United States Patent

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[73] Assignee **La-Z-Boy Chair Company**

[54] **MOTOR-OPERATED RECLINING CHAIR**
10 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** **297/69,**
297/83, 297/330
[51] **Int. Cl.** **A47c 1/02**
[50] **Field of Search** 297/69, 85,
83, 330, 348, 347, 259

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Primary Examiner—James T. McCall
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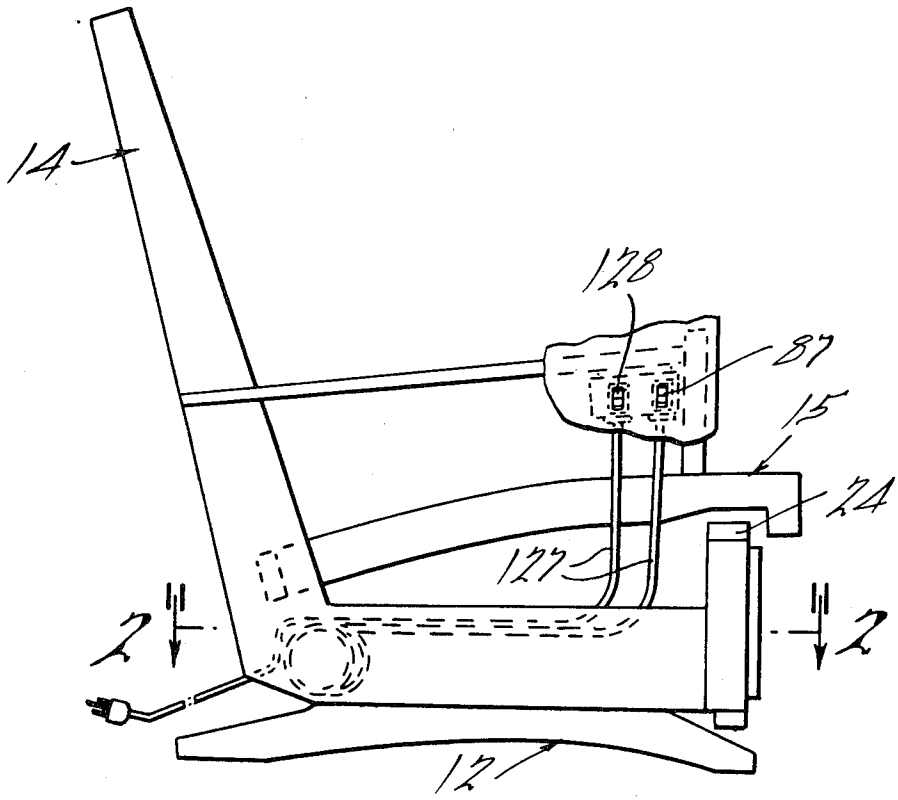
ABSTRACT: The chair has a base frame to which a chair frame is mounted for rearward tilting movement and on which a seat is supported for upward and forward movement as a pivoted back is moved rearwardly on the chair frame by a motor driven lead screw. The forward portion of the tiltable chair frame supports linkage for a leg rest which is operated by a second motor driven lead screw for swinging the leg rest forwardly of the seat and to retracted position. The motors are controlled by "off" switches the actuator of which can be moved in either direction for driving the motors clockwise or counterclockwise.



