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(54) **Powered rocker and glider recliner linkage mechanisms**

Verbindungsmechanismen für angetriebenen Schaukel- und Lehnstuhl

Mécanismes de liaison assistée pour fauteuil à bascule et fauteuil inclinable à patins

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## Description

### BACKGROUND OF THE INVENTION

**[0001]** The present invention relates broadly to motion upholstery furniture designed to support a user's body in an essentially seated disposition. Motion upholstery furniture includes recliners, incliners, sofas, love seats, sectionals, theater seating, traditional chairs, and chairs with a moveable seat portion, such furniture pieces being referred to herein generally as "seating units." More particularly, the present invention relates to an improved linkage mechanism developed to accommodate a seating unit that acts as a rocker or a glider recliner. Accordingly, the improved linkage mechanism of the present invention provides for reclining the seating unit while accommodating operation of a rocker mechanism or a glider assembly.

**[0002]** Reclining seating units exist that allow a user to forwardly extend a footrest or ottoman and to recline a backrest relative to a seat. These existing seating units typically provide three basic positions: a standard, non-reclined closed position; an extended position; and a reclined position. In the closed position, the seat resides in a generally horizontal orientation and the backrest is disposed substantially upright. Additionally, if the seating unit includes an ottoman attached with a mechanical arrangement, the mechanical arrangement is collapsed such that the ottoman is not extended. In the extended position, often referred to as a television ("TV") position, the ottoman is extended forward of the seat, and the backrest remains sufficiently upright to permit comfortable television viewing by an occupant of the seating unit. In the reclined position the backrest is positioned rearward from the extended position into an obtuse relationship with the seat for lounging or sleeping.

**[0003]** Several modern rocker and glider recliners presently in the industry are adapted to provide the adjustment capability described above. However, these recliners require relatively complex linkage mechanisms to afford this capability. The complex linkage assemblies limit certain design aspects utilized by furniture manufacturers, such as incorporation of a motor to provide powered adjustment. In particular, these present recliner linkage assemblies impose constraints on attaching a motor that can achieve full adjustment between the three positions above without interfering with internal cross-beams or limiting movement of the rocker mechanism or the glider assembly. Accordingly, the present invention introduces a novel linkage mechanism that allows a rocker-recliner-style or a glider-style-recliner seating unit to provide the features of full powered adjustment between the three positions above without interfering with cross-beams or the operation of the rocker mechanism or the glider assembly.

**[0004]** A Reclining seating unit is known from US 2003/0047973 A1.

### SUMMARY OF THE INVENTION

**[0005]** Embodiments of the present invention seek to provide a simplified, compact, linkage mechanism which can fully adjust a rocker-recliner-type seating unit (hereinafter "rocker recliner") or a glider-recliner-type seating unit (hereinafter "glider recliner") between three positions (closed, extended, and reclined) without limiting movement of a rocker mechanism or a glide assembly, respectively. Typically, the rocker mechanism allows a seat of the rocker recliner to sway forward and backward with respect to the base, while the glide assembly allows a seat of the glider recliner to oscillate forward and backward with respect to the base.

**[0006]** Generally, the rocker/glider recliner is powered by a linear actuator that assists adjustment of a linkage mechanism. Movement of the linear actuator is sequenced into a first phase and a second phase, where the second phase occurs once the first phase is substantially complete. In other words, a stroke of the first phase is carried out substantially independently of a stroke of the second phase. In an exemplary embodiment, the first phase acts to adjust the linkage mechanism between the closed and extended positions, while the second phase acts to adjust the linkage mechanism between the extended and reclined positions. Accordingly, in operation, the sequencing ensures that a footrest is substantially extended before a backrest begins reclining.

**[0007]** In embodiments of the present invention, the simplified linkage mechanism discussed above can be assembled to a linear actuator reassembling a compact motor and that is adaptable to essentially any type of seating unit. In an exemplary embodiment, the compact motor in concert with the linkage mechanism can achieve full, sequenced, and automated adjustment of the rocker/glider recliner between each of the closed, extended, and reclined positions. Typically, the compact motor may be employed in a proficient and cost-effective manner to adjust the linkage mechanism without creating interference or other disadvantages appearing in the conventional designs that are inherent with automation.

### BRIEF DESCRIPTION OF THE DRAWING

**[0008]** In the accompanying drawings which form a part of the specification and which are to be read in conjunction therewith, and in which like reference numerals are used to indicate like parts in the various views:

FIG. 1 is a diagrammatic lateral view of a seating unit in a closed position, in accordance with an embodiment of the present invention;

FIG. 2 is a view similar to FIG. 1, but in an extended position, in accordance with an embodiment of the present invention;

FIG. 3 is a view similar to FIG. 1, but in a reclined position, in accordance with an embodiment of the present invention;

FIG. 4 is a perspective view of a linear actuator mounted to a linkage mechanism that is adjusted to a reclined position, in accordance with an embodiment of the present invention;

FIG. 5 is a diagrammatic lateral view, from an internal perspective, of the linkage mechanism in the reclined position, in accordance with an embodiment of the present invention;

FIG. 6 is a view similar to FIG. 5, but in an extended position, in accordance with an embodiment of the present invention; and

FIG. 7 is a view similar to FIG. 5, but in a closed position, in accordance with an embodiment of the present invention;

FIG. 8 is a diagrammatic lateral view, from an external perspective, of the linkage mechanism in the reclined position, in accordance with an embodiment of the present invention;

FIG. 9 is a partial side-elevation view of the linkage mechanism in the closed position highlighting a sequence link, in accordance with an embodiment of the present invention;

FIG. 10 is a view similar to FIG. 9, but in the extended position, in accordance with an embodiment of the present invention;

FIG. 11 is a view similar to FIG. 9, but in the reclined position, in accordance with an embodiment of the present invention;

FIG. 12 is a perspective view of a linear actuator mounted to a linkage mechanism that is adjusted to a reclined position, in accordance with an embodiment of the present invention;

FIG. 13 is a diagrammatic lateral view, from an internal perspective, of the linkage mechanism in the reclined position, in accordance with an embodiment of the present invention;

FIG. 14 is a view similar to FIG. 13, but in an extended position, in accordance with an embodiment of the present invention;

FIG. 15 is a view similar to FIG. 13, but in a closed position, in accordance with an embodiment of the present invention; and

FIG. 16 is a diagrammatic lateral view, from an external perspective, of the linkage mechanism in the reclined position, in accordance with an embodiment of the present invention.

## DETAILED DESCRIPTION OF THE INVENTION

**[0009]** FIGS. 1-3 illustrate a seating unit 10. Seating unit 10 has a seat 15, a backrest 25, legs 26 (e.g., support bushings), a linkage mechanism 100 or 1000, a first foot-support ottoman 45, a second foot-support ottoman 47, a stationary base 35, and a pair of opposed arms 55. Stationary base 35 has a forward section 52, a rearward section 54, and is supported by the legs 26, where the legs 26 (e.g., bushings) support the stationary base 35 and raise it above an underlying surface (not shown). In addition, the stationary base 35 is interconnected to the , seat 15 via the linkage mechanism 100 or 1000 that is generally disposed between the pair of opposed arms 55, and the rearward section 54. Seat 15 is moveable over the stationary base 35 during adjustment of the seating unit 10, when swaying a rocker mechanism of the linkage mechanism 100, or when oscillating a glide assembly of the linkage mechanism 1000. In embodiments, the seat 15 or the backrest 25 is moveable according to the arrangement of the linkage mechanism 100 or 1000 such that no portion of the seat 15 interferes with the opposed arms 55 throughout adjustment.

**[0010]** Opposed arms 55 are laterally spaced and have an arm-support surface 57 that is typically substantially horizontal. In one embodiment, the pair of opposed arms 55 are attached to the stationary base 35 via intervening members. The backrest 25 extends from the rearward section 54 of the stationary base 35 and is rotatably coupled to the linkage mechanism 100 or 1000, typically proximate to the arm-support surface 57. First foot-support ottoman 45 and the second foot-support ottoman 47 are moveably supported by the linkage mechanism 100 or 1000. Each linkage mechanism 100 and 1000 is arranged to articulably actuate and control movement of the seat 15, the back 25, and the ottomans 45 and 47 between the positions shown in FIGS. 1-3, as more fully described below.

**[0011]** As shown in FIGS. 1-3, the seating unit 10 is adjustable to three basic positions: a closed position 20, an extended position 30 (i.e., TV position), and the reclined position 40. FIG. 1 depicts the seating unit 10 adjusted to the closed position 20, which is a normal non-reclined sitting position with the seat 15 in a generally horizontal position and the backrest 25 generally upright and generally perpendicular to the seat 15. In particular, the seat 15 is disposed in a slightly inclined orientation relative to the stationary base 35. In this embodiment, the inclined orientation may be maintained throughout adjustment of the seating unit 10. In addition, when adjusted to the closed position 20, the ottomans 45 and 47 are positioned below the seat 15.

**[0012]** Turning to FIG. 2, the extended position 30, or TV position, will now be described. When the seating unit 10 is adjusted to the extended position 30, the first foot-support ottoman 45 and the second foot-support ottoman 47 are extended forward of the forward section 52 of the stationary base 35 and disposed generally horizontal. However, the backrest 25 remains substantially perpendicular to the seat 15 and will not encroach an adjacent wall. Also, the seat 15 is maintained in the inclined orientation relative to the stationary base 35. Typically, the seat 15 is translated slightly forward and upward relative to the stationary base 35. Thus, the configuration of the seating unit 10 in the extended position 30 provides an occupant an inclined TV position while providing space-saving utility. This independent movement of the seat 15 allows for a variety of styling to be incorporated into the seat 15, such as T-cushion styling.

**[0013]** FIG. 3 depicts the reclined position 40, in which the seating unit 10 is fully reclined. Typically, the opposed arms 55 are attached to the stationary base 35 and the legs 26 extend from the stationary base 35. The backrest 25 is rotated rearward by the linkage mechanism 100 or 1000 and biased in a rearward inclination angle. The rearward inclination angle is typically an obtuse angle in relation to the seat 15. However, the rearward inclination angle of the backrest 25 is offset by a forward and upward translation of the seat 15 as controlled by the linkage mechanism 100 or 1000. This is in contrast to other reclining chairs with 3-position mechanisms, which cause their backrest to move rearward during adjustment, thereby requiring that the reclining chair be positioned a considerable distance from an adjacent rear wall or other proximate fixed objects. Thus, the forward and upward translation of the seat 15 in embodiments of the present invention allow for zero-wall clearance. Generally, the "zero-wall clearance" is utilized herein to refer to space-saving utility that permits positioning the seating unit 10 in close proximity to an adjacent rear wall and other fixed objects. In embodiments of the reclined position 40, the ottomans 45 and 47 may be moved farther forward and upward from their position in the extended position 30.

**[0014]** FIGS. 4-7 illustrate the exemplary configurations of the linkage mechanism 100 for a rocker-recliner-type seating unit (hereinafter "rocker recliner) that is powered by a linear actuator included within a motor assembly 300. As discussed above, the linkage mechanism 100 is arranged to articulably actuate and control movement of a seat, a backrest, and ottoman(s) of the rocker recliner when the linkage mechanism 100 is adjusted between the positions shown in FIGS. 5-7. That is, the linkage mechanism 100 is adjustable to three basic positions: reclined position (FIGS. 5 and 8), an extended (TV) position (FIG. 6), and a closed position (FIG. 7). In the reclined position, as shown in FIGS. 5 and 8, the backrest is rotated rearwardly by the linkage mechanism 100 and biased in a rearward inclination angle, which is an obtuse angle in relation to the seat. When the rocker recliner is adjusted to the extended position, as shown in FIG. 6, the ottomans are extended forward and disposed generally horizontal, while the backrest remains substantially perpendicular to the seat. The closed position of FIG. 7 is a normal non-reclined sitting position with the seat in a generally horizontal position and the back generally upright and in a substantial, perpendicular-biased relation to the seat.

**[0015]** Further, the linkage mechanism 100 comprises a plurality of linkages that are arranged to actuate and control movement of the rocker recliner during adjustment between the closed, the extended, and the reclined position. These linkages may be pivotably interconnected. It is understood and appreciated that the pivotable couplings (illustrated as pivot points in the figures) between these linkages can take a variety of configurations, such as pivot pins, bearings, traditional mounting hardware, rivets, bolt and nut combinations, or any other suitable fasteners which are well-known in the furniture-manufacturing industry. Further, the shapes of the linkages and the brackets may vary as desired, as may the locations of certain pivot points. It will be understood that when a linkage is referred to as being pivotably "coupled" to, "interconnected" with, "attached" on, etc., another element (e.g., linkage, bracket, frame, and the like), it is contemplated that the linkage and elements may be in direct contact with each other, or other elements (such as intervening elements) may also be present.

**[0016]** Generally, the linkage mechanism 100 guides the rotational movement of the backrest, the translation of the seat, and the extension of the ottoman(s). In an exemplary configuration, these movements are controlled by a pair of essentially mirror-image linkage mechanisms (one of which is shown herein and indicated by reference numeral 100), which comprise an arrangement of pivotably interconnected linkages. The linkage mechanisms are typically disposed in opposing-facing relation about a longitudinally-extending plane that bisects the rocker recliner between the pair of opposed arms. As such, the ensuing discussion will focus on only one of the linkage mechanisms 100, with the content being equally applied to the other, complimentary, linkage assembly.

**[0017]** With reference to FIG. 4, a perspective view of the linkage mechanism 100 in the reclined position is shown, in accordance with an embodiment of the present invention. In embodiments, the linkage mechanism 100 includes a footrest assembly 200, a seat-mounting plate 400, a seat-adjustment assembly 500, a base plate, and a rocker mechanism 410. The footrest assembly 200 is comprised of a plurality of links arranged to extend and collapse the ottomans during adjustment of the rocker recliner between the extended position and the closed position. The seat-mounting plate 400 is configured to fixedly mount to the seat of the rocker recliner, and, in conjunction with an opposed seat-mounting plate, defines a seat support surface (not shown). Generally, the seat-adjustment assembly 500 is adapted to recline and incline the backrest of the rocker recliner, which is coupled to the back-mounting link 510. Further, the seat-adjustment assembly 500 includes links (e.g., the motor bellcrank 430) that indirectly couple an activator bar 350 of a motor assembly 300 to the seat-mounting plate 400, thereby facilitating movement of the rocker-recliner seat in response to actuation of a linear actuator within the motor assembly 300.

