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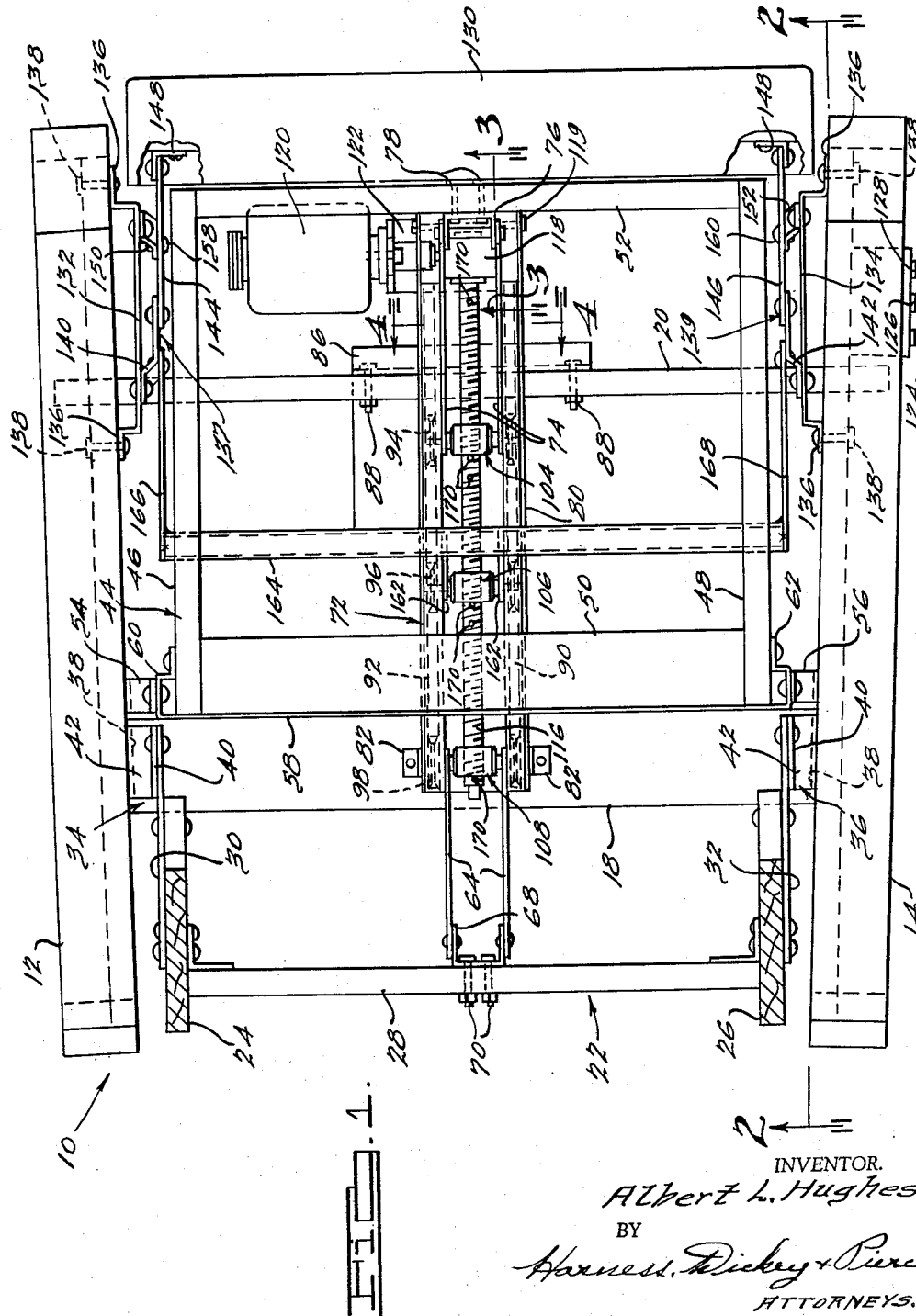
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MOTOR-OPERATED RECLINING CHAIR