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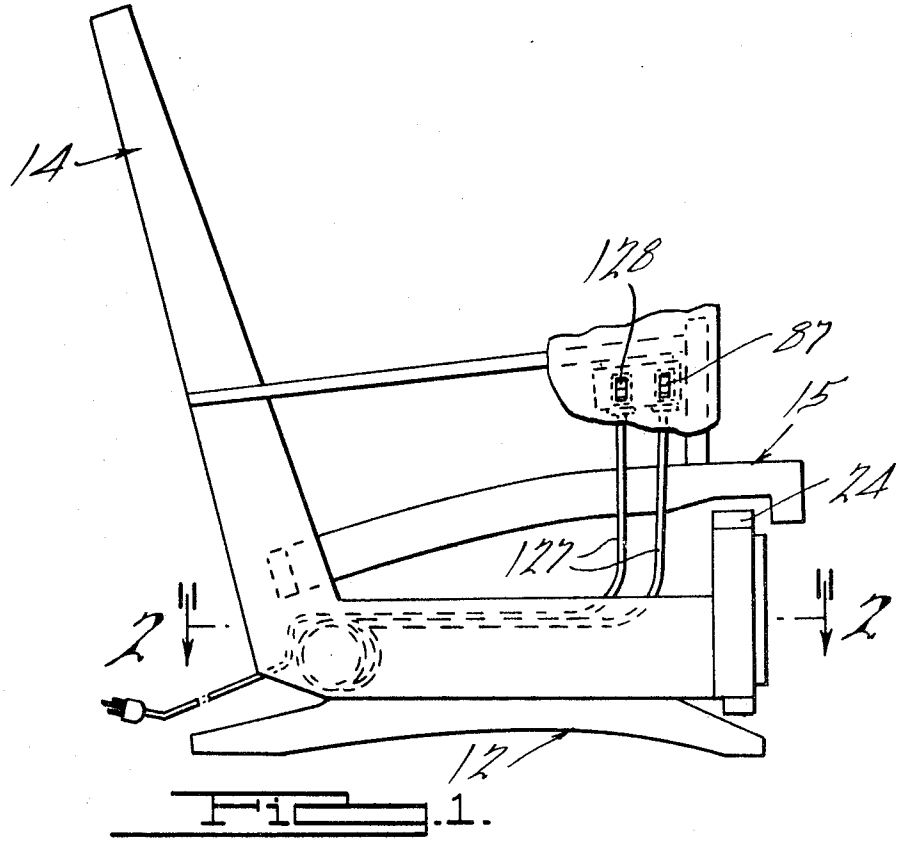

Fig. 1.

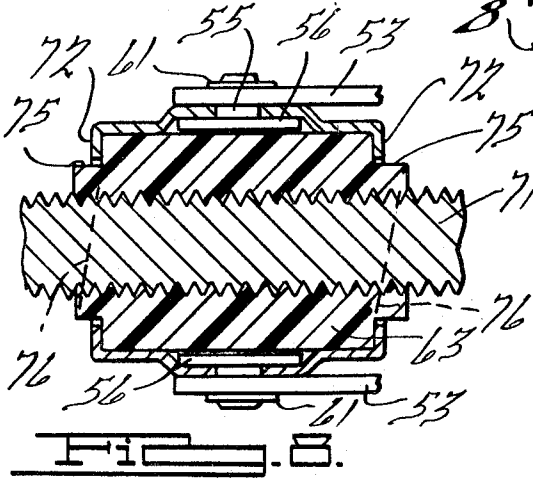

Fig. 8.

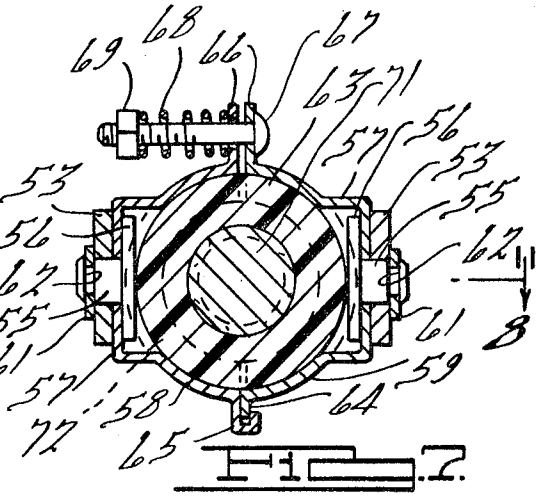

Fig. 2.