**[0018]** As mentioned previously, with reference to FIG. 4, the linkage mechanism 100 is coupled to the motor assembly 300, which provides powered adjustment of the linkage mechanism 100 between the reclined, the extended, and the closed positions. The motor assembly 300 includes a front motor tube 310, a front motor bracket 315, a motor mechanism 320, a front motor tube bracket 325, a track 330, a motor activator block 340, and an activator bar 350. The motor mechanism 320 and the motor activator block 340 are slidably connected via the

track 330. This "linear actuator" comprised of the motor mechanism 320, the track 330, and the motor activator block 340 is held in position and coupled to the linkage mechanism 100 by way of the front motor tube 310 and the activator bar 350. Generally, the front motor tube 310 and the activator bar 350 span between and couple together the linkage mechanism 100 shown in FIG. 1 and its counterpart, mirror-image linkage mechanism (not shown). In embodiments, the front motor tube 310 and the activator bar 350 function as a set of crossbeams and may be formed from square metal tubing. Alternatively, the seat-mounting plate 400 and the plurality of links that comprise the linkage mechanism 100 are typically formed from metal stock, such as stamped, formed steel. However, it should be understood and appreciated that any suitable rigid or sturdy material known in the furniture-manufacturing industry may be used in place of the materials described above. For instance, a rocker element 412 of the rocker mechanism 410 may be molded plastic, fiberglass, or another resilient material.

**[0019]** The front motor tube 310 is attached to the linkage mechanism 100 via the front motor tube bracket 325, which is fixedly coupled to a front ottoman link 110 of the footrest assembly 200. The activator bar 350 includes a pair of opposed ends and is rotatably coupled to the motor bellcrank 430 of the seat-adjustment assembly 500 via a motor pivot bracket 470. The motor mechanism 320 is protected by a housing that is pivotably coupled to the front motor tube 310 via the front motor bracket 315. The motor activator block 340 is attached to the activator bar 350 between the opposed ends by way of fasteners.

**[0020]** In operation, the motor mechanism 320 and the motor activator block 340 cause the motor activator block 340 to longitudinally traverse, or slide, along the track 330. This sliding action produces a lateral force or thrust on the front motor tube 310 and the activator bar 350, which, in turn, generates movement of the linkage mechanism 100. As more fully discussed below, the sliding action of the motor activator block 340, or stroke of the linear actuator, is sequenced into a first phase and a second phase. In an exemplary embodiment, the first phase and second phase are mutually exclusive in stroke. In other words, the linear-actuator stroke of the first phase fully completes before the linear-actuator stroke of the second phase commences, and vice versa.

**[0021]** Initially, the track 330 is operably coupled to the motor mechanism 320 and includes a first travel section 331 and a second travel section 332. The motor activator block 340 translates longitudinally along the track 330 under automated control of the motor mechanism 320 such that the motor activator block 340 translates within the first travel section 331 during the first phase and the second travel section 332 during the second phase. As illustrated in FIG. 4, the dashed line separating the first travel section 331 and the second travel section 332 indicates that the travel sections 331 and 332 abut, however, they do not overlap. It should be realized that the precise length of the travel sections 331 and 332 is provided for demonstrative purposes only, and that the length of the travel sections 331 and 332, or ratio of the linear-actuator stroke allocated to each of the first phase and second phase, may vary from the length or ratio depicted.

**[0022]** Generally, the first phase involves longitudinal translation of the motor activator block 340 along the first travel section 331 of the track 330 that creates a lateral thrust at the front motor tube 310. The lateral thrust invokes movement of the front ottoman link 110. The movement of the front ottoman link 110 invokes and controls adjustment of the footrest assembly 200 between the closed position and the extended position. Further, during the first phase, the motor mechanism 320 moves forward and upward with respect to the rocker mechanism 410 while the motor activator block 340 remains generally fixed in space, thereby extending the footrest assembly 200 from the closed position to the extended position. Once a stroke of the first phase is substantially complete, the second phase occurs.

**[0023]** Generally, the second phase involves longitudinal translation of the motor activator block 340 along the second travel section 332 of the track 330 that creates a lateral thrust at the activator bar 350. The lateral thrust invokes movement of the motor bellcrank 430. The movement of the motor bellcrank 430 invokes and controls adjustment of the seat-adjustment assembly 500 between the extended position and the reclined position. Further, during the second phase, the motor activator block 340 moves rearward with respect to the rocker mechanism 410 while the motor mechanism 320 remains generally fixed in space, thereby adjusting the seat-adjustment assembly 500 from the extended position to the reclined position. In embodiments, a weight of an occupant seated in the rocker recliner and/or springs interconnecting links of the seat-adjustment assembly 500 may assist in creating the sequence. Accordingly, the sequence ensures that adjustment of the footrest between the closed and extended positions is not interrupted by an adjustment of the backrest, and vice versa. In other embodiments, as depicted in FIGS. 9-11, a sequencing assembly integrated within the linkage mechanism 100 is provided to control the adjustment of the rocker recliner.

**[0024]** In one instance, the combination of the motor mechanism 320, the track 330, and the motor activator block 340 is embodied as an electrically powered linear actuator. In this instance, the linear actuator is controlled by a hand-operated controller that provides instructions to the linear actuator. These instructions may be provided upon detecting a user-initiated actuation of the hand-operated controller. Further, these instructions may cause the linear actuator to carry out a complete first phase and/or second phase of movement. Or, the instructions may cause the linear actuator to partially complete the first phase or the second phase of movement. As such, the linear actuator may be capable of being moved to and maintained at various positions within a stroke of the

first phase or the second phase, in an independent manner.

**[0025]** Although a particular configuration of the combination of the motor mechanism 320, the track 330, and the motor activator block 340 has been described, it should be understood and appreciated that other types of suitable devices that provide sequenced adjustment may be used, and that embodiments of the present invention are not limited to a linear actuator as described herein. For instance, the combination of the motor mechanism 320, the track 330, and the motor activator block 340 may be embodied as a telescoping apparatus that extends and retracts in a sequenced manner.

**[0026]** Turning now to FIG. 5, the components of the linkage mechanism 100 will now be discussed in detail. As discussed above, the linkage mechanism 100 includes the footrest assembly 200, the seat-mounting plate 400, the seat-adjustment assembly 500, and the rocker mechanism 410. The footrest assembly 200 includes the front ottoman link 110, a rear ottoman link 120, an outer ottoman link 130, a mid-ottoman bracket 140, an inner ottoman link 150, and a footrest bracket 170. Front ottoman link 110 is rotatably coupled to a forward portion 401 of the seat-mounting plate 400 at pivot 115. The front ottoman link 110 is also pivotably coupled to the outer ottoman link 130 at pivot 113 and the inner ottoman link 150 at pivot 117. Further, the front ottoman link 110 is attached to the front motor tube 310 via the front motor tube.bracket 325 mounted at locations 111. The rear ottoman link 120 is rotatably coupled to the forward portion 401 of the seat-mounting plate 400 at pivot 121 and pivotably coupled to the outer ottoman link 130 at pivot 133. Further, as shown in FIG. 8, the rear ottoman link 120 is pivotably coupled to a forward portion 591 of the footrest drive link 590, of the seat-adjustment assembly 500, at pivot 275. During adjustment in the first phase (i.e., adjustment between the closed and extended positions), directional force transferred by the linear actuator to the front ottoman link 110 causes the footrest assembly 200 to push out to the extended position or to collapse to the closed position. This movement of the footrest assembly 200, and specifically of the rear ottoman link 120, within the first phase invokes translation of the footrest drive link 590. The translation of the footrest drive link 590, in turn, shifts a sequence element 526 within a guide slot 551 of a sequence link 550 between a first region 555 and a second region 556, as described more fully below, with reference to FIGS. 9-11.

**[0027]** The outer ottoman link 130 is pivotably coupled on one end to the rear ottoman link 120 at the pivot 133 and the front ottoman link 110 at the pivot 113. At an opposite end, the outer ottoman link 130 is pivotably coupled to the footrest bracket 170 at pivot 172. Between the ends of the outer ottoman link 130, the mid-ottoman bracket 140 is pivotably coupled thereto at pivot 135. The mid-ottoman bracket 140 is also pivotably coupled to the inner ottoman link 150 at pivot 141. The inner ottoman link 150 is further pivotably coupled to the front ottoman link 110 at the pivot 117 and to the footrest bracket 170 at pivot 175. In embodiments, the footrest bracket 170 and the mid-ottoman bracket 140 are designed to attach to ottomans, such as the first foot-support ottoman 45 and the second foot-support ottoman 47, respectively. In a specific instance, as shown in FIGS. 2 and 5, the footrest bracket 170 and the mid-ottoman bracket 140 support respective ottomans in a substantially horizontal disposition when the footrest assembly 200 is fully extended upon completion of the first phase of adjustment.

**[0028]** With reference to FIG. 4, the pair of rocker mechanisms 410 that moveably support the linkage mechanism 100 will now be described. Typically, each rocker mechanism 410 serves to provide vertical support for a respective linkage mechanism 100 above the underlying surface while allowing an occupant of the rocker recliner to easily tilt, sway, or rock the linkage mechanism 100 forward and/or rearward. Each of the rocker mechanisms 410 include a rocker base 411, a rocker element 412, and at least one spring 425. The rocker base 411 includes a front end, a rear end, and a mid section 416. Typically, the front end and the rear end attach to respective legs that stabilize the rocker base 411 above the underlying surface. Further, the rocker base 411 includes a rearward portion 417 tat intermittently contacts with a wheel 530, as more fully discussed below.

**[0029]** In embodiments, the rocker element 412 is formed with a convex curvature 413, or bevel, that rollably engages to or physically rides upon the mid section 416 of the rocker base 411. Typically, each rocker element 412 is attached to a respective base plate 580. In a particular instance, the rocker element 412 is fixedly coupled to the base plate 580 at a forward location 581 and at a mid location 582 (see FIGS. 5 and 8). The spring(s) 425 serve to interconnect the rocker base 411 and the rocker element 412. As illustrated in FIG. 4, the spring(s) 425 are embodied as a pair of vertically disposed compression springs that extend between an upper bracket 418 and a lower bracket 419. The upper bracket 418 is mounted to the rocker element 412 while the lower bracket 419 is mounted to a pair of lower crossbeams 415 that span between the rocker elements 412. These lower crossbeams 415, in cooperation with upper crossbeams 414, interconnect the rocker elements 412 and provide lateral support thereto.

**[0030]** In operation, the interconnection of the spring(s) 425 between the rocker base 411 and the rocker element 412 facilitates a controlled sway of the rocker element 412, as the rocker element's 412 convex curvature 413 rollably rides over an upper flattened surface of the rocker base 411. This controlled sway of the rocker element 412, with respect to the underlying surface, is translated to the base plate 580 that couples to the linkage mechanism 100. Accordingly, the controlled sway enabled by the rocker mechanism 410 allows an occupant sitting in the rocker recliner to easily tilt or rock the linkage mechanism 100 back and forth in a rocking motion with minimal effort. Although the controlled sway is described herein

as being facilitated by the spring(s) 425, it should be appreciated and understood that various other devices (e.g., air cylinders or dampeners) or components (e.g., compressible members) may be employed to restrain, enhance, and/or control the sway furnished by the rocker mechanisms 410.

**[0031]** Turning now to FIGS. 5 and 8, the interconnecting links of the seat-adjustment assembly 500 will now be discussed. Initially, in embodiments, the seat-adjustment assembly 500 includes a motor bellcrank 430, a front lift link 440, a front pivot link 450, a lifter link 460, the motor pivot bracket 470 (see FIG. 5), the back-mounting link 510, a rear pivot link 520, a wheel 530, a wheel link 540, a sequence link 550, a wheel control link 565, and the footrest drive link 590.

**[0032]** As discussed above, the footrest drive link 590 is pivotably coupled at the forward portion 591 to the rear ottoman link 120, of the footrest assembly 200, at the pivot 275. In addition, the footrest drive link 590 is pivotably coupled at a back end 593 to the rear pivot link 520 at pivot 525. In an exemplary embodiment, the pivot 525 is coupled to a generally cylindrical sequence element 526 (e.g., bushing, disc, wheel, and the like) that extends, at least partially within a longitudinal guide slot (see reference numeral 551 of FIG. 8) formed (e.g., laser cut or stamped) within a lower portion 554 of the sequence link 550. In one embodiment, the sequence element 526 is rollably or slidably engaged within the guide slot 551 and laterally captured between the footrest drive link 590 and the rear pivot link 520. Although various configurations of the assembly and interplay between the guide slot 551 and the sequence element 526 have been described, it should be understood and appreciated that other types of suitable mechanisms that allow longitudinal shifting of a pivot location between links may be used, and that embodiments of the present invention are not limited to the slot-and-element configuration described herein. For instance, the sequence element 526 and the guide slot 551 may be replaced by a track that guides a roller in a predefined trajectory in order to achieve sequencing of adjustment.

**[0033]** In instances of the present invention, the guide slot 551 represents a pill-shaped aperture formed within the lower portion 554 of the sequence link 550. Further, a central, longitudinal axis of the guide slot 551 may be substantially aligned with a central, longitudinal axis of the sequence link 550. In an exemplary embodiment, the sequence element 526 fully extends through the guide slot 551 such that the sequence element 526 substantially spans between the footrest drive link 590 and the rear pivot link 520, which laterally retain the sequence link 550 onto the sequence element 526. In operation, the guide slot 551 acts to guide in a predetermined trajectory and retain the sequence element 526 (see FIGS. 9-11). Further, the guide slot 551 of the sequence link 550 assists in ensuring the first phase and second phase of the linear-actuator stroke do not interfere with or overlap each other.

**[0034]** Beyond being rollably or slidably engaged within the guide slot 551 of the sequence link 550 at the pivot 525, the rear pivot link 520 is rotatably coupled to the back-mounting link 510 at pivot 521. Similarly, an upper portion 553 of the sequence link 550 is rotatably coupled to the back-mounting link 510 at pivot 552. In an exemplary embodiment, the pivot 521 is rearward of the pivot 552, with respect to the rocker recliner. Further, the pivot 552 is rearward of pivot 511, which rotatably couples a rearward portion 402 of the seat-mounting plate 400 to the back-mounting link 510. Further yet, the pivot 511 is rearward of pivot 515, which pivotably couples the back-mounting link 510 to a back end 442 of the front lift link 440, as discussed more fully below.

**[0035]** Turning now to FIGS. 5 - 8, a remainder of the seat-adjustment assembly 500 will now be described. As discussed above, the rear pivot link 520 is rotatably coupled to the back-mounting link 510 at pivot 521 and to the footrest drive link 590 at pivot 525. Additionally, the rear pivot link 520 is pivotably coupled to a rearward portion 583 of the base plate 580 at pivot 522. The base plate 580 is further pivotably coupled to a front end 461 of the lifter link 460 at pivot 466, which is located forward of the mid location 582 of the base plate 580. A back end 462 of the lifter link 460 is pivotably coupled to a second end 434 of the motor bellcrank 430 at pivot 465.