Filed June 17, 1958

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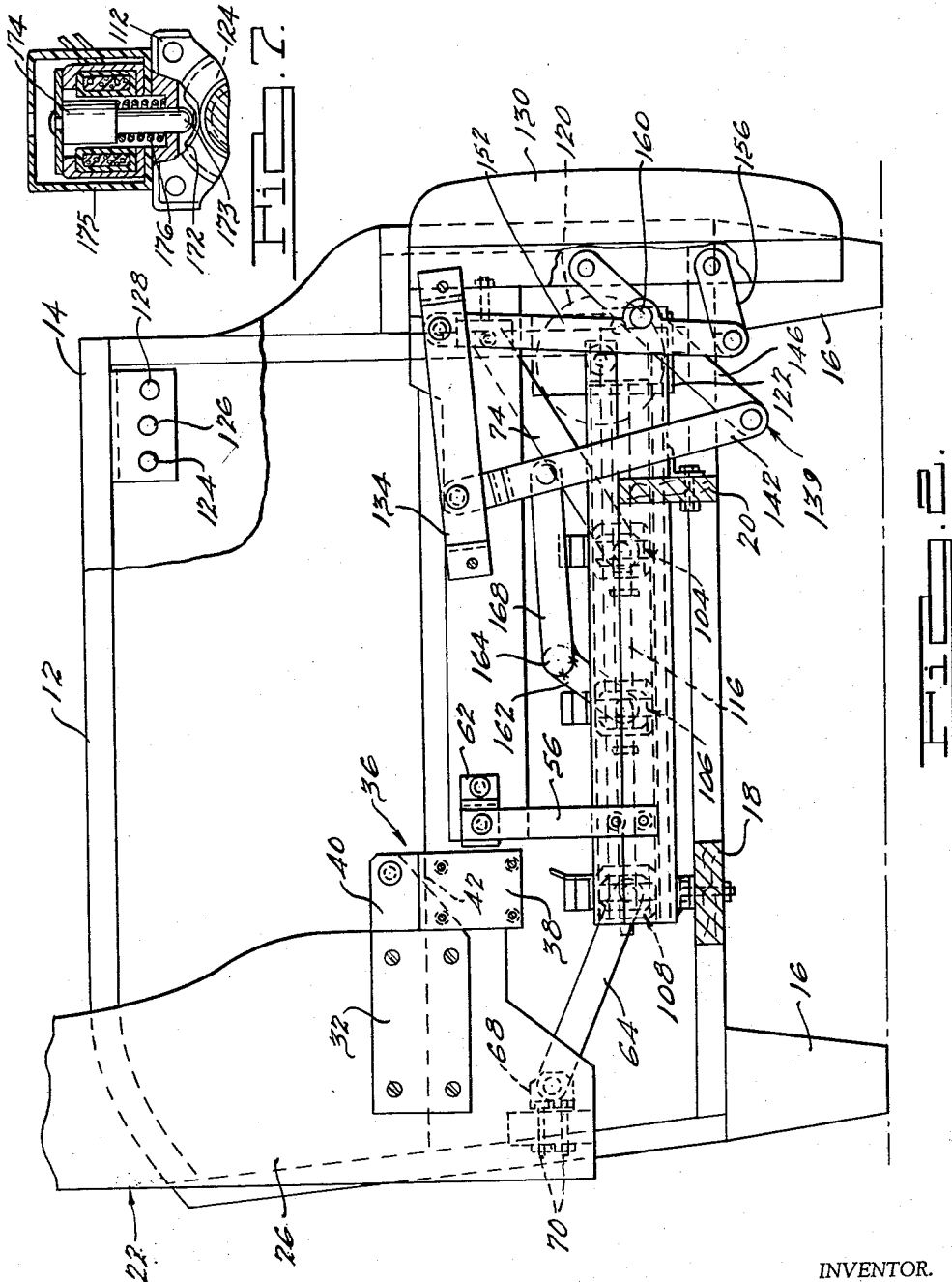
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INVENTOR.