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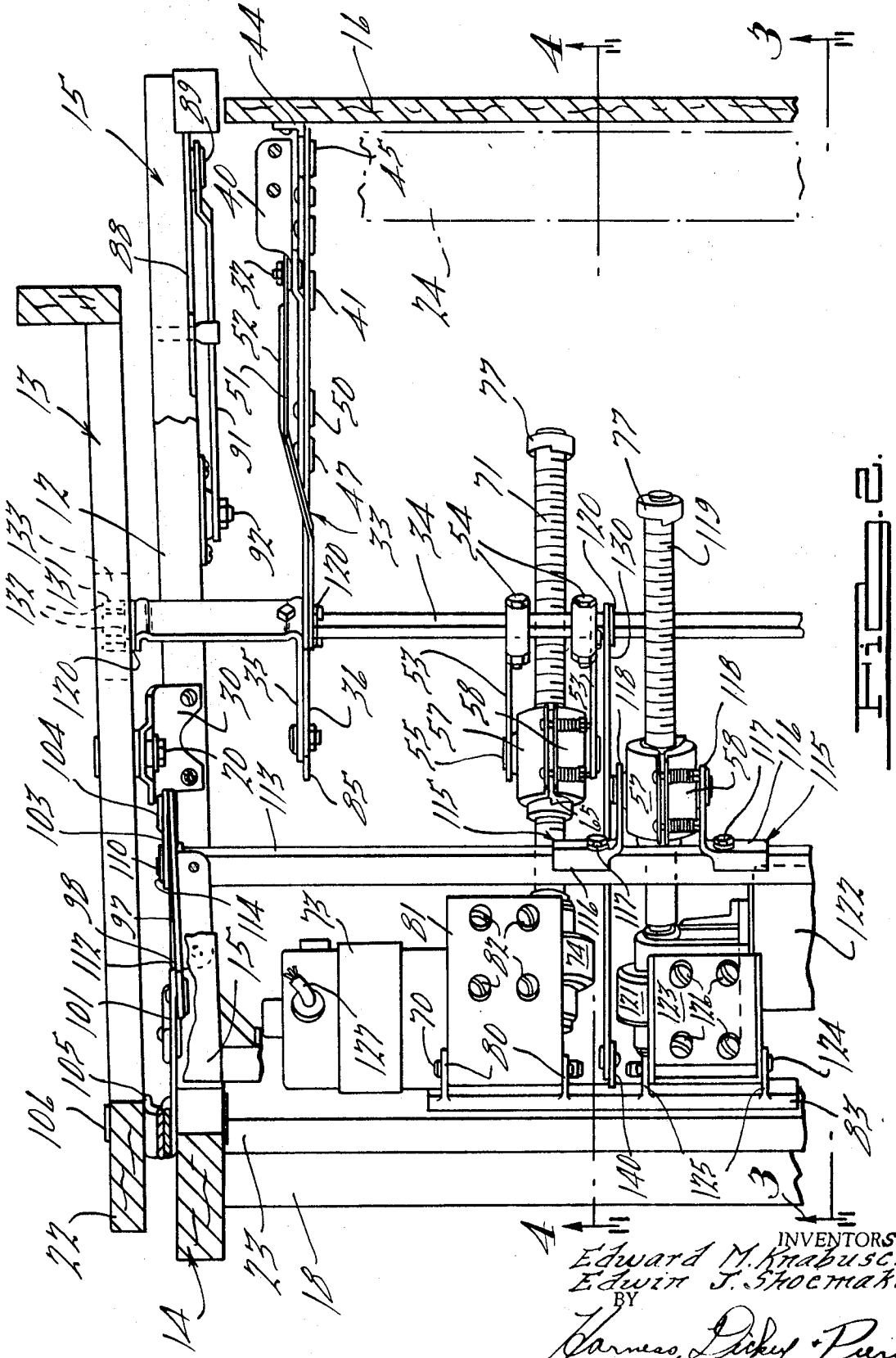