**[0036]** In an exemplary embodiment, the motor bellcrank 430 is an L-shaped link that includes a mid portion 433 located between a first end 432 and the second end 434. As mentioned above, the activator bar 350 is rotatably coupled to the first end 432 of the motor bellcrank 430 via the motor pivot bracket 470 of the motor assembly 300 at pivot 431. The front lift link 440 includes a front end 441 and a back end 442. In embodiments, the back end 442 of the front lift link 440 is pivotably coupled to the back-mounting link 510 at pivot 515. The front end 441 of the front lift link 440 is pivotably coupled to the front pivot link 450 at pivot 445. The mid portion 433 of the motor bellcrank 430 is rotatably coupled to a section between the front end 441 and the back end 442 of the front lift link 440. The front pivot link 450 is also coupled to the base plate 580 at pivot 446. The pivot 446 is positioned forward of the pivot 466 on the base plate 580, which is positioned forward of the forward location 581 that attaches the rocker element 412 to the base plate 580.

**[0037]** The back-mounting link 510 serves to support the backrest and is angled rearwardly to a reclined orientation when the linkage mechanism 100 is moved from the extended position to the reclined position. The back-mounting link 510 is pivotably coupled to the back end 442 of the front lift link 440 at the pivot 515, the upper portion 553 of the sequence link 550 at pivot 552, and the rear pivot link 520 at the pivot 521. Also, the back-mounting link 510 is rotatably coupled to the rearward portion 402 of the seat-mounting plate 400 at pivot 511.

**[0038]** The seat-mounting plate 400 serves to support the seat of the rocker recliner. The seat-mounting plate

400 is situated in a substantially horizontal orientation when the linkage mechanism 100 resides in the closed position and the extended position. But, when the linkage mechanism 100 is adjusted to the reclined position, with the assistance of the linear actuator, the seat-mounting plate 400 is shifted upward and rotated slightly rearward, thereby orientating the seat in a slightly angled position. The seat-mounting plate 400 is pivotably coupled to the front ottoman link 110 and the rear ottoman link 120 of the footrest assembly 200 at the pivots 115 and 121, respectively. Also, the seat-mounting plate 400 is pivotably coupled to the back-mounting link 510 of the seat-adjustment assembly 500 at the pivot 511. As illustrated in the FIGS. 5-8, the locations of the pivots that interconnect the linkage mechanism 100 and the seat-mounting plate 400 are configured to translate the seat-mounting plate 400 at a substantially consistent inclination angle, with respect to the base plate 580, throughout the adjustment of the rocker recliner between the closed position, the extended position, and the reclined position.

**[0039]** The rear pivot link 520 is pivotably coupled to the wheel link 540 at pivot 527. The wheel link 540 is pivotably coupled to the wheel control link 565 at pivot 567 and is rotatably coupled to the rear pivot link 520 at the pivot 527. At a lower end, a wheel 530 is rotatably coupled to the wheel link 540 at pivot 541. The wheel link 540 is substantially vertically orientated when the linkage mechanism 100 is adjusted to the extended and reclined positions. This configuration of the wheel link 540 brings the wheel 530 within close proximity of an upper surface of the rearward portion 417 of the rocker base 411. Further, the wheel 530 and the upper portion of the rocker base 411 are aligned to induce contact upon the occurrence of excessive rocking, thereby reducing exaggerated rearward tilt of the rocker mechanism 410 upon the wheel 530 contacting the upper portion of the rocker base 411.

**[0040]** The wheel control link 565 is pivotably coupled to the wheel link 540 at the pivot 567 and to the base plate 580 at pivot 566. Generally, the wheel control link 565 functions to retract the wheel 530 from the close proximity to the upper portion of the rocker base 411 when the linkage mechanism 100 is adjusted from the extended position to the closed position. As discussed above, the base plate 580 is fixedly attached to the upper portion of the rocker element 412 at the locations 581 and 582. Further, the base plate 580 is pivotably coupled to a variety of linkages: the rear pivot link 520 at the pivot 522, the wheel control link 565 at the pivot 566, the lifter link 460 at pivot 466, and the front pivot link 450 at pivot 446.

**[0041]** The operation of the seat-adjustment assembly 500 will now be discussed with reference to FIGS. 5-11. Initially, an occupant of the rocker recliner may invoke an adjustment from the reclined position (FIGS. 3, 4, 5, 8, and 11) to the extended position (FIGS. 2, 6, and 10) in an effort to sit upright for viewing television. In an exemplary embodiment, the occupant may invoke an actuation at a hand-operated controller that sends a control signal with instructions to the linear actuator. As discussed above, the linear actuator moves in a sequenced manner, which is enforced by a weight of the occupant, a placement of springs within the seat-adjustment assembly 500, and/or a configuration of the sequence link 550 and sequence element 526. Typically, the movement of the linear actuator is sequenced into two substantially independent strokes: the first phase (adjusting between the closed and extended positions), and the second phase (adjusting between the extended and reclined positions).

**[0042]** Upon receiving the control signal from the hand-operated controller when the linkage mechanism 100 resides in the reclined position, the linear actuator carries out a stroke in the second phase. That is, with reference to FIG. 4, the linear actuator slides the motor activator block 340 forward with respect to the rocker mechanism 410 while holding the motor mechanism 320 relatively fixed in space. This sliding action of the motor activator block 340 pulls the activator bar 350 and the attached motor pivot bracket 470 forward. The forward force on the motor pivot bracket 470 creates a clockwise moment 705 (see FIG. 6) on the motor bellcank 430 about the pivot 435 that pulls the front lift link 440 downward. This pulling action is caused, in part, by the rotation of the motor bellcrank 430 at the pivot 465, which pivotably couples the motor bellcrank 430 to the lifter link 460. The lifter link 460 is restrained from translational movement by its pivotable coupling to the base plate 580 at the pivot 466.

**[0043]** Further, the downward pulling action on the front lift link 440 creates a counter-clockwise moment 701 (see FIG. 6) of the back-mounting link 510 about the pivot 511, which rotatably couples the back-mounting link 510 to the seat-mounting plate 400. This moment 701 of the back-mounting link 510 inclines the attached seat and causes the sequence element 526, which is coupled to the rear pivot link 520 at the pivot 525, to slide in an upward trajectory within the longitudinal guide slot 551 of the sequence link 550. In an exemplary embodiment, the sequence element 526 slides from the second region 556 (see FIG. 11) to the first region 555 (see FIG. 10) of the guide slot 551. As discussed above, if the sequence element 526 resides within the second region 556 (when the rocker recliner is adjusted to the reclined position), the interaction of the sequence element 526 and the sequence link 550 resists adjustment of the rocker recliner directly from the reclined position to the closed position. Then, upon the back-mounting link 510 rotating to a position that causes contact between a rear stop 420 and the front lift link 440, the linkage mechanism 100 has achieved the extended position and the linear actuator has completed the stroke of the second phase.

**[0044]** The operation of the footrest assembly 200 will now be discussed with reference to FIGS. 6 and 7. As discussed above, when desiring to move from the extended position (FIG. 6) to the closed position (FIG. 7),

the occupant may invoke an actuation at the hand-operated controller that sends the control signal with instructions to the linear actuator to carry out a stroke in the first phase. Upon receiving the control signal from the hand-operated controller, the linear actuator slides the motor mechanism 320 rearward with respect to the rocker mechanism 410 while holding the motor activator block 340 relatively fixed in space. This sliding action of the motor mechanism 320 pulls the front motor tube 310 and the attached front ottoman link 110 rearward. In an exemplary embodiment, the rearward force on the front ottoman link 110 removes the front ottoman link 110 from contact with a front stop 422, which serves to limit the extension of the footrest assembly 200.

**[0045]** Further, the rearward force on the front ottoman link 110 indirectly causes a rearward translation of the footrest drive link 590. This rearward translation of the footrest drive link 590 directly creates a movement 711 of the rear pivot link 520 about the pivot 521, which rotatably couples the rear pivot link 520 to the back-mounting link 510. This movement 711 (see FIG. 7) functions to slide the sequence element 526 (coupled to the rear pivot link 520 at the pivot 525) in an downward trajectory within the longitudinal guide slot 551 of the sequence link 550.

**[0046]** In an exemplary embodiment of the first phase, the sequence element 526 slides from the first region 555 (see FIG. 10) to the second region 556 (see FIG. 9) of the guide slot 551. As discussed above, if the sequence element 526 resides within the first region 555 (when the rocker recliner is adjusted to the extended position), the interaction of the sequence element 526 and the sequence link 550 allows adjustment of the rocker recliner to either the reclined position or to the closed position. However, upon adjusting the rocker recliner to the closed position, the sequence element 526 resides within the second region 556 (see FIG. 9) and the interaction of the sequence element 526 and the sequence link 550 resists adjustment of the rocker reclined directly from the closed position to the reclined position. Further, the movement 711 functions to slightly lift upward and tilt forward the back-mounting link 510. This forward tilt of the back-mounting link 510 pulls the front lift link 440 downward at the pivot 515 about the pivot 445. Once the front lift link 440 is pulled downward to a position where it makes contact with a mid stop 421 attached to the seat-mounting plate 400 (see FIG. 7), the linkage mechanism 100 has achieved the closed position.

**[0047]** In a manner that is reverse to the steps discussed above, with reference to adjustment of the footrest assembly 200 from the closed position to the extended position, the automated force of the motor mechanism 320 on the front motor tube 310 in the first phase of the linear-actuator stroke rotates the front ottoman link 110 about the pivot 115. This rotation acts to extend the footrest assembly 200 and causes the links 110, 120, 130, and 150 to move upwardly and/or rotate in a clockwise direction. Also, the brackets 140 and 170 are raised and rotated in a clockwise fashion such that the ottomans 45 and 47 (see FIGS. 1-3) are adjusted from a collapsed, generally vertical orientation to an extended, generally horizontal orientation. Extension of the footrest assembly is restrained upon the front ottoman link 110 coming into contact with the front stop 422.

**[0048]** In addition, upon completion of the first phase, continued actuation of the linear actuator causes the adjustment of the linkage mechanism 100 within the second phase of the linear-actuator stroke. Within the second phase, the automated force of the motor activator block 340 on the activator bar 350 rotates the motor bellcrank 430 in a counter-clockwise direction about the pivot 435 (with respect to FIGS. 5 - 7), which acts to raise the front lift link 440 and, in turn, bias rearward the back-mounting link 510 via the pivot 515. The rearward bias of the back-mounting link 510, as well as continued adjustment within the second phase, is restrained upon the completion of the stroke within the second phase.

**[0049]** With reference to FIGS. 12-16, the exemplary configurations of a linkage mechanism 1000 for a glider-recliner-type seating unit (hereinafter "glider recliner) are shown and will now be discussed. The linkage mechanism 1000 is arranged to articulably actuate and control movement of a seat, a backrest, and ottoman(s) of the glider recliner when the linkage mechanism 1000 is adjusted between the positions shown in FIGS. 13-15. That is, the linkage mechanism 1000 is adjustable to three basic positions: the reclined position (FIG. 13), the extended (TV) position (FIG. 14), and the closed position (FIG. 15). In the reclined position, as shown in FIG. 13, the backrest is rotated rearwardly by the linkage mechanism 1000 and biased in a rearward inclination angle, which is an obtuse angle in relation to the seat. When the glider recliner is adjusted to the extended position, as shown in FIG. 14, the ottomans are extended forward and disposed generally horizontal, while the backrest remains substantially perpendicular to the seat. The closed position of FIG. 15 is a normal non-reclined sitting position with the seat in a generally horizontal position and the back generally upright and in a substantial, perpendicular-biased relation to the seat.

**[0050]** Further, the linkage mechanism 1000 comprises a plurality of linkages that are arranged to actuate and control movement of the glider recliner during adjustment between the closed, the extended, and the reclined position. As with the linkage mechanism 100 of the rocker recliner, these linkages may be pivotably interconnected via a variety of configurations, such as pivot pins, bearings, traditional mounting hardware, rivets, bolt and nut combinations, or any other suitable fasteners which are well-known in the furniture-manufacturing industry.

**[0051]** Generally, the linkage mechanism 1000 guides the rotational movement of the backrest, the translation of the seat, and the extension of the ottoman(s). In an exemplary configuration, these movements are controlled by a pair of essentially mirror-image linkage mechanisms (one of which is shown herein and indicated by

reference numeral 1000), which comprise an arrangement of pivotably interconnected linkages. The linkage mechanisms are typically disposed in opposing-facing relation about a longitudinally-extending plane that bisects the glider recliner between the pair of opposed arms. As such, the ensuing discussion will focus on only one of the linkage mechanisms 1000, with the content being equally applied to the other, complimentary, linkage assembly.

**[0052]** With reference to FIG. 12, a perspective view of the linkage mechanism 1000 in the reclined position is shown, in accordance with an embodiment of the present invention. In embodiments, the linkage mechanism 1000 includes the footrest assembly 200, the seat-mounting plate 400, a seat-adjustment assembly 700, and a glide assembly 600. The footrest assembly 200 is comprised of a plurality of links arranged to extend and collapse the ottomans during adjustment of the glider recliner between the extended position and the closed position. The seat-mounting plate 400 is configured to fixedly mount to the seat of the glider recliner, and, in conjunction with an opposed seat-mounting plate, defines the seat support surface. Generally, the seat-adjustment assembly 700 is adapted to recline and incline the backrest of the glider recliner, which is coupled to the back-mounting link 510. Further, the seat-adjustment assembly 700 includes links that indirectly couple an activator bar 350 of the motor assembly 300 to the seat-mounting plate 400, thereby facilitating movement of the glider-recliner seat in response to actuation of the linear actuator within the motor assembly 300. As mentioned previously, with reference to FIG. 4, the motor assembly 300 provides powered adjustment between the reclined, the extended, and the closed positions. Because the incorporation of the motor mechanism 300 to the linkage mechanism 100 of the rocker recliner is substantially similar to the incorporation of the motor mechanism 300 to the linkage mechanism 1000 of the glider recliner, the components, configuration, and functionality of the motor mechanism 300 will not be reiterated.

**[0053]** Turning now to FIG. 13, the components of the linkage mechanism 1000 will now be discussed in detail. As discussed above, the linkage mechanism 1000 includes the footrest assembly 200, the seat-mounting plate 400, the seat-adjustment assembly 700, and the glide assembly 600. The configuration of the footrest assembly 200 is substantially similar to that of the rocker recliner, as discussed above, and will not be reiterated. The glide assembly 600 serves to provide vertical support for a remainder of the linkage mechanism 1.000. The glide assembly 600 includes a glide bracket 740 that is fixedly mounted to a chassis that raises the linkage mechanism 1000 above an underlying surface (not shown). The glide assembly 600 also includes a carrier link 750 that is coupled to the footrest assembly 200 and the seat-adjustment assembly 700.