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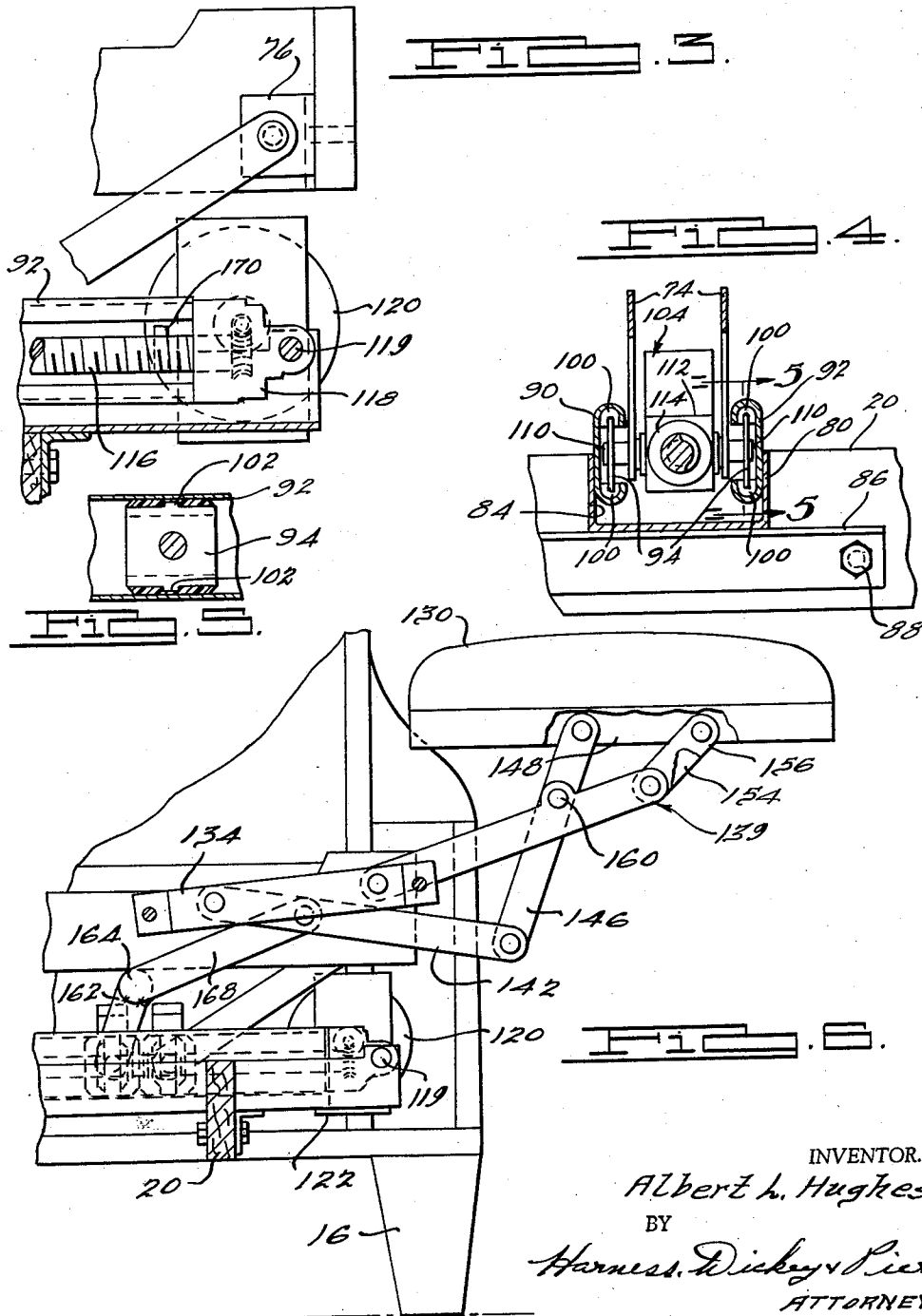
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MOTOR-OPERATED RECLINING CHAIR

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5 Claims. (Cl. 297—69)

This invention relates to reclining chairs and more particularly to a reclining chair having a motor-operated mechanism for moving the chair to the desired reclining position.

It is one object of the invention to provide a reclining chair which can be moved to any desired reclining position by a motor-operated mechanism.

It is another object of the invention to provide a reclining chair which can be moved to the desired reclining position by a relatively simple mechanism actuated by an electric motor, the mechanism being of the type employed in power-operated automobile seats.

It is a further object of the present invention to provide a reclining chair that is power operated by a simple electric motor actuated mechanism which is compact, rugged, dependable in operation and relatively economical to manufacture.

Other objects, features and advantages of the present invention will become apparent from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a plan view of a reclining chair embodying features of the invention, partially broken away, and with the back and seat thereof omitted to more clearly illustrate the power actuating mechanism therebeneath.