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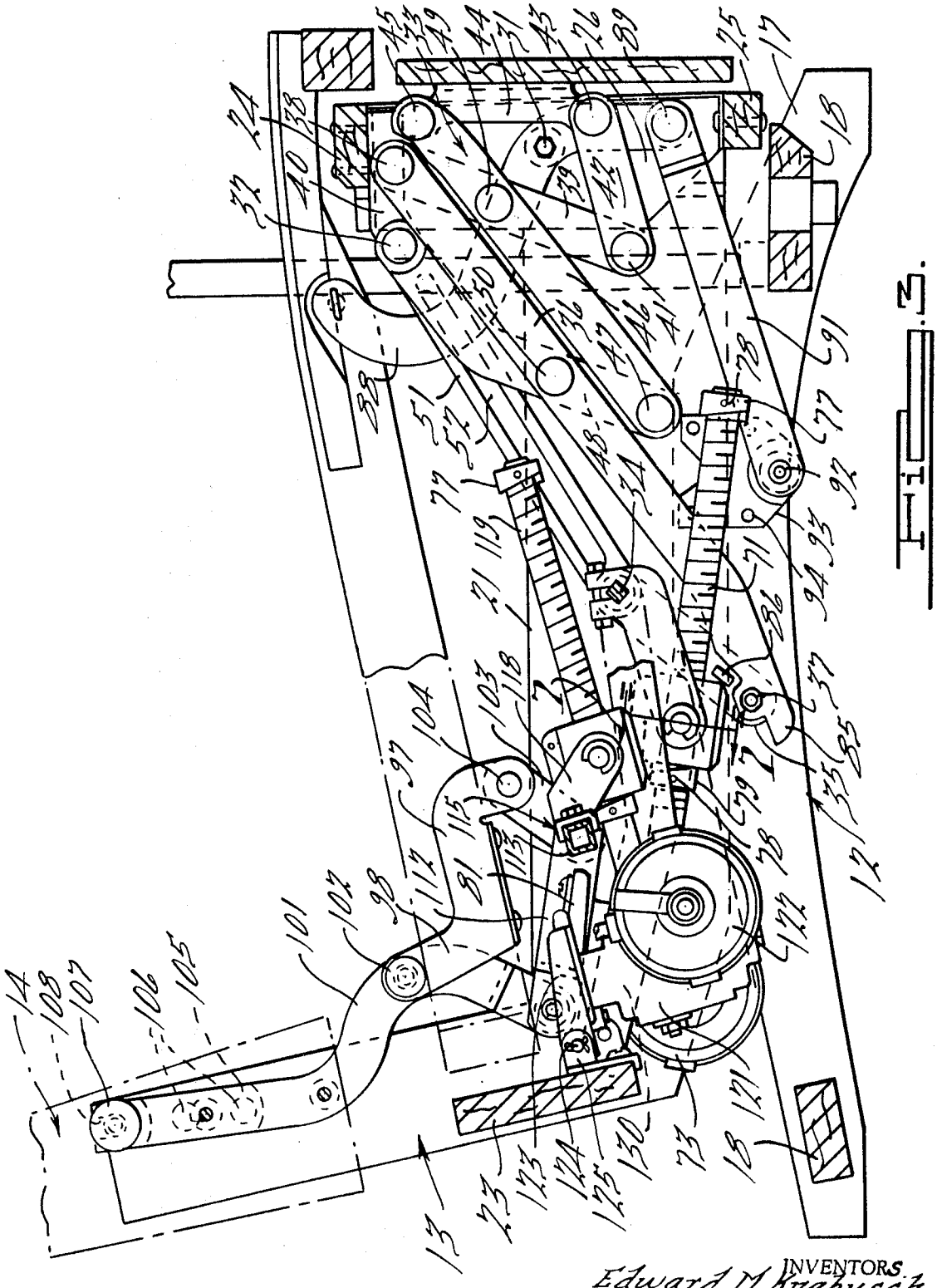