**[0054]** Generally, the carrier link 750 is configured to swing, oscillate, or glide both forward and backward with respect to the stationary glide bracket 740. Typically, the glide bracket 740 and the carrier link 750 are moveably coupled by a plurality of intermediate glide links that allow forward and rearward translation of the linkage mechanism 1000 with respect to the underlying surface. In an exemplary embodiment, the pair of glide links include a rear glide link 560 and a front glide link 570. An upper end of the rear glide link 560 is pivotably coupled to the glide bracket 740 at pivot 586, while a lower end of the rear glide link 560 is pivotably coupled to the carrier link 750 at pivot 585. An upper end of the front glide link 570 is pivotably coupled to the glide bracket 740 at pivot 576, while a lower end of the front glide link 570 is pivotably coupled to the carrier link 750 at pivot 575. In operation, the rear glide link 560 and the front glide link 570 swing in concert to translate the carrier link 750 with respect to the glide bracket 740. Specifically, the pivots 575, 576, 585, and 586 are arranged to allow the rear glide link 560 and the front glide link 570 to sway in substantially parallel-spaced relation to each other; thus, facilitating the glide action of the linkage mechanism 1000.

**[0055]** Turning now to FIGS. 13 and 16, the interconnecting links of the seat-adjustment assembly 700 will now be discussed. Initially, in embodiments, the seat-adjustment assembly 700 includes the motor bellcrank 430, the front lift link 440, a carrier link 750, the lifter link 460, the motor pivot bracket 470 (see FIG. 13), the back-mounting link 510, the rear pivot link 520, a rear link 710, a blocker control link 720, the sequence link 550, a hook link 730, and the footrest drive link 590. As discussed above, the footrest drive link 590 is pivotably coupled at the forward portion 591 to the rear ottoman link 120, of the footrest assembly 200, at the pivot 275. Further, the footrest drive link 590 is indirectly coupled to the glide assembly 600 via the blocker control link 720 and the hook link 730. That is, a rearward portion 592 of the footrest drive link 590 is pivotably coupled to an upper end 543 of the blocker control link 720 at pivot 545, while a lower end 542 of the blocker control link 720 is pivotably coupled to a back end of the hook link 730 at pivot 569 (see FIG. 14). A front end of the hook link 730 is rotatably coupled to a mid portion 451 of the carrier link 750 of the glide assembly at pivot 586.

**[0056]** In addition, the footrest drive link 590 is pivotably coupled at the back end 593 to the rear pivot link 520 at the pivot 525. In an exemplary embodiment, the pivot 525 is coupled to a generally cylindrical sequence element 526 that extends, at least partially within a longitudinal guide slot (see reference numeral 551 of FIG. 16) formed within a lower portion 554 of the sequence link 550. Beyond being engaged within the guide slot 551 of the sequence link 550 at the pivot 525, the rear pivot link 520 is rotatably coupled to the back-mounting link 510 at pivot 521. Similarly, an upper portion 553 of the sequence link 550 is rotatably coupled to the back-mounting link 510 at the pivot 552. In an exemplary embodiment, the pivot 521 is rearward of the pivot 552, with respect to the glider recliner. Further, the pivot 552 is rearward

of pivot 511, which rotatably couples a rearward portion 402 of the seat-mounting plate 400 to the back-mounting link 510. Further yet, the pivot 511 is rearward of pivot 515, which pivotably couples the back-mounting link 510 to the back end 442 of the front lift link 440, as discussed more fully above.

**[0057]** Turning now to FIGS. 13-16, a remainder of the seat-adjustment assembly 700 will now be described. As discussed above, the rear pivot link 520 is rotatably coupled to the back-mounting link 510 at the pivot 521 and to the footrest drive link 590 at the pivot 525. Additionally, the rear pivot link 520 is pivotably coupled to an upper end of the rear link 710 at the pivot 522. A lower end of the rear link 710 is pivotably coupled to the carrier link 750 at the pivot 535. In an exemplary embodiment, the pivot 535 is located rearward of the mid portion 451 of the carrier link 750. The carrier link 750 is further pivotably coupled to the front end 461 of the lifter link 460 at the pivot 466, which is located forward of the mid portion 451. The back end 462 of the lifter link 460 is pivotably coupled to the second end 434 of the motor bellcrank 430 at pivot 465.

**[0058]** As mentioned above, the activator bar 350 is rotatably coupled to the first end 432 of the motor bellcrank 430 via the motor pivot bracket 470 of the motor assembly 300 at pivot 431. In embodiments, the back end 442 of the front lift link 440 is pivotably coupled to the back-mounting link 510 at pivot the 515. The front end 441 of the front lift link 440 is pivotably coupled to the carrier link 750 at the pivot 445. The mid portion 433 of the motor bellcrank 430 is rotatably coupled to the section between the front end 441 and the back end 442 of the front lift link 440.

**[0059]** In embodiments, the back-mounting link 510 of the linkage mechanism 1000 is pivotably coupled to the back end 442 of the front lift link 440 at the pivot 515, the upper portion 553 of the sequence link 550 at the pivot 552, and the rear pivot link 520 at the pivot 521. Also, the back-mounting link 510 is rotatably coupled to the rearward portion 402 of the seat-mounting plate 400 at pivot 511. Further, the sequence link 550 is rotatably coupled to the back-mounting link 510 at the pivot 552 and, as discussed more fully above, includes a longitudinal slot (see reference numeral 551 of FIG. 16).

**[0060]** The seat-mounting plate 400 serves to support the seat of the glider recliner. In embodiments, the seat-mounting plate 400 is pivotably coupled to the front ottoman link 110 and the rear ottoman link 120 of the footrest assembly 200 at the pivots 115 and 121, respectively. Also, the seat-mounting plate 400 is pivotably coupled to the back-mounting link 510 of the seat-adjustment assembly 700 at the pivot 511. As illustrated in the FIGS. 13-16, the locations of the pivots that interconnect the linkage mechanism 1000 and the seat-mounting plate 400 are configured to translate the seat-mounting plate 400 at a substantially consistent inclination angle, with respect to the glide bracket 740, throughout the adjustment of the glider recliner between the closed position, the extended position, and the reclined position.

**[0061]** The operation of the seat-adjustment assembly 700 will now be discussed with reference to FIGS. 9-16. Initially, an occupant of the glider recliner may invoke an adjustment from the reclined position (FIGS. 3, 11, and 13) to the extended position (FIGS. 2, 10, and 14) in an effort to sit upright for viewing television. In an exemplary embodiment, the occupant may invoke an actuation at a hand-operated controller that sends a control signal with instructions to the linear actuator. As discussed above, the linear actuator moves in a sequenced manner, which is enforced by a weight of the occupant, a placement of springs within the seat-adjustment assembly 700, and/or a configuration of the sequence link 550 and sequence element 526. Typically, the movement of the linear actuator is sequenced into two substantially independent strokes: the first phase (adjusting between the closed and extended positions), and the second phase (adjusting between the extended and reclined positions).

**[0062]** Upon receiving the control signal from the hand-operated controller when the linkage mechanism 1000 resides in the reclined position, the linear actuator carries out a stroke in the second phase. That is, with reference to FIG. 12, the linear actuator slides the motor activator block 340 forward with respect to the glide assembly 600 while holding the motor mechanism 320 relatively fixed in space. This sliding action of the motor activator block 340 pulls the activator bar 350 and the attached motor pivot bracket 470 forward. The forward force on the motor pivot bracket 470 creates the clockwise moment 705 (see FIG. 14) on the motor bellcrank 430 about the pivot 435 that pulls the front lift link 440 downward. This pulling action is caused, in part, by the rotation of the motor bellcrank 430 at the pivot 465, which pivotably couples the motor bellcrank 430 to the lifter link 460. The lifter link 460 is restrained from translational movement by its pivotable coupling to the carrier link 750 at the pivot 466.

**[0063]** Further, the downward pulling action on the front lift link 440 creates the counter-clockwise moment 701 (see FIG. 14) of the back-mounting link 510 about the pivot 511, which rotatably couples the back-mounting link 510 to the seat-mounting plate 400. This moment 701 of the back-mounting link 510 inclines the attached seat and causes the sequence element 526, which is coupled to the rear pivot link 520 at the pivot 525, to slide in an upward trajectory within the longitudinal guide slot 551 of the sequence link 550. In an exemplary embodiment, the sequence element 526 slides from the second region 556 (see FIG. 11) to the first region 555 (see FIG. 10) of the guide slot 551. As discussed above, if the sequence element 526 resides within the second region 556 (when the glider recliner is adjusted to the reclined position), the interaction of the sequence element 526 and the sequence link 550 resists adjustment of the glider recliner directly from the reclined position to the closed position. Then, upon the back-mounting link 510 rotating to a position that causes contact between a rear stop 420 and the front lift link 440, the linkage mechanism 1000

has achieved the extended position and the linear actuator has completed the stroke of the second phase.

**[0064]** The operation of the footrest assembly 200 will now be discussed with reference to FIGS. 14 and 15. As discussed above, when desiring to move from the extended position (FIG. 14) to the closed position (FIG. 15), the occupant may invoke an actuation at the hand-operated controller that sends the control signal with instructions to the linear actuator to carry out a stroke in the first phase. Upon receiving the control signal from the hand-operated controller, the linear actuator slides the motor mechanism 320 rearward with respect to the glide assembly 600 while holding the motor activator block 340 relatively fixed in space. This sliding action of the motor mechanism 320 pulls the front motor tube 310 and the attached front ottoman link 110 rearward. In an exemplary embodiment, the rearward force on the front ottoman link 110 removes the front ottoman link 110 from contact with a front stop 422, which serves to limit the extension of the footrest assembly 200.

**[0065]** Further, the rearward force on the front ottoman link 110 indirectly causes a rearward translation of the footrest drive link 590. This rearward translation of the footrest drive link 590 directly creates a movement 711 of the rear pivot link 520 about the pivot 521, which rotatably couples the rear pivot link 520 to the back-mounting link 510. This movement 711 (see FIG. 15) functions to slide the sequence element 526 (coupled to the rear pivot link 520 at the pivot 525) in an downward trajectory within the longitudinal guide slot 551 of the sequence link 550.

**[0066]** In an exemplary embodiment of the first phase, the sequence element 526 slides from the first region 555 (see FIG. 10) to the second region 556 (see FIG. 9) of the guide slot 551. As discussed above, if the sequence element 526 resides within the first region 555 (when the glider recliner is adjusted to the extended position), the interaction of the sequence element 526 and the sequence link 550 allows adjustment of the glider recliner to either the reclined position or to the closed position. However, upon adjusting the glider recliner to the closed position, the sequence element 526 resides within the second region 556 (see FIG. 9) and the interaction of the sequence element 526 and the sequence link 550 resists adjustment of the glider reclined directly from the closed position to the reclined position. Further, the movement 711 functions to slightly lift upward and tilt forward the back-mounting link 510. This forward tilt of the back-mounting link 510 pulls the front lift link 440 downward at the pivot 515. Once the front lift link 440 is pulled downward to a position where it makes contact with a mid stop 421, the linkage mechanism 1000 has achieved the closed position.

**[0067]** In a manner that is reverse to the steps discussed above, with reference to operation of the footrest assembly 200 from the closed position to the extended position, the automated force of the motor mechanism 320 on the front motor tube 310 in the first phase of the linear-actuator stroke rotates the front ottoman link 110 about the pivot 115. This rotation acts to extend the footrest assembly 200 and causes the links 110, 120, 130, and 150 to move upwardly and/or rotate in a clockwise direction. Also, the brackets 140 and 170 are raised and rotated in a clockwise fashion such that the ottomans 45 and 47 (see FIGS. 1-3) are adjusted from a collapsed, generally vertical orientation to an extended, generally horizontal orientation. Extension of the footrest assembly is restrained upon the front ottoman link 110 coming into contact with the front stop 422.

**[0068]** In addition, upon completion of the first phase, continued actuation of the linear actuator causes the adjustment of the linkage mechanism 1000 within the second phase of the linear-actuator stroke. Within the second phase, the automated force of the motor activator block 340 on the activator bar 350 rotates the motor bellcrank 430 in a counter-clockwise direction about the pivot 435 (with respect to FIGS. 13-16), which acts to raise the front lift link 440 and, in turn, bias rearward the back-mounting link 510 via the pivot 515. The rearward bias of the back-mounting link 510, as well as continued adjustment within the second phase, is restrained upon the completion of the stroke within the second phase.

**[0069]** It should be understood that the construction of the linkage mechanisms 100 and 1000 lend themselves to enable the various links and brackets to be easily assembled and disassembled from the remaining components of the rocker/glider recliner. Specifically the nature of the pivots and/or mounting locations, allows for use of quick-disconnect hardware, such as a knock-down fastener. Accordingly, rapid disconnection of components prior to shipping, or rapid connection in receipt, is facilitated.

**[0070]** The present invention has been described in relation to particular embodiments, which are intended in all respects to be illustrative rather than restrictive.

## Claims

**1.** A seating unit (10), comprising:

a pair of seat-mounting plates (400) in substantially parallel-spaced relation, wherein each of the seat-mounting plates (400) is disposed in an inclined orientation in relation to an underlying surface;

a pair of generally mirror-image linkage mechanisms (100; 1000) adapted to move the seating unit (10) between a closed position, an extended position, and a reclined position, wherein each of the linkage mechanisms (100; 1000) comprises:

(a) a back-mounting link (510) rotatably coupled to a respective seat-mounting plate (400) and configured to support a backrest

(25) of the seating unit (10);
(b) a sequence link (550) rotatably coupled to the back-mounting link (510), wherein the sequence link (550) includes a guide slot (551);
(c) a rear pivot link (520) rotatably coupled to the back-mounting link (510) and to a sequence element (526), wherein the sequence element (526) extends into the guide slot (551), and wherein interaction between the sequence element (526) and the sequence link (550) resists direct adjustment between the closed position and the reclined position;
(d) a motor bellcrank (430) having a mid portion (433) located between a first end (431) and a second end (432), wherein an activator bar (350) is rotatably coupled to the first end (431) of the motor bellcrank (430); and
(e) a front lift link (440) having a front end (441) and a back end (442), wherein the back end (442) of the front lift link (440) is pivotably coupled to the back-mounting link (510), and wherein the mid portion (433) of the motor bellcrank (430) is rotatably coupled to a section between the front end (441) and the back end (442) of the front lift link (440); and

a linear actuator (320, 330, 340), coupled to the activator bar (350), that is sequenced into a mutually exclusive first phase and second phase, wherein the first phase moves the linkage mechanisms (100; 1000) between the closed position and the extended position, and wherein
the second phase moves the linkage mechanisms (100; 1000) between the extended position and the reclined position.

**2.** The seating unit (10) of claim 1,
wherein the seating unit (10) has a seat (15) that is translatable with respect to the underlying surface and a backrest (25) that is angularly adjustable with respect to the seat (15),
wherein the guide slot (551) of the sequence link (550) includes a first region (555) and a second region (556);
wherein the sequence element (526) resides within the second region (556) of the guide slot (551) when the seating unit (10) is adjusted to the reclined position, and when the seating unit (10) is adjusted to the reclined position, the interaction of the sequence element (526) and the sequence link (550) resists adjustment of the seating unit (10) to the closed position,
wherein the sequence element (526) resides within the first region (555) of the guide slot (551) when the seating unit (10) is adjusted to the extended position, and when the seating unit (10) is adjusted to the extended position, the interaction of the sequence element (526) and the sequence link (550) allows adjustment of the seating unit (10) to either the reclined position or to the closed position, and
wherein the sequence element (526) resides within the second region (556) of the guide slot (551) when the seating unit (10) is adjusted to the closed position, and when the seating unit (10) is adjusted to the closed position, the interaction of the sequence element (526) and the sequence link (550) resists adjustment of the seating unit to the reclined position.