FIG. 2 is a sectional view of the structure illustrated in FIG. 1, taken along the line 2—2 thereof;

FIG. 3 is a sectional view of the structure illustrated in FIG. 1, taken along the line 3—3 thereof;

FIG. 4 is a sectional view of the structure illustrated in FIG. 1, taken along the line 4—4 thereof;

FIG. 5 is a sectional view of the structure illustrated in FIG. 4, taken along the line 5—5 thereof;

FIG. 6 is a fragmentary view of a portion of the structure of FIG. 2 illustrating the foot rest in its raised position, and

FIG. 7 is an enlarged broken view of the structure illustrated in FIG. 4.

Referring to FIGS. 1 and 2, a reclining chair 10 embodying features of the present invention is comprised of side arms 12 and 14 mounted on legs 16 and interconnected by transverse members 18 and 20. The side arms 12 and 14 and members 18 and 20 constitute the main supporting structure of the reclining chair.

A back rest 22 comprising spaced side members 24 and 26 interconnected by a flat back member 28 is pivotally mounted between the side arms 12 and 14 by plates 30 and 32 which are fixed to the side members 24 and 26, respectively, the plates 30 and 32 being pivotally connected to Z-shaped members 34 and 36, respectively, which in turn are fixed to the side arms 12 and 14, respectively. It will be observed that each of the Z-shaped members 34 and 36 are comprised of two vertically extending leg portions 38 and 40 interconnected by a horizontally extending web portion 42, and that the plates 30 and 32 are connected to the leg portions 40 which are spaced from the side arms 12 and 14 to enable the back rest 22 to pivot without interference from the side arms 12 and 14.

A seat supporting frame 44 is also pivoted between the side arms 12 and 14 in a manner similar to the back rest 22 and comprises two side members 46 and 48 interconnected by transverse members 50 and 52. Each of the

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side members 46 and 48 are pivotally connected to Z-shaped members 54 and 56, similar to the Z-shaped members 34 and 36, by a structural member 58 extending across the back of the seat supporting frame 44 and having end portions 60 and 62 which are fixed to the side members 46 and 48, respectively. It will be observed that each of the end portions 60 and 62 of the member 58 are also Z-shaped and that the offset leg portions thereof are pivotally connected to the legs of the Z-shaped members 54 and 56 which are offset from the side arms 12 and 14, the other legs of the Z-shaped members 54 and 56 being suitably fixed to the side arms in a manner similar to the aforementioned Z-shaped members 34 and 36. In this manner, both the back rest 22 and the seat supporting frame 44 are pivotally mounted between the side arms 12 and 14.

The back rest 22 is prevented from freely pivoting by a pair of parallel spaced-apart linkages 64 each having one end thereof pivotally connected to the legs of a channel-shaped member 68 fixed to the back member 28 by bolts 70 or the like extending through the web of the channel-shaped member. The other ends of the linkages 64 are suitably fixed, as will be described in greater detail hereinafter, to an element of a driving mechanism 72 disposed midway between the side arms 12 and 14 and supported on the transverse members 18 and 20 interconnecting the side arms.

The seat supporting frame 44 is prevented from freely pivoting in a similar manner by parallel spaced-apart linkages 74 having the ends thereof pivotally connected to the legs of a channel-shaped member 76 which is fixed to the transverse member 52 of the seat supporting frame by bolts 78 or the like passing through the web of the channel-shaped member 76. The other ends of the linkages 74 are connected to another element of the driving mechanism 72 as will be described in greater detail hereinafter.

Referring also to FIGS. 3-5, as well as FIGS. 1 and 2, the driving mechanism 72 is comprised of a channel-shaped member 80 having the web thereof supported on and fixed to the transverse members 18 and 20 interconnecting the side arms. It will be observed that the channel-shaped member 80 is affixed to the transverse member 18 by angle-shaped members 82 and that a portion of the transverse member 20 is notched as at 84 to enable the channel-shaped member 80 to extend there-through, an angle-shaped member 86 being fastened to the transverse member 20 by suitable bolts 88 or the like so that the horizontal leg thereof provides additional support for the web of the channel-shaped member 80.