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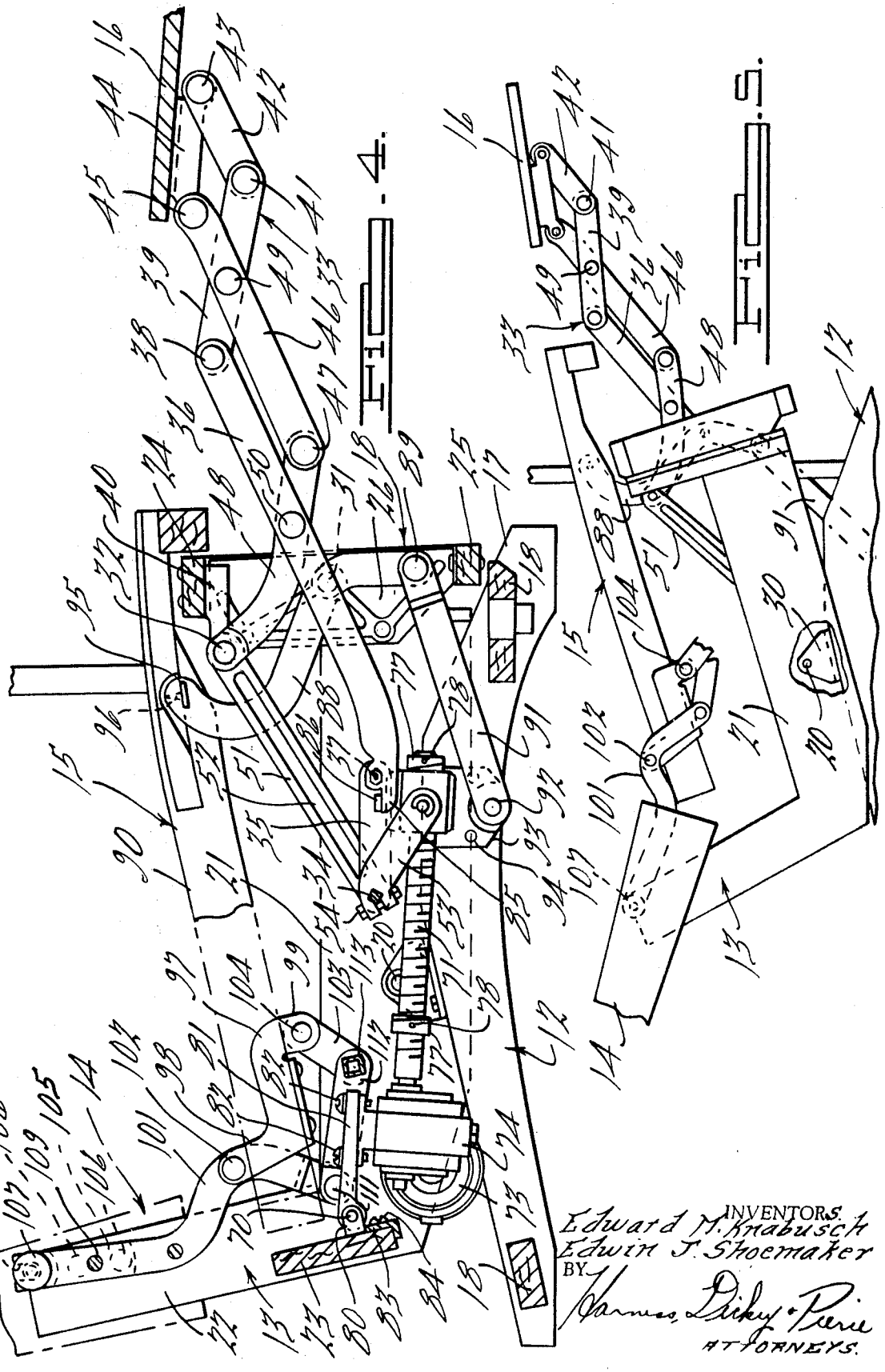

Fig. 4.

Fig. 5.