**3.** The seating unit (10) of claim 2, wherein the sequence link (550) includes an upper portion (553) and a lower portion (554), wherein the upper portion (553) is rotatably coupled to the back-mounting link (510).

**4.** The pair of linkage mechanisms (100; 1000) of claim 3, wherein the guide slot (551) is formed within the lower portion (554) of the sequence link (550).

**5.** The seating unit (10) of any one of claims 2-4, further comprising:

a seat-mounting plate (400) that supports the seat (15), wherein the seat-mounting plate (400) is rotatably coupled to the back-mounting link (510);
a base plate (580) that is interconnected to the seat-mounting plate (400) via a system of links;
wherein the rear pivot link (520) is rotatably coupled to a rearward portion of the base plate (580).

**6.** The seating unit (10) of any one of claims 2-5, wherein the sequence element (526) fully extends through the guide slot (551), and wherein the first region (555) is above the second region (556) within the guide slot (551).

**Patentansprüche**

**1.** Sitzeinheit (10), umfassend:

ein Paar Sitzbefestigungsplatten (400) in im Wesentlichen parallel beabstandeter Beziehung, wobei eine jede der Sitzbefestigungsplatten (400) in einer geneigten Orientierung bezüglich einer darunterliegenden Oberfläche angeordnet ist;
ein Paar von allgemein spiegelbildlichen Verbindungsanordnungsmechanismen (100; 1000), welche dazu eingerichtet sind, die Sitzeinheit (10) zwischen einer geschlossenen Position, einer erweiterten Position, und einer zurückge-

neigten Position zu bewegen, wobei eine jede der Verbindungsanordnungsmechanismen (100; 1000) umfasst:

(a) eine Lehnenbefestigungsverbindung (510), welche drehbar mit einer entsprechenden Sitzbefestigungsplatte (400) gekoppelt ist und dazu eingerichtet ist, eine Rückenlehne (25) der Sitzeinheit (10) zu halten;
(b) eine Folgeverbindung (550), welche drehbar mit der Lehnenbefestigungsverbindung (510) gekoppelt ist, wobei die Folgeverbindung (550) einen Führungsschlitz (551) aufweist;
(c) eine hintere Schwenkverbindung (520), welche drehbar mit der Lehnenbefestigungsverbindung (510) und einem Folgeelement (526) gekoppelt ist, wobei sich das Folgeelement (526) in den Führungsschlitz (551) erstreckt, und wobei sich ein Zusammenspiel zwischen dem Folgeelement (526) und der Folgeverbindung (550) einer direkten Verstellung zwischen der geschlossenen Position und der zurückgeneigten Position widersetzt;
(d) einen Motorwinkelhebel (430) mit einem Mittelabschnitt (433), welcher sich zwischen einem ersten Ende (431) und einem zweiten Ende (432) befindet, wobei eine Aktivierungsstange (350) drehbar mit dem ersten Ende (431) des Motorwinkelhebels (430) gekoppelt ist; und
(e) eine vordere Hebeverbindung (440) mit einem vorderen Ende (441) und einem hinteren Ende (442), wobei das hintere Ende (442) der vorderen Hebeverbindung (440) verschwenkbar mit der Lehnenbefestigungsverbindung (510) gekoppelt ist, und wobei der Mittenabschnitt (433) des Motorwinkelhebels (430) drehbar an ein Teilstück zwischen dem vorderen Ende (441) und dem hinteren Ende (442) der vorderen Hebeverbindung (440) gekoppelt ist; und

einen linearen Aktuator (230, 330, 340), welcher mit der Aktivierungsstange (350) gekoppelt ist, welcher in eine sich gegenseitig ausschließende Abfolge einer ersten Phase und zweiten Phase eingeteilt ist, wobei die erste Phase die Verbindungsanordnungsmechanismen (100; 1000) zwischen der geschlossenen Position und der erweiterten Position bewegt, und wobei die zweite Phase die Verbindungsanordnungsmechanismen (100; 1000) zwischen der erweiterten Position und der zurückgeneigten Position bewegt.

**2.** Sitzeinheit (10) gemäß Anspruch 1,
wobei die Sitzeinheit (10) einen Sitz (15), welcher bezüglich der darunterliegenden Oberfläche verschiebbar ist und eine Rückenlehne (25), welche bezüglich des Sitzes (15) winkelmäßig verstellbar ist, aufweist,
wobei der Führungsschlitz (551) der Folgeverbindung (550) einen ersten Bereich (555) und einen zweiten Bereich (556) aufweist;
wobei sich das Folgeelement (526) in dem zweiten Bereich (556) des Führungsschlitzes (551) aufhält, wenn die Sitzeinheit (10) in die zurückgeneigte Position verstellt wird, und wenn die Sitzeinheit (10) in die zurückgeneigte Position verstellt wird, dass sich das Zusammenspiel des Folgeelements (526) und der Folgeverbindung (550) einer Verstellung der Sitzeinheit (10) in die geschlossene Position widersetzt, wobei sich das Folgeelement (526) in dem ersten Bereich (555) des Führungsschlitzes (551) aufhält, wenn die Sitzeinheit (10) in die erweiterte Position verstellt wird, und wenn die Sitzeinheit (10) in die erweiterte Position verstellt wird, dass sich das Zusammenspiel des Folgeelements (526) und der Folgeverbindung (550) einer Verstellung der Sitzeinheit (10) in entweder die zurückgeneigte Position oder in die geschlossene Position ermöglicht, und
wobei sich das Folgeelement (526) in dem zweiten Bereich (556) des Führungsschlitzes (551) aufhält, wenn die Sitzeinheit (10) in die geschlossene Position verstellt wird, und wenn die Sitzeinheit (10) in die geschlossene Position verstellt wird, dass sich das Zusammenspiel des Folgeelements (526) und der Folgeverbindung (550) einer Verstellung der Sitzeinheit in die zurückgeneigte Position widersetzt.

**3.** Sitzeinheit (10) gemäß Anspruch 2, wobei die Folgeverbindung (550) einen oberen Abschnitt (553) und einen unteren Abschnitt (554) aufweist, wobei der obere Abschnitt (553) drehbar mit der Lehnenbefestigungsverbindung (510) gekoppelt ist.

**4.** Paar von Verbindungsanordnungsmechanismen (100; 1000) gemäß Anspruch 3, wobei der Führungsschlitz (551) innerhalb des unteren Abschnitts (554) der Folgeverbindung (550) ausgebildet ist.

**5.** Sitzeinheit (10) gemäß einem jeden der Ansprüche 2-4, ferner umfassend:

eine Sitzbefestigungsplatte (400), welche den Sitz (15) hält, wobei die Sitzbefestigungsplatte (400) drehbar mit der Lehnenbefestigungsverbindung (510) gekoppelt ist;
eine Grundplatte (580), welche über ein System von Verbindungen mit der Sitzbefestigungsplatte (400) zusammenhängt;
wobei die hintere Schwenkverbindung (520) drehbar mit einem rückwärtigen Abschnitt der

Grundplatte (580) gekoppelt ist.

6. Sitzeinheit (10) gemäß einem jeden der Ansprüche 2-5, wobei sich das Folgeelement (526) vollständig durch den Führungsschlitz (551) erstreckt, und wobei sich der erste Bereich (555) in dem Führungsschlitz (551) oberhalb des zweiten Bereiches (556) befindet.

**Revendications**

1. Unité d'assise (10), comprenant :

une paire de plaques de montage de siège (400) selon une relation sensiblement parallèlement, espacée, dans laquelle chacune des plaques de montage de siège (400) est disposée selon une orientation inclinée par rapport à une surface sous-jacente ;
une paire de mécanismes de liaison généralement en image miroir (100 ; 1000) adaptés pour déplacer l'unité d'assise (10) entre une position fermée, une position étendue et une position inclinée, dans laquelle chacun des mécanismes de liaison (100 ; 1000) comprend :

(a) un maillon de montage sur dossier (510) couplé de manière rotative à une plaque de montage de siège respectif (400) et configuré pour supporter un dossier (25) de l'unité d'assise (10) ;
(b) un maillon de séquence (550) couplé de manière rotative au maillon de montage sur dossier (510), dans laquelle le maillon de séquence (550) inclut une fente de guidage (551) ;
(c) un maillon de pivotement arrière (520) couplé de manière rotative au maillon de montage sur dossier (510) et à un élément de séquence (526), dans laquelle l'élément de séquence (526) s'étend dans la fente de guidage (551), et dans laquelle l'interaction entre l'élément de séquence (526) et le maillon de séquence (550) résiste à un ajustement direct entre la position fermée et la position inclinée ;
(d) un guignol de moteur (430) ayant une partie intermédiaire (433) situé entre une première extrémité (431) et une seconde extrémité (432), dans laquelle une barre d'activation (350) est couplée de manière rotative à la première extrémité (431) du guignol de moteur (430) ; et
(e) un maillon de levage avant (440) ayant une extrémité avant (441) et une extrémité arrière (442), dans laquelle l'extrémité arrière (442) du maillon de levage avant (440) est couplée de manière pivotante au maillon de montage sur dossier (510), et dans laquelle la partie intermédiaire (433) du guignol de moteur (430) est couplée de manière rotative à une section entre l'extrémité avant (441) et l'extrémité arrière (442) du maillon de levage avant (440) ; et

un actionneur linéaire (320, 330, 340), couplé à la barre d'activation (350), qui est séquencé en une première phase et une seconde phase mutuellement exclusive, dans laquelle la première phase déplace les mécanismes de liaison (100 ; 1000) entre la position fermée et la position étendue, et dans laquelle la seconde phase déplace les mécanismes de liaison (100; 1000) entre la position étendue et la position inclinée.

2. Unité d'assise (10) selon la revendication 1,
dans laquelle l'unité d'assise (10) comporte un siège (15) qui peut être déplacé en translation par rapport à la surface sous-jacente et un dossier (25) qui est angulairement ajustable par rapport au siège (15),
dans laquelle la fente de guidage (551) du maillon de séquence (550) inclut une première région (555) et une seconde région (556) ;
dans laquelle l'élément de séquence (526) réside dans la seconde région (556) de la fente de guidage (551) quand l'unité d'assise (10) est ajustée vers la position inclinée, l'interaction de l'élément de séquence (526) et du maillon de séquence (550) résiste à l'ajustement de l'unité d'assise (10) vers la position fermée,
dans laquelle l'élément de séquence (526) réside dans la première région (555) de la fente de guidage (551) quand l'unité d'assise (10) est ajustée vers la position étendue, et quand l'unité d'assise (10) est ajustée vers la position étendue, l'interaction de l'élément de séquence (526) et du maillon de séquence (550) permet l'ajustement de l'unité d'assise (10) vers la position inclinée ou vers la position fermée, et dans laquelle l'élément de séquence (526) réside dans la seconde région (556) de la fente de guidage (551) quand l'unité d'assise (10) est ajustée vers la position fermée, et quand l'unité d'assise (10) est ajustée vers la position fermée, l'interaction de l'élément de séquence (526) et le maillon de séquence (550) résiste à l'ajustement de l'unité d'assise vers la position inclinée.

3. Unité d'assise (10) selon la revendication 2, dans laquelle le maillon de séquence (550) inclut une partie supérieure (553) et une partie inférieure (554), dans laquelle la partie supérieure (553) est couplée de manière rotative au maillon de montage sur dossier (510).

4. Paire de mécanismes de liaison (100 ; 1000) selon

la revendication 3, dans laquelle la fente de guidage (551) est formée dans la partie inférieure (554) du maillon de séquence (550).

**5.** Unité d'assise (10) selon l'une quelconque des revendications 2-4, comprenant en outre :

une plaque de montage sur siège (400) qui supporte le siège (15), dans laquelle la plaque de montage sur siège (400) est couplée de manière rotative au maillon de montage sur dossier (510) ;
une plaque de base (580) qui est interconnectée à la plaque de montage sur siège (400) par le biais d'un système de maillons ;
dans laquelle le maillon de pivotement arrière (520) est couplé de manière rotative à une partie arrière de la plaque de base (580).

**6.** Unité d'assise (10) selon l'une quelconque des revendications 2-5, dans laquelle l'élément de séquence (526) s'étend totalement à travers la fente de guidage (551), et dans laquelle la première région (555) se situe au-dessus de la seconde région (556) dans la fente de guidage (551).

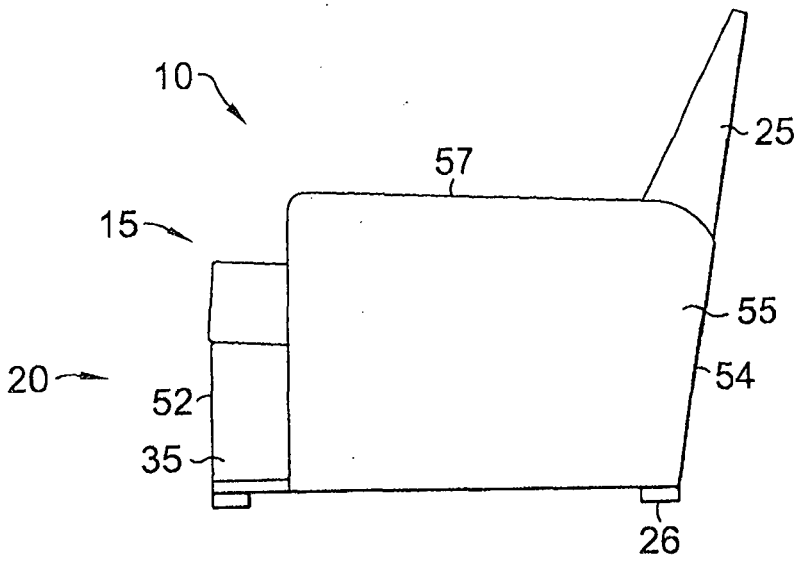



FIG. 1.