A pair of parallel spaced-apart substantially channel-shaped members 90 and 92 have the webs thereof affixed to the inner faces of the legs of the channel-shaped member 80, as most clearly illustrated in FIG. 4, so that the arcuate end portions thereof provide slides for three pairs of spaced plates 94, 96 and 98. As most clearly illustrated in FIGS. 4 and 5, it will be observed that each of the plates 94 are disposed within one of the channel-shaped members 90 and 92 and have bearing elements 100 of a suitable low friction resin material secured over the ends thereof and fitted within the arcuate portions of the channel-shaped members 90 and 92. It will also be observed that each of the plates 94 is provided with a projecting lug 102 to prevent the low friction resin material 100 from moving relative thereto and to insure that the sliding surface is between the bearing elements 100 and the arcuate portions of the channel-shaped members 90 and 92. The low friction resin material can be any suitable resin, such as polyethylene, nylon, Teflon, or the like, molded to the proper shape. The plates 96 and 98 have the bearing elements 100 affixed thereto in the same manner, and with this construction, each of the plates 94,

96 and 98 are free to slide relative to the channel-shaped members 90 and 92.

Solenoid mechanisms 104, 106 and 108 are supported between each of the pairs of plates 94, 96 and 98, respectively, by trunnions or pins 110 projecting outwardly therefrom and having the ends thereof fixed to their respective pairs of plates. Each of these solenoid mechanisms 104, 106 and 108 is similar to that described and claimed in a patent to Richard J. Williams, No. 2,857,776, issued October 28, 1958, and assigned to the assignee of the present invention.

However, in the interest of facilitating the understanding of the present invention without reference to the aforesaid copending application, the construction of the solenoid mechanisms will be briefly described. Each of the solenoid mechanisms comprises a housing 112 having a cylindrical shaped running nut 114 rotatably mounted therein. Each of the running nuts 114 has a suitable detent 172 in the cylindrical surface thereof which is alignable with and adapted to be engaged by a ball end 173 of the plunger 174 of a solenoid 175 mounted upon the housing 112. The end 172 is adapted to be urged into the detent against the pressure of a spring 176 by the plunger when the solenoid is energized. The plunger 174 is retracted by the spring 176 and each of the nuts 114 is free to rotate relative to the housing 112 until the solenoid associated therewith is energized to force the plunger downwardly so that the ball end engages the detent in the cylindrical surface of the nut. This locks the nut against rotation relative to the housing for a purpose which will be described in greater detail hereinafter.

As most clearly illustrated in FIGS. 1 and 2, a threaded shaft 116 passes through each of the running nuts 114 and the right end thereof extends within and is adapted to be rotatably driven by a speed reducing unit 118 mounted on the right end of the channel-shaped member 80 by any suitable means such as a pin 119 for example passing through the unit and the legs of the channel-shaped member 80. An electric motor 120 for driving the speed reducing unit 118 is also mounted on the channel-shaped member 80 by an adapter extension 122 secured to the underside of the web of the channel-shaped member 80.

With this construction, the threaded shaft 116 serves as a lead screw that can be rotated by the motor 120 in either of two directions so as to drive each of the running nuts 114 along the shaft 116 when the solenoid associated therewith is energized to lock the nuts against rotation as previously described. When the nuts are locked against rotation in this manner, it is apparent that they will run along the shaft 116 in one direction or other depending upon the direction of rotation of the shaft and will consequently drive the housings 112 and pins 110 along therewith since these members are slidably supported on the channel-shaped members 90 and 92 by the sliding relationship between the bearing elements 100 on the plates 94, 96 and 98 as previously described.

As most clearly illustrated in FIG. 1, the ends of the linkages 64 which are connected to the driving mechanism 72 are pivotally connected to the pins 110 of the solenoid mechanism 108, and the linkages 74 which are connected to the seat supporting frame 44 are pivotally connected to the pins 110 of the solenoid mechanism 104. Suitable electric switches 124 and 126 or the like may be mounted on the side arm 14 of the chair for controlling the operation of the solenoid mechanisms 104 and 108, respectively, by suitable electric circuitry (not shown). Each of the switches has a non-energized neutral position and up and down positions which energize their respective solenoid mechanisms and simultaneously energize the electric motor 120 in either of two directions depending on whether the switch is in its up or down position.

