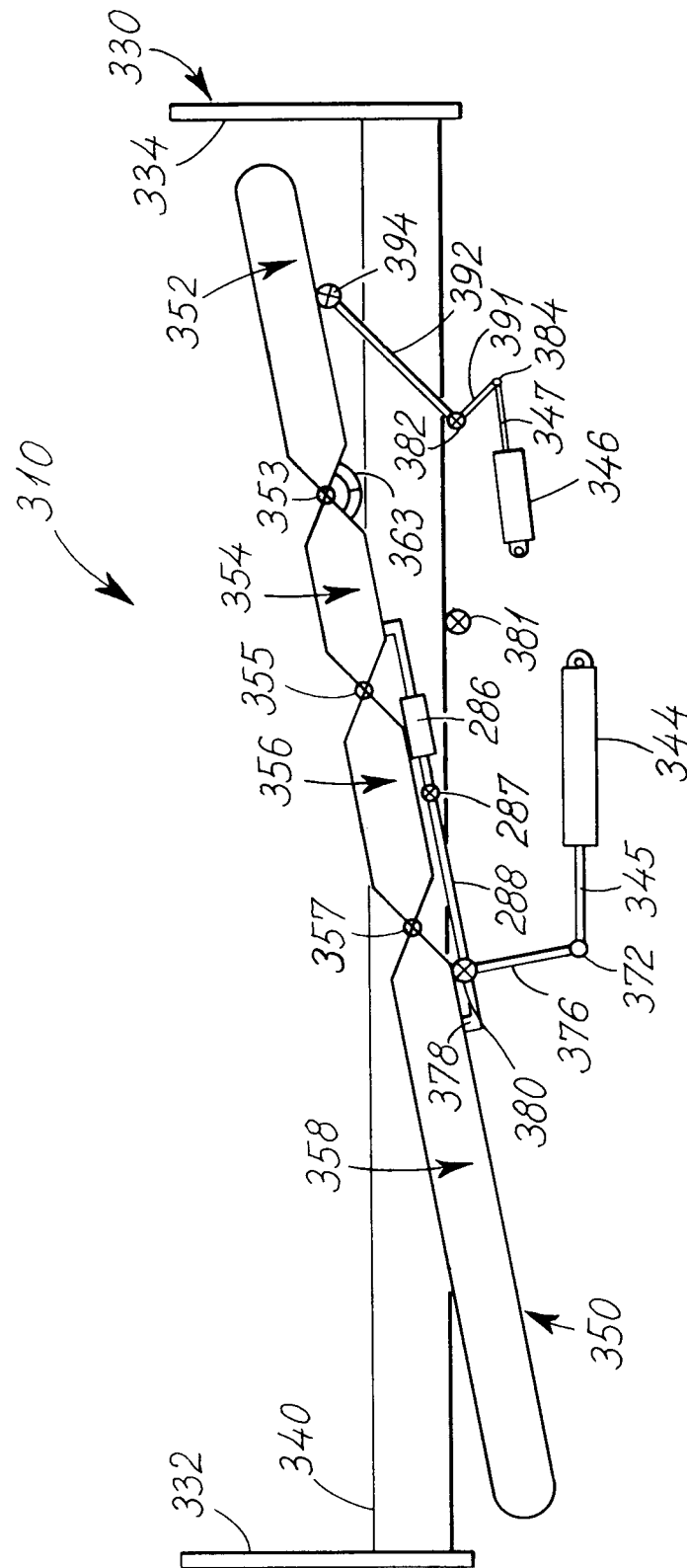


Fig. 13





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 61 0019

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	FR-A-1 132 440 (GERVASIO) * page 1, right column, line 25 - line 39 * * page 3, left column, line 55 - right column, line 6; figures 1,11 * ---	1,5	A61G7/015
A	NL-A-6 613 444 (FAVRO N.V.) * the whole document * ---	1	
A	GB-A-836 628 (BREACH) * page 1, line 66 - page 2, line 27; figures 1,2 * ---	1	
A,D	WO-A-9 011 748 (MOLNLYCKE) * abstract; figures * -----	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			A61G A47C
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 01 JULY 1992	Examiner BAERT F.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			