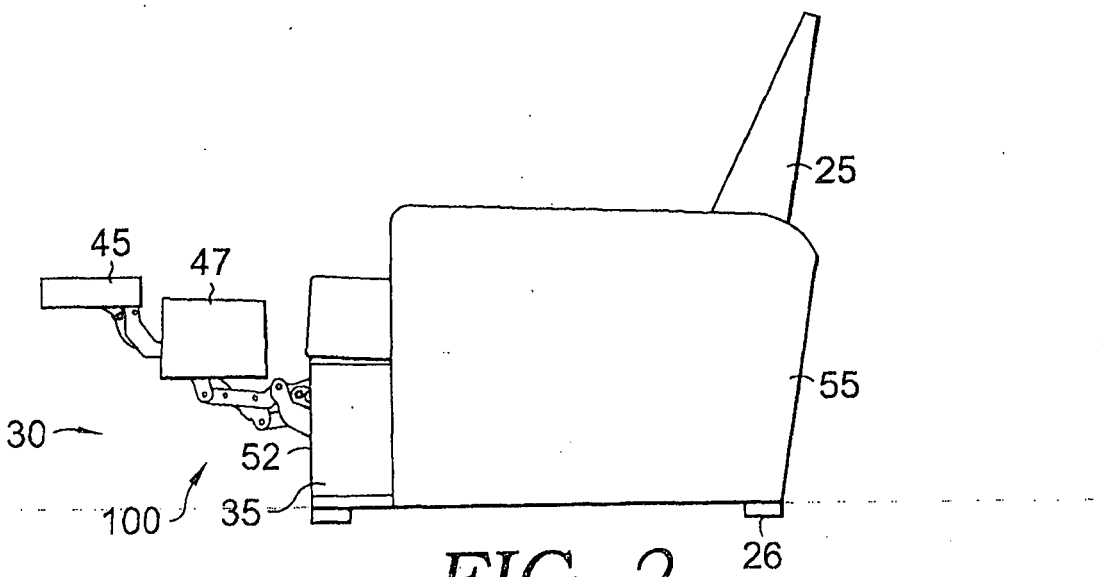



FIG. 2.

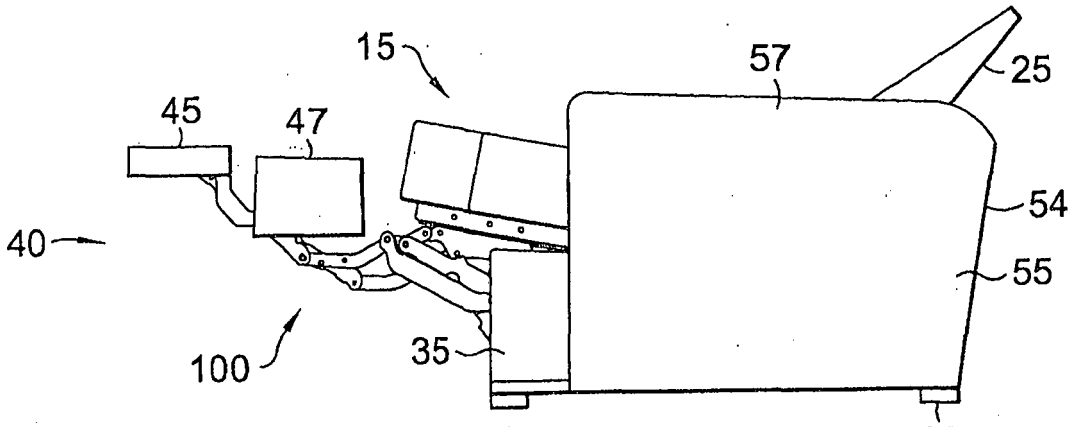



FIG. 3.

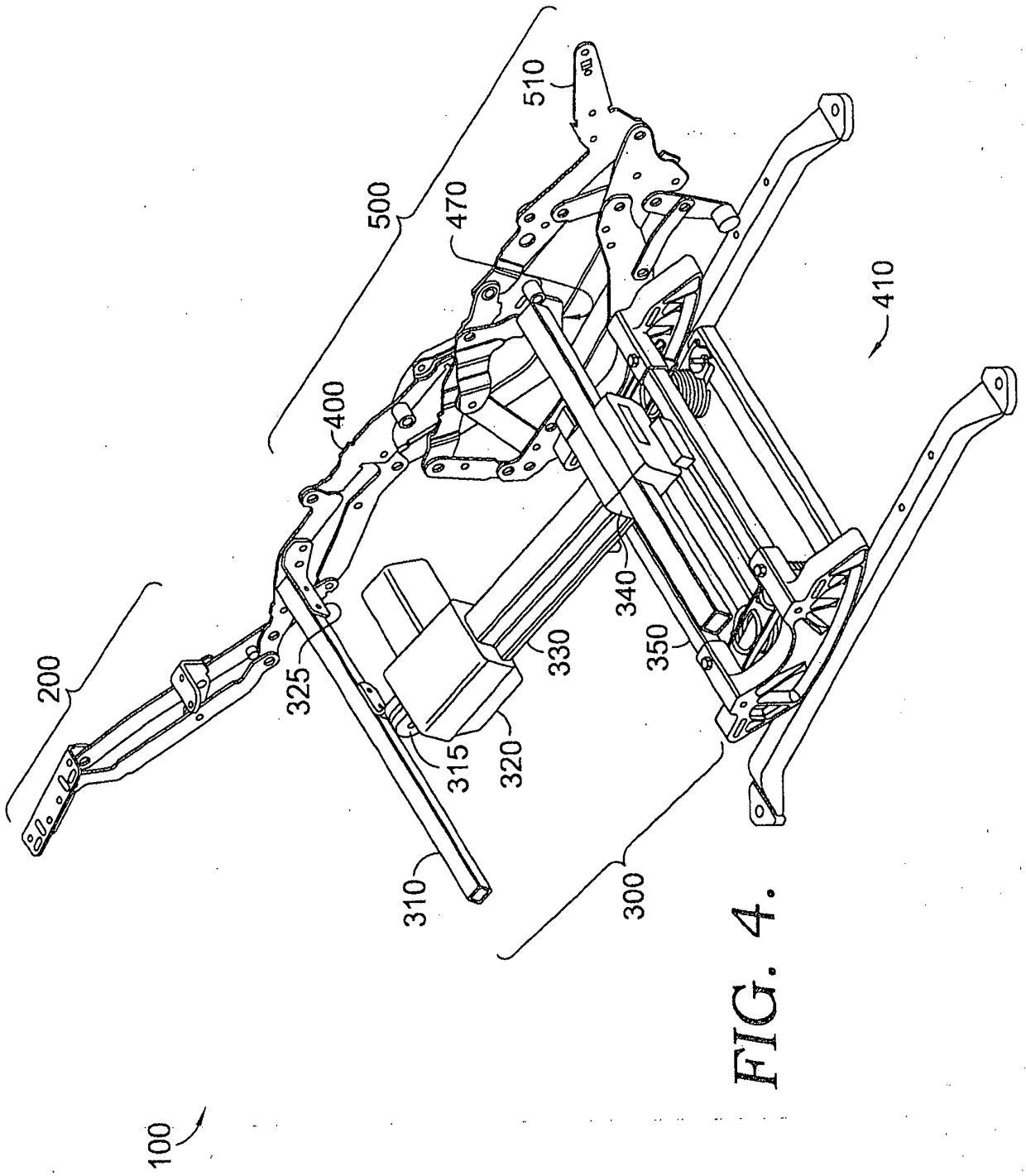



FIG. 4.

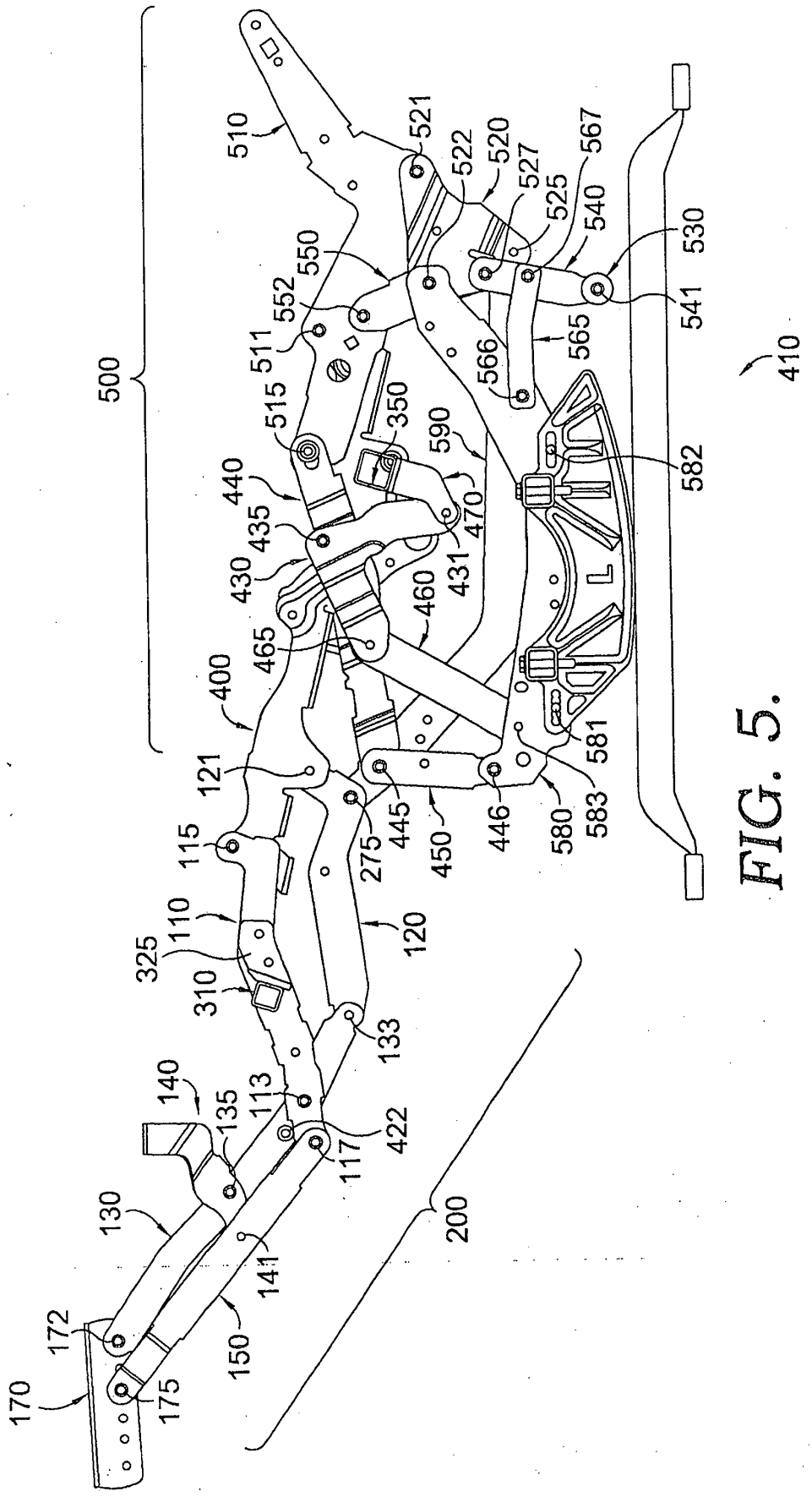

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FIG. 5.

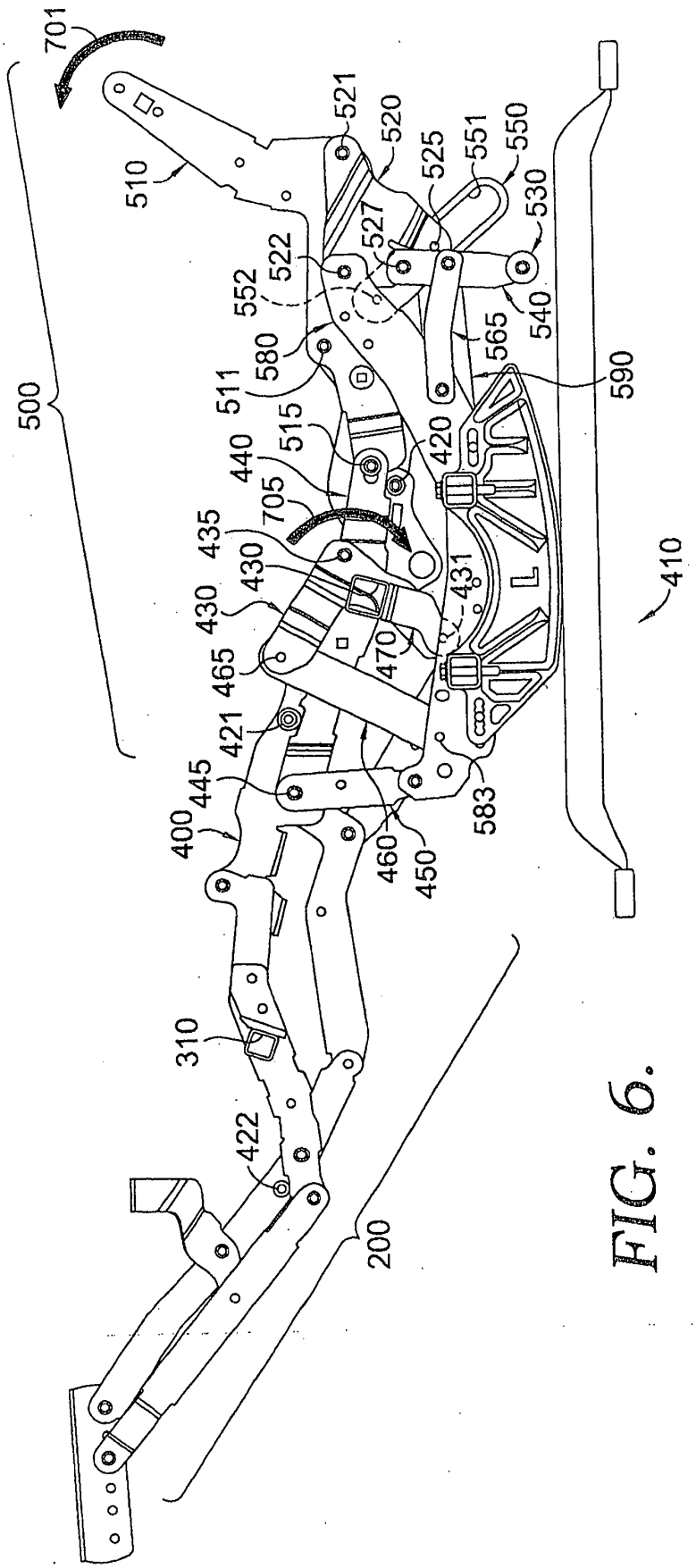

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FIG. 6.