As illustrated in FIGS. 1 and 2, the seat supporting frame 44 is in its normal position and to raise the seat, the switch 124 is moved to its "up" position which en-

ergizes the solenoid mechanism 104 to lock the nut 114 thereof against rotation, as previously described. The motor 120 is simultaneously energized to rotate the shaft 116 in the direction determined by the "up" position of the switch 124 to drive the entire solenoid mechanism 104 to the right, as viewed in FIGS. 1 and 2. This also drives the lower end of the linkages 74 pivotally connected to the outwardly projecting pins 110 of the solenoid mechanism 104 to the right which in turn forces the front end of the seat supporting frame 44 to pivot upwardly.

Conversely, when the switch 124 is moved to its "down" position the motor 120 is reversed so that the shaft 116 is rotated in the opposite direction to drive the solenoid mechanism 104 to the left to lower the seat supporting frame 44. Of course, movement in either direction can be stopped at any time by returning the switch 124 to the neutral position which stops the movement of the solenoid mechanism 104 by deenergizing the solenoid to free the running nut for rotation relative to the housing 112 and simultaneously deenergizes the circuit to the motor 120.

The back rest 22 is similarly controlled by the switch 126. When the switch 126 is moved to its "down" position the solenoid 108 is energized to lock the running nut 114 thereof against rotation and the motor 120 rotates the shaft 116 in the appropriate direction to move the solenoid mechanism 108 to the right which, of course, also moves the ends of the linkages 64 connected thereto to the right. Since the other ends of the linkages 64 are pivotally connected to the angle-shaped member 68 fixed to the back member 28 of the back rest, and the back rest is pivotally connected to the side arms 12 and 14 as previously described, it will pivot in a counterclockwise direction, as viewed in FIG. 2, to a reclining position determined by the distance the solenoid mechanism 108 is moved to the right.

When the switch 126 is moved to its "up" position, the motor 120 is energized to rotate the shaft 116 in the reverse direction and the solenoid 108 is also energized so that the plunger thereof again locks the nut 114 against rotation to cause the solenoid mechanism 108 to move to the left which, of course, raises the back rest by pivoting it in a clockwise direction, as viewed in FIG. 2.

The reclining chair 10 is also provided with a footrest 130 which is movable between a vertical position, as illustrated in FIG. 2, to a raised horizontal position, as illustrated in FIG. 6, by suitable linkage systems 137 and 139 connected between the sides of the foot rest and channel-shaped brackets 132 and 134 having outwardly projecting flanges 136 affixed to the side arms 12 and 14, respectively, by bolts 138 or the like. The linkage systems 137 and 139 briefly comprise links 140 and 142 pivotally connected to the brackets 132 and 134, respectively, adjacent the left ends thereof, links 144 and 146 pivotally connected to the pivoting ends of the links 140 and 142, respectively, and having the other ends thereof pivotally connected to angle-shaped members 148 affixed to the footrest 130 along each of the side edges thereof, links 150 and 152 pivotally connected to the mounting brackets 132 and 134, respectively, adjacent the right ends thereof, links 154 and 156 pivotally connected to the pivoting ends of the links 150 and 152, respectively, with the other ends thereof pivotally connected to the angle-shaped members 148 fixed to the footrest 130.

It will also be observed that the links 150 and 152 are pivotally connected to the links 144 and 146, respectively, by pins 158 and 160 intermediate the ends thereof. With these identical linkage systems 137 and 139, each pivotally connected to the brackets 132 and 134, respectively, at two spaced points, it is apparent that the footrest 130 is movable between the vertical position illustrated in FIG. 2 and the raised horizontal position illustrated in FIG. 6.

To connect the linkage systems 137 and 139 for power

operation in response to the direction of rotation of the shaft 116, a pair of links 162 are pivotally connected to the outwardly projecting pins 110 of the solenoid mechanism 106, the other ends of the links 162 being fixed to a cross shaft 164 adjacent the middle thereof as by welding or the like. Links 166 and 168 are then fixed to the opposite ends of the cross shaft 164, as by welding or the like, with the other ends thereof being pivotally connected to the links 140 and 142, respectively, intermediate the ends thereof.