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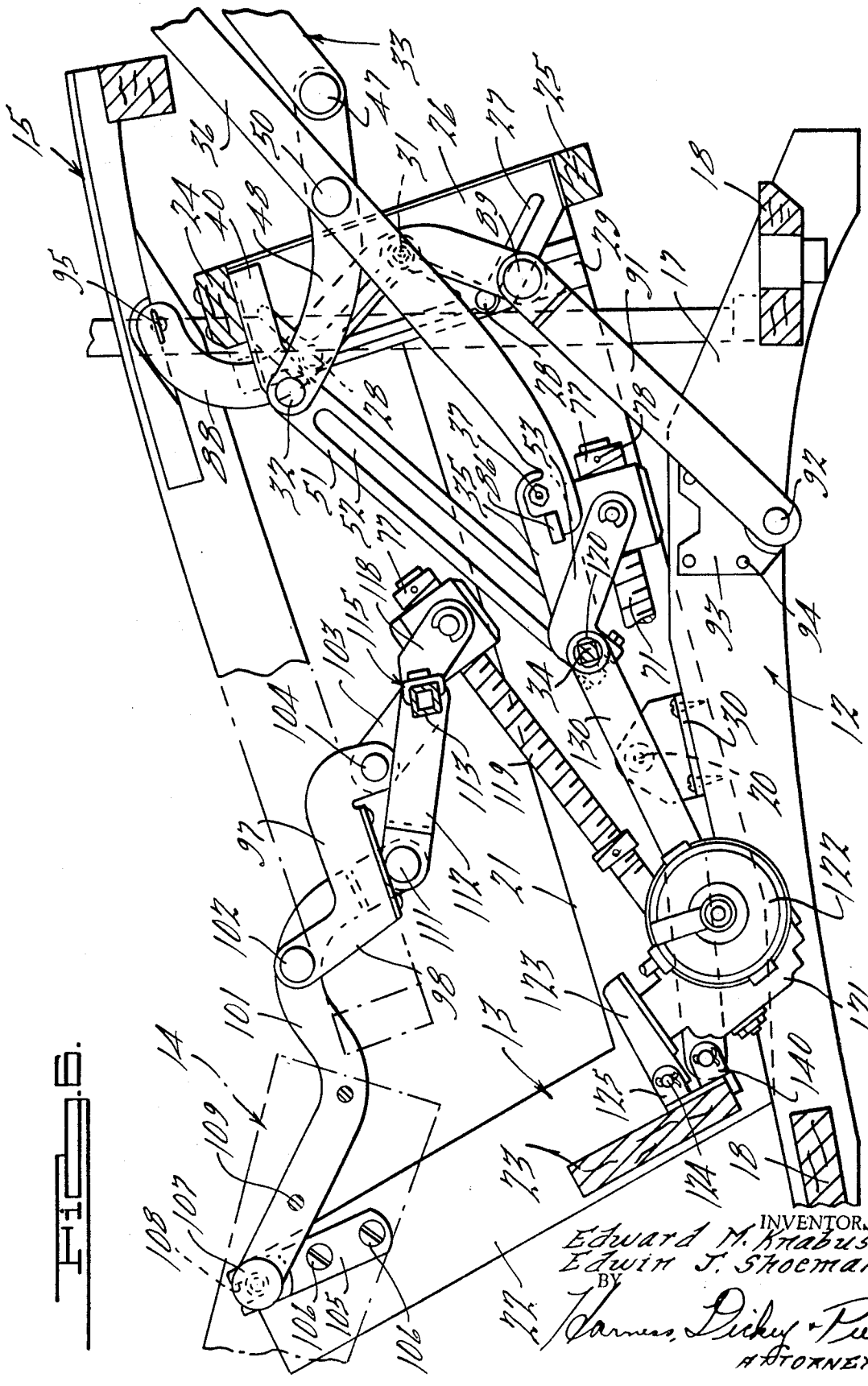

FIG. 6.

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MOTOR-OPERATED RECLINING CHAIR

BACKGROUND OF THE INVENTION

Reference may be had to the U.S. Pat. No. 3,016,264, to A. L. Hughes, issued Jan. 9, 1962 for "Motor-Operated Reclining Chair" over which the present motor-operated chair is believed to be a substantial improvement.

SUMMARY OF THE INVENTION

The electrically operated chair has a base on which a chair frame is mounted for fore and aft tilting movement. A seat frame is supported on linkage on the chair frame for upward and forward movement. A back frame is pivoted to uprights on the chair frame having tilting linkages which are interconnected with the linkage of the seat frame and operated from a crossbar located therebeneath. The bar is pivotally secured to a nut on a lead screw driven by a motor at a predetermined reduced speed for travel from one to the other end thereof when moving the back frame from an erect position to a fully reclined position. The motor of the lead screw is pivotally secured to the rear portion of the chair frame to have the motor tilt therewith and relative thereto. The forward portion of the seat frame carries swinging linkages which control the upward and forward movement of the seat frame.