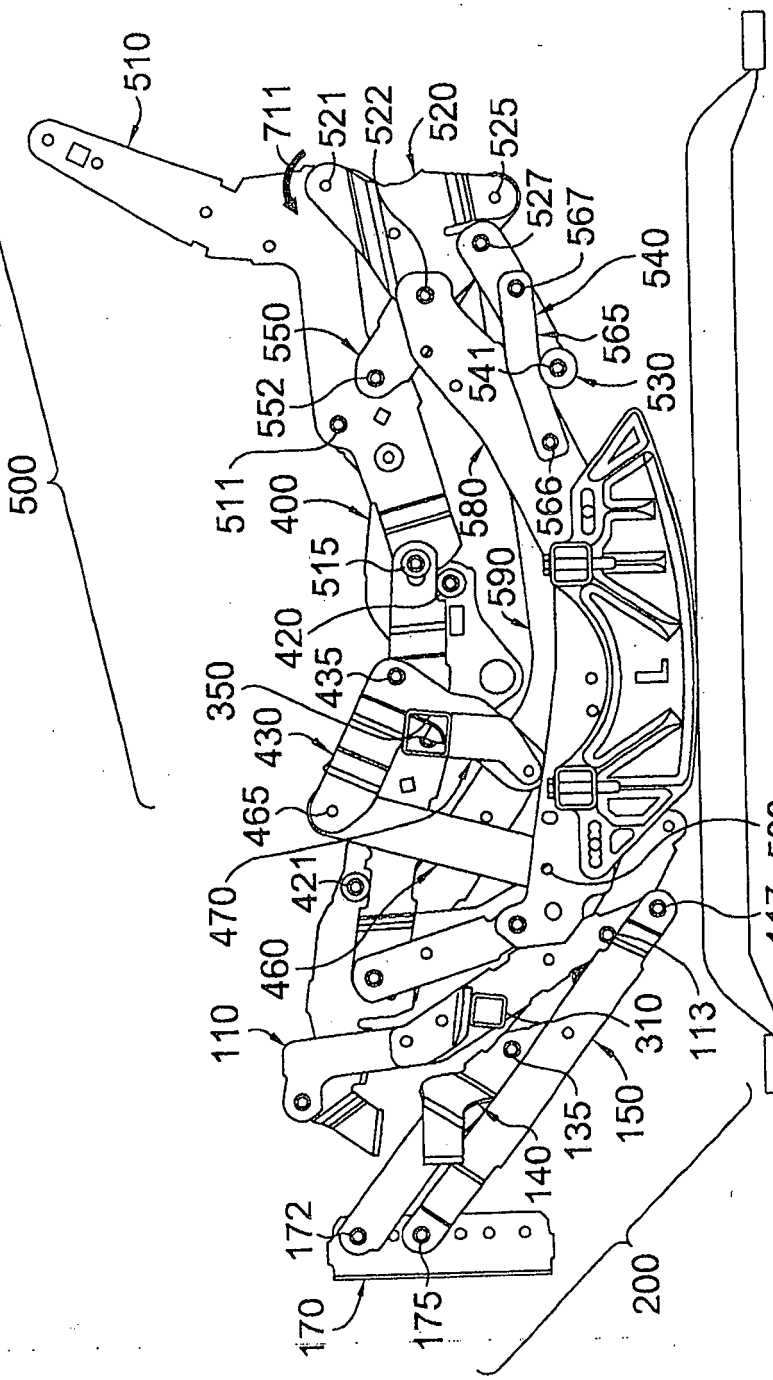

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FIG. 7.

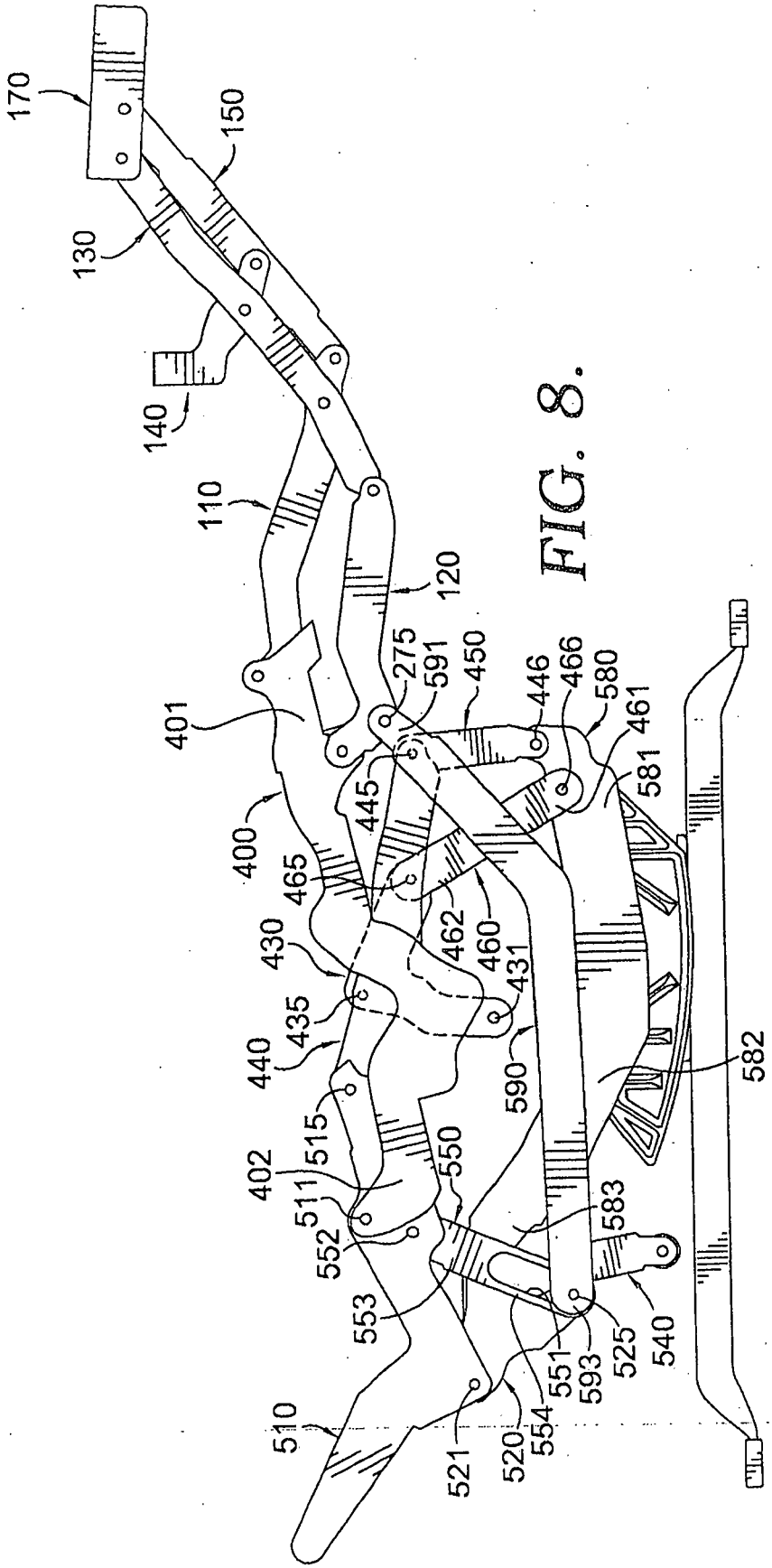

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FIG. 8.

FIG. 9.

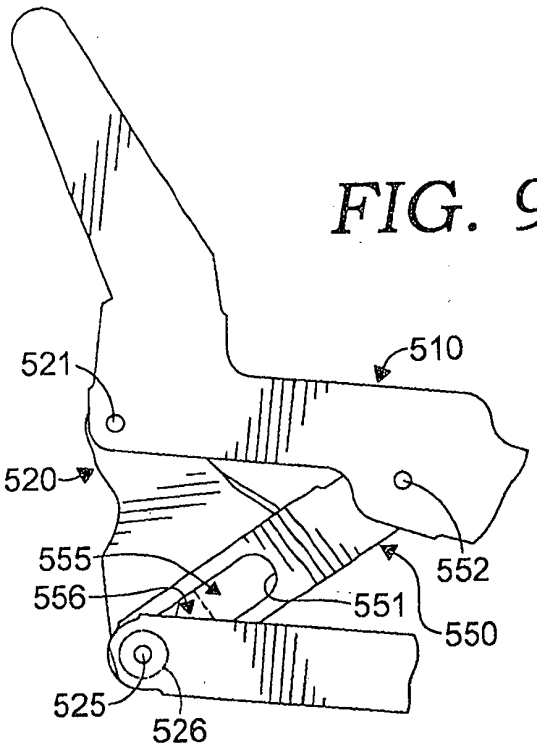



FIG. 10.

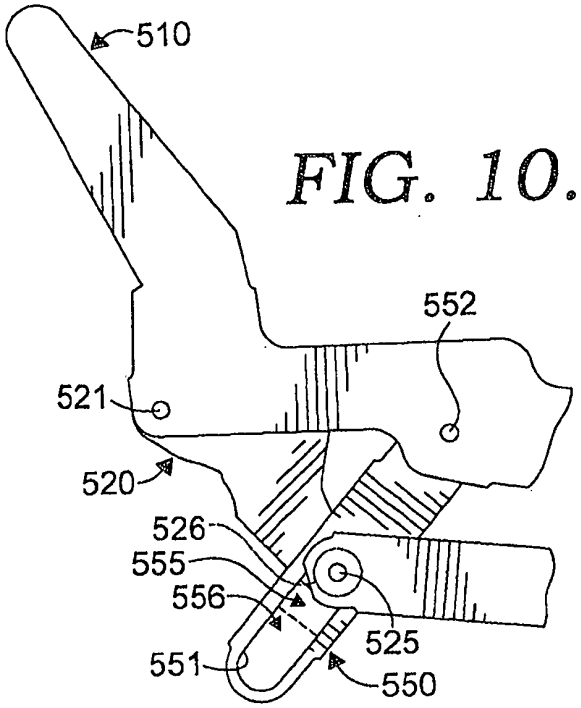
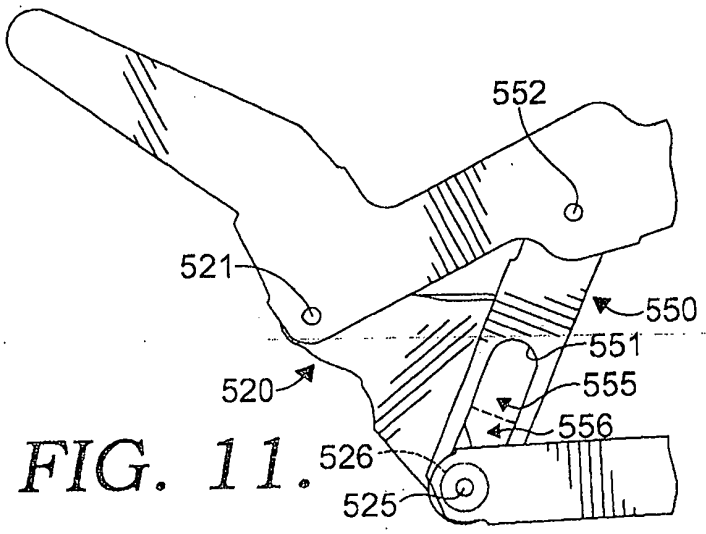



FIG. 11.



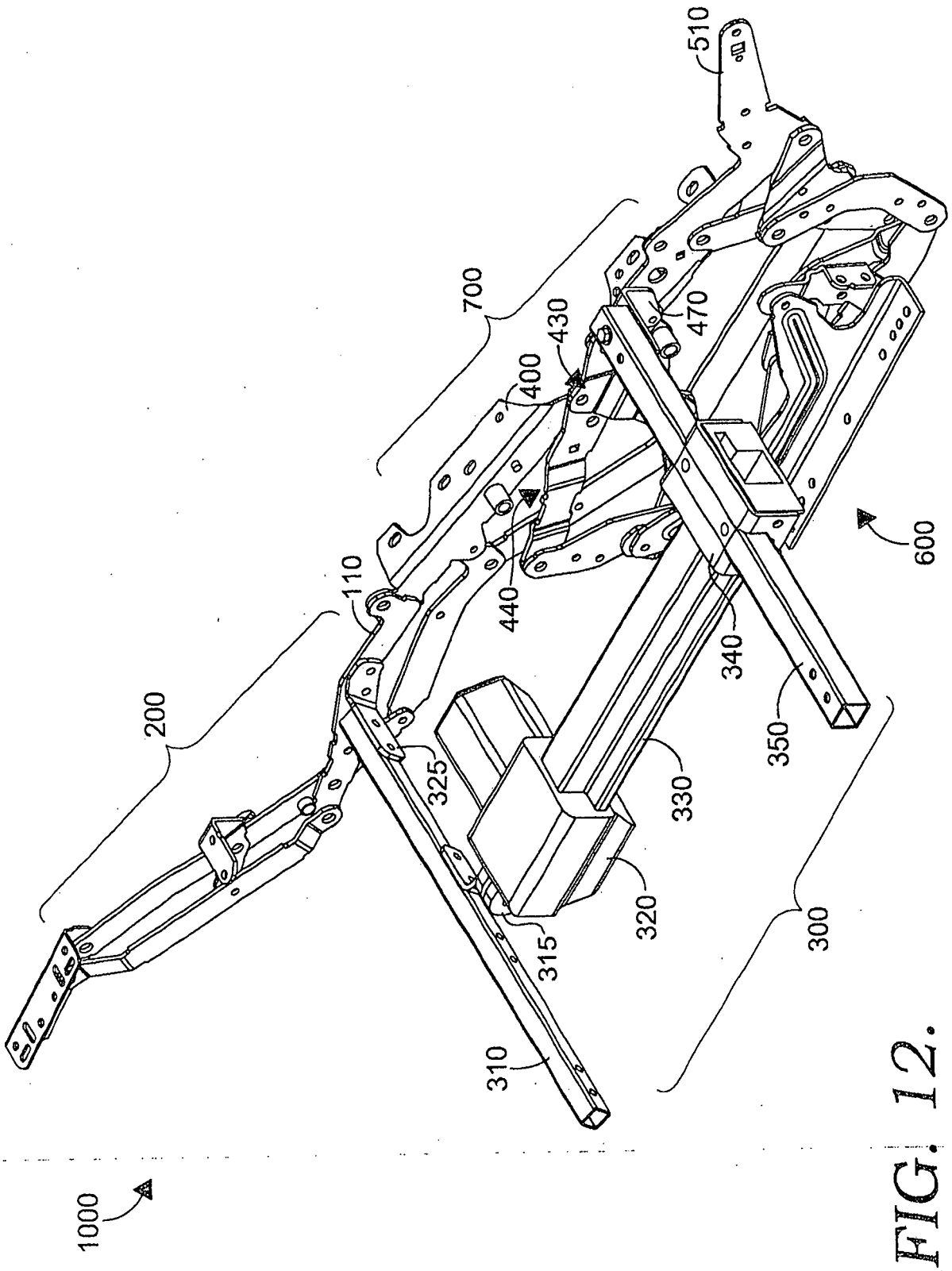

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FIG. 12.