With this construction, the movement of the electric solenoid 106 to the right, as viewed in FIG. 2, will move the links 162, the cross shaft 164 and the links 166 and 168 in unison (all of these elements being rigidly connected together), to the position illustrated in FIG. 6, and by virtue of the pivotal connection between the links 166 and 168, and the links 140 and 142, respectively, the footrest 130 is moved to the raised horizontal position as illustrated in FIG. 6. A suitable electric switch 128, similar to the electric switches 124 and 126, may be mounted on the side arm 14 so as to energize the solenoid 106 and the electric motor 120 when moved to the "up" position to cause the solenoid 106 to move to the right, and to lower the footrest 130 to its vertical position, as illustrated in FIG. 2, when the electric switch 128 is moved to its "down" position.

To insure that the travel of each of the solenoid mechanisms 104, 106 and 108 is confined to predetermined portions of the shaft 116 so that they will not interfere with one another, a plurality of pins 170 are fixed to the shaft 116 so as to project therefrom, as most clearly illustrated in FIGS. 1 and 5. It will be observed that there are a pair of pins on each side of each of the solenoid mechanisms and that as illustrated in FIG. 1, each of the solenoid mechanisms is in its extreme left position wherein it contacts the pin on the left-hand side thereof.

These pins serve as stop means for limiting the movement of the solenoid mechanisms by positively blocking or contacting the running nuts to stop the movement of the solenoid mechanisms. As soon as one of the running nuts strikes one of the pins 170 it begins to rotate with the shaft since it can no longer move axially along the shaft 116. This rotation of the running nut cams the ball end of the plunger of the solenoid out of the detent on the cylindrical surface of the running nut, as previously described, to permit the running nut to rotate relative to the solenoid mechanism when it can no longer move axially on the shaft 116.

All of this, of course, is completely described in the aforementioned copending application and reference is again made thereto for a complete description of the operation of the solenoid mechanisms on the rotating shaft 116. Actually each of the solenoid mechanisms is designed so that when the ball end of the plunger is cammed upwardly out of the detent on the running nut when the axial movement of the nut is stopped by a pin 170, and the spring 176 urges the plunger upwardly to prevent it from re-engaging the detent. With this construction, each of the switches 124, 126 and 128 can be moved either up or down to drive the portions of the seat controlled thereby to the desired position without worrying about going too far since as soon as the solenoid mechanisms engage one of the pins on either side thereof, the portion of the seat operated thereby will automatically come to a halt regardless of whether the operator holds the switch in an energized position.

While it will be apparent that the preferred embodiment of the invention herein disclosed is well calculated to fulfill the objects above stated, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope or fair meaning of the subjoined claims.

What is claimed is:

1. A power-operated reclining chair comprising, a frame, spaced-apart side arms secured at the side of the

frame, driving means mounted on said frame, said driving means including a lead screw disposed between and parallel to said side arms, three solenoid actuated running nut means mounted on said lead screw, each of said solenoid actuated running nut means being adapted to move axially over predetermined portions of said lead screw in response to the rotation of said lead screw in either of two directions, a back rest pivotally mounted to said frame, linkage means having one end thereof pivotally connected to said back rest and the other end thereof pivotally connected to one of said solenoid actuated running nut means, a seat pivotally connected to said frame, second linkage means having one end thereof pivotally connected to said seat and the other end thereof pivotally connected to a second one of said solenoid actuated running nut means, a footrest, a linkage system for movably connecting said footrest to said frame to enable said footrest to be moved between a vertical lowered position and a horizontal raised position, third linkage means pivotally connected to said linkage system and to a third one of said solenoid actuated running nut means, and means for selectively energizing each of said solenoid actuated running nut means and rotating said lead screw in either of two directions to selectively move the back rest, seat and footrest.

2. A power-operated reclining chair comprising parallel spaced-apart side arms, transverse members extending between and rigidly connected to said side arms adjacent the bottom thereof, a back rest disposed between said arms and pivotally connected thereto, a seat supporting frame disposed between said arms and pivotally connected thereto, a footrest, a linkage system for mounting said footrest on said side arms for movement between a vertical lowered position and a horizontal raised position, an upwardly presenting channel-shaped member mounted on said transverse members substantially midway between and parallel to said side arms, solenoid actuated running nut means, means for mounting each of said solenoid actuated running nut means for sliding movement between the legs of said upwardly presenting channel-shaped member, a lead screw extending through said solenoid actuated running nut means, means for selectively rotating said lead screw in either of two directions and for selectively energizing each of said solenoid actuated running nut means for axial movement relative to said lead screw in response to the rotation thereof, a first linkage means having one end thereof pivotally connected to said back rest and the other end thereof pivotally connected to one of said solenoid actuated running nut means, a second linkage means having one end thereof pivotally connected to said seat supporting frame and the other end thereof pivotally connected to a second one of said solenoid actuated running nut means, and a third linkage means having one end thereof pivotally connected to a third one of said solenoid actuated running nut means and the other end thereof pivotally connected to said linkage system.