The front portion of the chair frame carries a pair of scissor linkages for a leg rest, one of the links of which is pivoted to an arm fixed to a square cross-shaft. A central arm on the cross-shaft is pivoted to an arm on a nut on a second lead screw driven by a motor at a speed different from the speed of the motor which drives the lead screw for the tiltable back frame. The end of the other link of the scissor linkages is pivoted to the forward end of the chair frame so that upon the turning of the cross-shaft, the leg rest is swung from a vertical position at the front of the chair frame to a position forwardly and horizontally of the seat frame. The reverse movement of the nut on the second lead screw retracts the leg rest to its initial position against the front of the chair frame. The lead screw retains the seat and back frames as well as the leg rest in any intermediate position between an upright position of the back frame to a fully reclined position thereof.

The nuts are preferably made of a nonfriction material such as Nylon which is retained within spring pressed casing sections in which it can rotate. The friction between the nut and casing sections is regulated by the springs which provide a predetermined holding force between the casing sections and the nut to maintain a driving force therebetween while permitting the nut to rotate therewithin when held from advancing. This may occur from an overload on the nut or by the engagement of either end of the nut with rings on the lead screw between which the nut is movable. The advanced movement of the nuts on the lead screws and the actuation of the linkage systems produce a substantially horizontal position between the leg rest, seat and back frames so that the chair can be used as a bed and to this end it may be made wider to provide more comfort to the sleeper. Such a chair is adaptable for use in small apartments so that in emergencies, it may be employed as a bed as well as a decorative motor driven functional chair.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view in elevation of a chair to which the motor operated systems are applied for producing the actuation of the chair, back and seat frames and the leg rest carried thereby;

FIG. 2 is an enlarged broken sectional view of the structure illustrated in FIG. 1, taken on the line 2–2 thereof;

FIG. 3 is an enlarged broken sectional view of the structure illustrated in FIG. 2, taken on the line 3–3 thereof;

FIG. 4 is an enlarged broken sectional view of the structure illustrated in FIG. 2, taken on the line 4–4 thereof;

FIG. 5 is a broken view of the structure illustrated in FIG. 4, with the back and seat frames in reclined position and the leg rest extended;

FIG. 6 is an enlarged broken view of the structure illustrated in FIG. 3, with the back frame in reclined position;

FIG. 7 is an enlarged sectional view of the structure illustrated in FIG. 3, taken on the line 7–7 thereof, and

FIG. 8 is a sectional view of the structure illustrated in FIG. 7, taken on the line 8–8 thereof.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The chair 11 of the present invention is made up of a base 12, a chair frame 13, a back frame 14, a seat frame 15 and a leg rest panel 16. The base 12 may take any form and here is illustrated as being of rectangular construction having oppositely disposed side members 17 joined by crossmembers 18 at the front and rear. The chair frame 13 has side members of L-shape embodying a horizontal portion 21 and a rearwardly sloping upright 22 with the side portions being interconnected by a rear crossmember 23 and by front top and bottom rails 24 and 25 which are joined together by sideplates 26. The chair frame 13 is mounted outside of the base frame 12 and is secured thereto by a pivot 20 on a bracket 30 on opposite sides of the frames. The sideplates 26 have reinforcing ribs 27 in line with a pair of apertures containing screws 28 by which the plates are secured to uprights 29 at the front of the chair frame. The reinforcing ribs also extend to an aperture containing a pivot 31. The leg rest panel 16 is supported upon the chair frame 13 by a pair of scissor linkage systems 33 which are clearly illustrated and described in the U.S. Pat. No. 3,235,307, to E. M. Knabusch et al., issued Feb. 15, 1966 for "Reclining Chair." It is to be understood that the scissor linkage systems 33 are applied to both sides of the chair frame 13 but since both are exactly alike, only one will be described herein in detail. A square shaft 34 extends transversely of the chair frame 13 to which operating arms 35 are secured near the outer ends. An actuating link 36 is secured by a pivot 37 to the end of the arm 35, the opposite end being secured by a pivot 38 to a link 39. The link 39 is secured by a pivot 41 to a link 42 which is secured by a pivot 43 to a mounting bracket 44, one of which is mounted near each end of the leg rest panel 16. A pivot 45 secures a link 46 to the opposite end of the bracket 44 having its opposite end secured by a pivot 47 to a link 48 which is secured to a bracket 40 supported on the rail 24 by a pivot 32. The link 46 is secured to the link 39 by a pivot 49 and the link 36 is joined to the link 48 by a pivot 50.