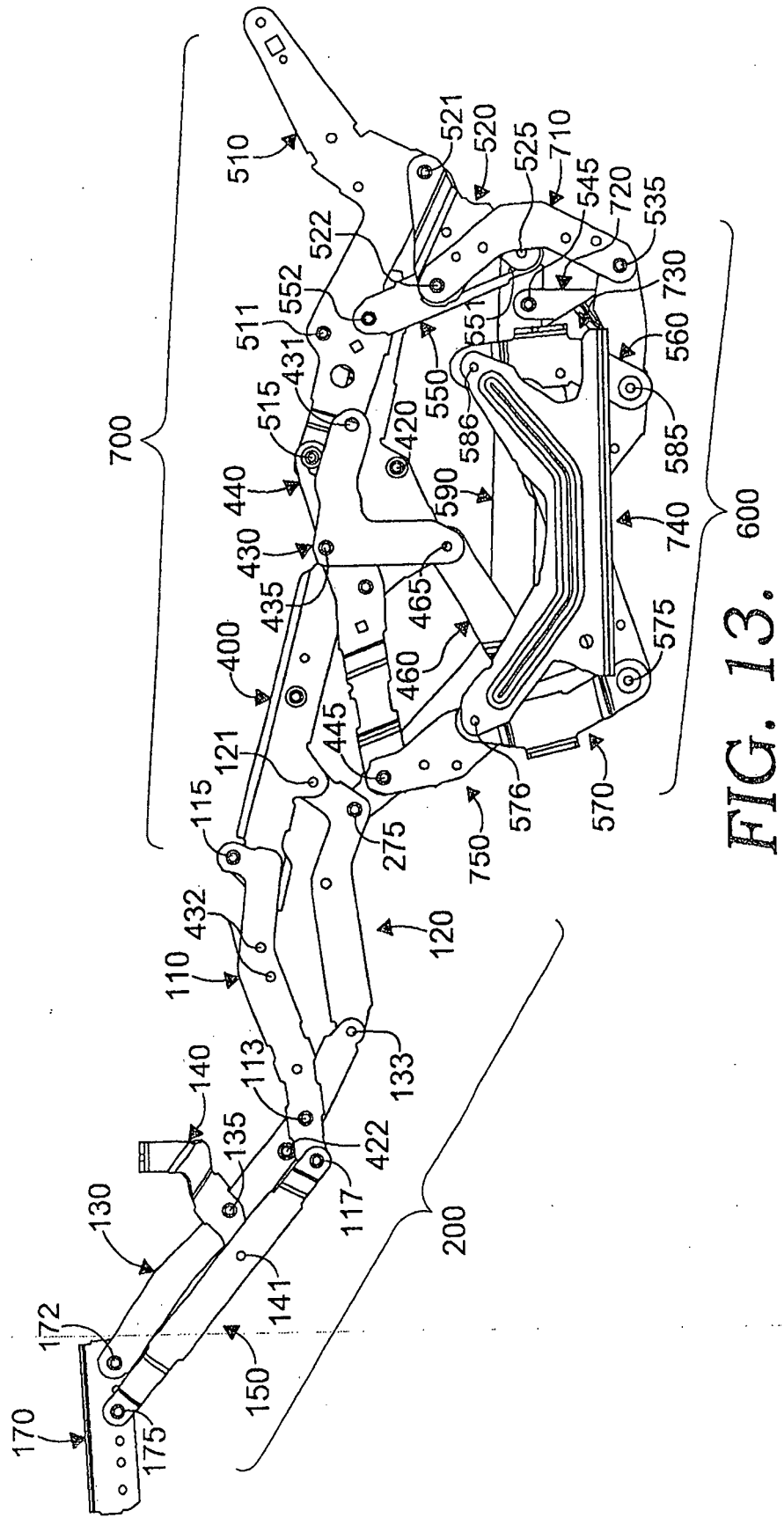

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FIG. 13.

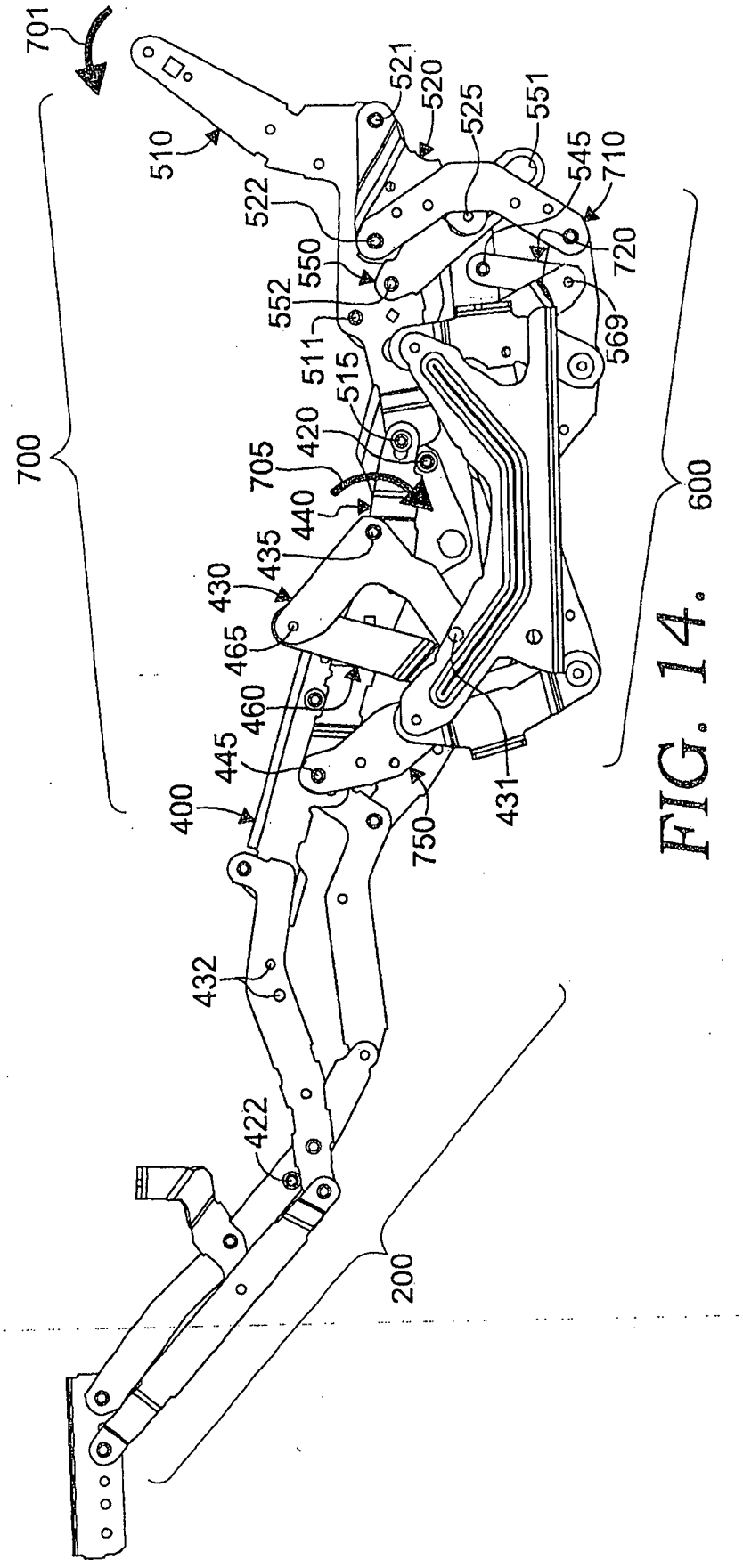

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FIG. 14.

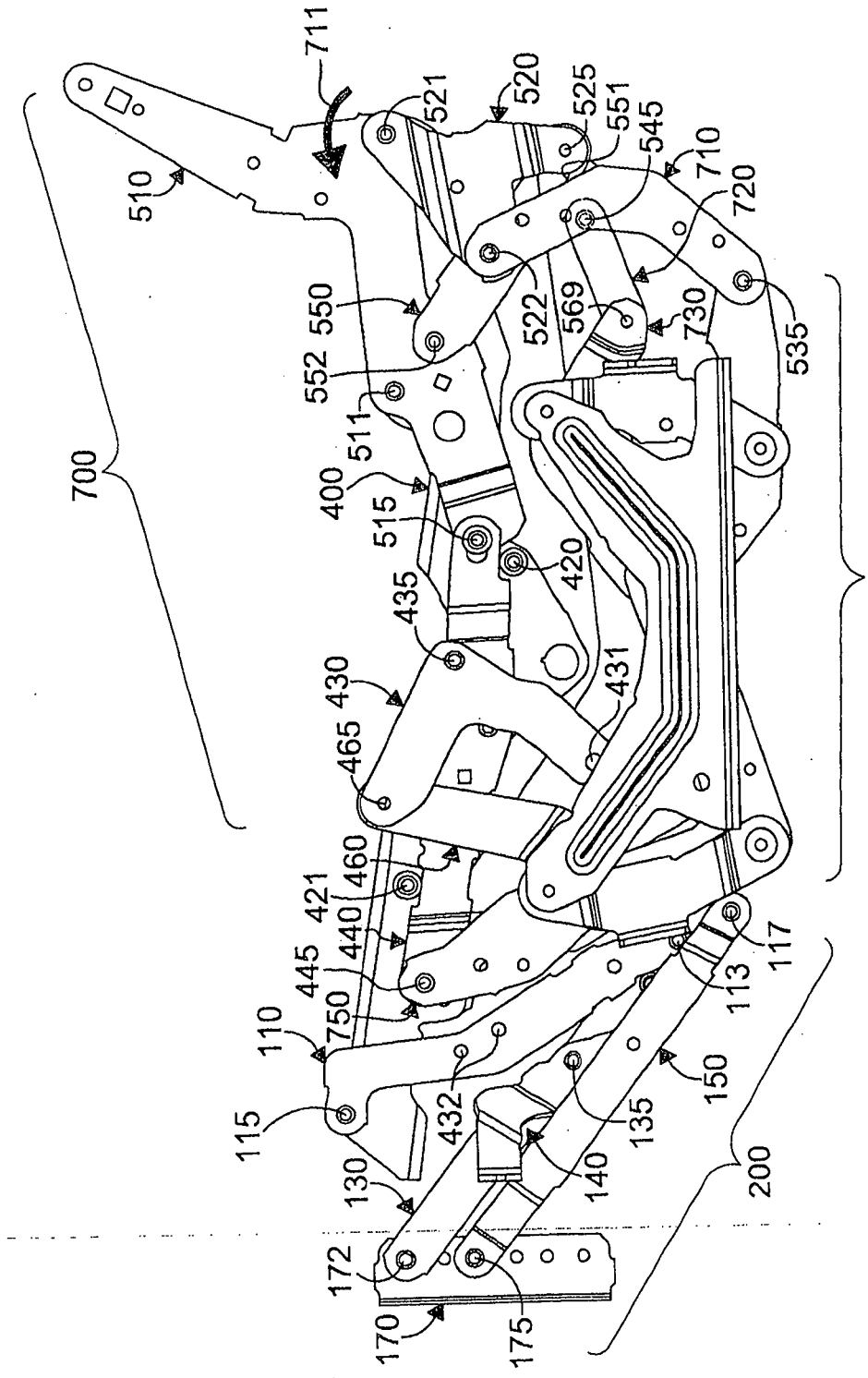

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FIG. 15.

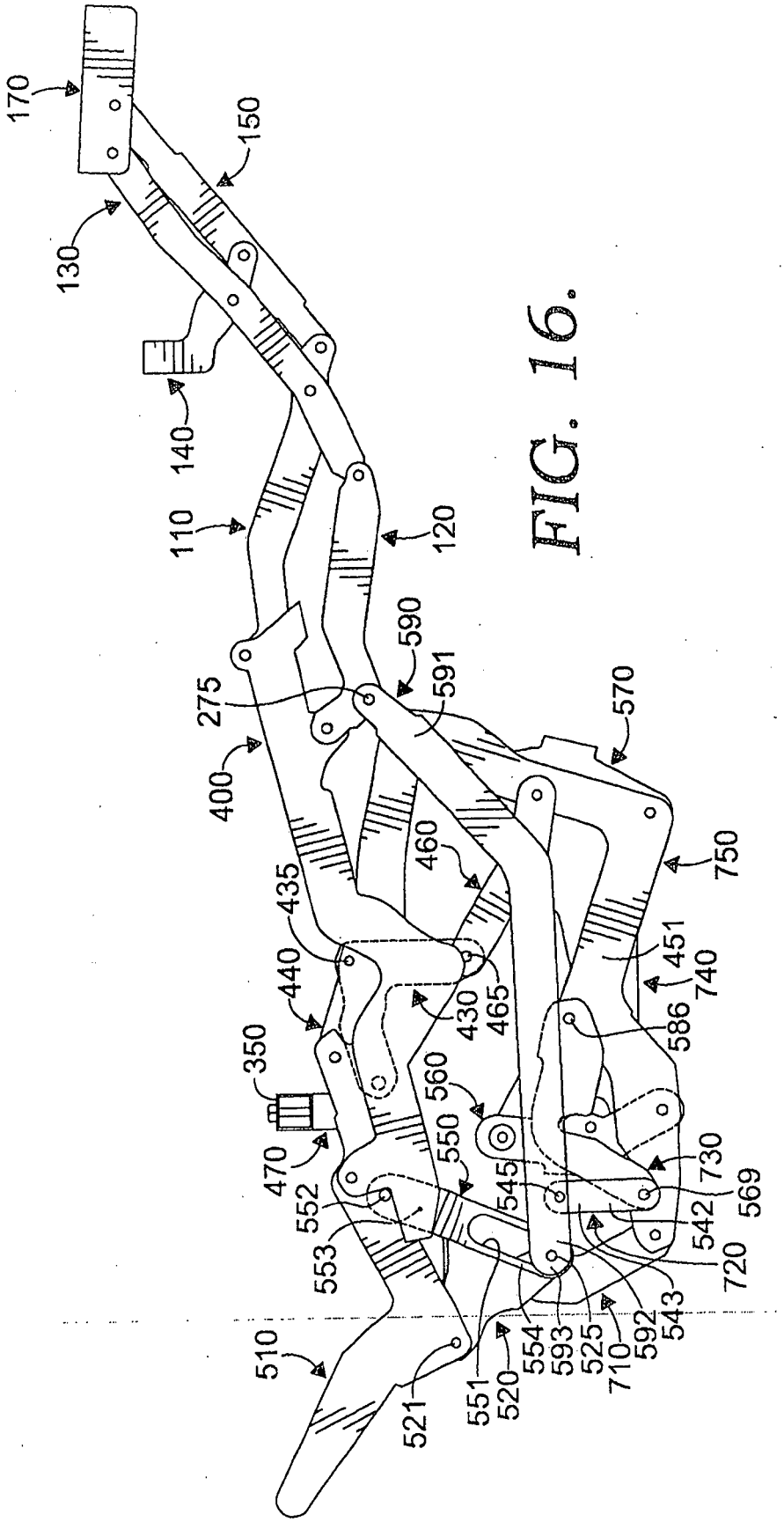

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FIG. 16.

## REFERENCES CITED IN THE DESCRIPTION

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### Patent documents cited in the description


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