3. A power-operated reclining chair comprising parallel spaced-apart side arms, transverse members extending between and rigidly connected to said side arms adjacent the bottom thereof, a back rest disposed between said side arms and pivotally connected thereto, a seat supporting frame disposed between said side arms and pivotally connected thereto, a footrest, a first linkage system pivotally connected to one of said side arms at spaced points thereon and pivotally connected to one side of said footrest at spaced points thereon, a second linkage system pivotally connected to the other of said side arms at spaced points thereon and pivotally connected to the other side of said footrest at spaced points thereon, said linkage systems enabling said footrest to be moved between a vertical lowered position and a horizontal raised position, an upwardly presenting channel-shaped member mounted on said transverse members midway between and parallel to said side arms, parallel spaced-

apart inwardly presenting channel-shaped members mounted on each of the legs of said upwardly presenting channel-shaped member, three plates slidably mounted within each of said inwardly presenting channel-shaped members, three solenoid actuated running nut means having pins projecting outwardly from opposite sides thereof, each of said pins being connected to one of said plates so that each of said solenoid actuated running nut means is slidably mounted between said inwardly presenting channel-shaped members, a lead screw extending through each of said solenoid actuated running nut means, a speed reducing unit mounted on one end of said upwardly presenting channel-shaped member and drivingly engaging said lead screw, an electric motor mounted on said one end of the upwardly presenting channel-shaped member for driving said speed reducing unit, an electrical switch means for selectively energizing said electric motor for rotation in either of two directions and for selectively actuating each of said solenoid actuated running nut means for axial movement relative to said lead screw in response to the rotation of said lead screw, stop means on said lead screw for confining the axial movement of each of said solenoid actuated running nut means to predetermined portions of said lead screw, a first linkage means having one end thereof pivotally connected to said back rest and the other end thereof pivotally connected to the outwardly projecting pins of one of said solenoid actuated running nut means, a second linkage means having one end thereof pivotally connected to said seat supporting frame and the other end thereof pivotally connected to the outwardly projecting pins of a second one of said solenoid actuated running nut means, a third linkage means having one end thereof pivotally connected to the outwardly projecting pins of a third one of said solenoid actuated running nut means and the other end thereof rigidly connected to a transverse rod extending between said side arms, a link rigidly connected to one end of said transverse rod with the other end thereof pivotally connected to said first linkage system, and a second link having one end thereof rigidly connected to the other end of said transverse rod with the other end thereof pivotally connected to said second linkage system.

4. In a power operated reclining chair, a supporting frame, a seat cushion on said frame, a back cushion pivoted to said frame, a footrest pivoted to said frame

by a linkage system which moves the footrest between a vertically lowered position and a horizontally raised position, power operated means on said frame including a lead screw and a plurality of solenoid actuated running nut means on said lead screw, each of said solenoid actuated running nut means being adapted to move axially over a predetermined portion of said lead screw in response to the rotation of said lead screw in either of two directions, linkage means having one end thereof connected to said back cushion and the other end thereof connected to one of said solenoid actuated running nut means, a second linkage means connected to said linkage system and to a second one of said solenoid actuated running nut means, and means for selectively energizing each of said solenoid actuated running nut means and rotating said lead screw in either of two directions to selectively move the back cushion and footrest to a desired tilted position.

5. A power operated reclining chair including, in combination, a seat frame, a back member pivoted on said seat frame, a footrest pivoted on said seat frame, unit drive means on said seat frame, a single motor on said seat frame for operating said drive means in either direction of rotation, means connecting said drive means to said back member for moving the latter angularly to raised and lowered positions, means connecting said drive means to said footrest member for moving the latter angularly to raised and lowered positions, and means selectively controlling said motor and drive means for actuating said back member and said footrest member simultaneously and independently to raised and lowered positions.

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