A brace link 51 having a central strengthening rib 52 is secured to the pivot 32 and is pivoted to the square cross-shaft 34 on a bushing 120 to be described hereinafter. The center of the cross-shaft is fixed to spaced arms 53 which are clamped thereto by bolts 54. The arms 53 are pivoted to trunnions 55 extending from heads 56 within an offset 57 in a pair of casing sections 58 and 59. The arms 53 are retained upon the trunnions by split spring washers 61 which extend into an annular slot 62 at the outer end thereof. A lead screw nut 63 made of any antifriction material known in the art to be suitable, is herein illustrated being made of Nylon. The casing section 59 has a downwardly extending flange 64 disposed within an upwardly presenting channel 65 on the casing section 58 in hinged relation thereto. The diametrically opposite sides of the casing sections 58 and 59 have extending flanges 66 through which a pair of bolts 67 extend each having a spring 68 thereon tensioned by an adjusting nut 69. The tension of the spring 68 is such that the nut will not turn within the casing sections 58 and 59 when the nut is driven along a lead screw 71 but will turn therewithin when restricted against advancement, as illustrated in FIG. 4.

The ends of the casing sections are flanged inwardly at 72 to encompass the forward and rearward end faces of the nut when the casing sections are assembled thereover to cause the sections to move with the nut longitudinally along the lead screw 71. The lead screw is driven by a motor 73 through a speed reduction unit 74 at a predetermined desired speed. The central portion of both ends 75 of the nut projects beyond the flanges 72 of the casing sections and a pair of sloping surfaces provide stop faces 76 on the ends thereof which mate with a similar pair of stop faces on rings 77 secured on the lead screw by pins 78. The nut travels on the lead screw 71 between the

rings 77 to fully extended and fully retracted position of the leg rest panel 16. The panel is retained in any position by stopping the nut at any point along the lead screw between the rings 77.

The gear reduction unit 74 is secured to a platform 81 by screws 82, the platform being pivoted by a stub shaft 70 between bosses 80 on a cross plate 83 which is secured by screws 84 to the crossmember 23 on the chair frame 13. This permits the lead screw to move upwardly and downwardly relatively to the cross-shaft 34. The advancement of the nut 63 from its rear position against the ring 77 swings the arm 35 counterclockwise and the leg rest 16 from a retracted position, as illustrated in FIG. 3, to a forward extended position, as illustrated in FIG. 4. The link 36 has an extending finger 85 at the end which abuts a stop 86 carried by the arm 35 when the leg rest panel 16 is in the fully extended position.

The motor is energized by a switch 87 which normally is in "off" position. The switch actuator is so arranged that when the upper portion is moved inwardly the motor will be operated to advance the nut forwardly on the lead screw and when the lower portion is moved inwardly the motor will be reversed to retract the nut on the lead screw. Should the switch be maintained "on" at the forward or rear positions of the nut, the ring 77 will be engaged and the nut will be carried around with the lead screw within the casing sections 58 and 59, thereby preventing the elements of the link systems from being overstressed.

The pivot 31 on the plate 26 supports an S-shaped link 88, the lower end of which is secured by a pivot 89 to a link 91 which is secured by a pivot 92 to a bracket 93 attached on the chair frame 13 by screws 94. The upper end of the S-shaped links 88 are pivoted on a pin 95 in an aperture in the side rails 90 of the seat frame 15. The pin 95 has a flat head which is secured to the seat frame by a screw 96. A bracket 97 is secured to each of the side rails 90 near the rear end thereof. The bracket 97 has an upwardly extending end 98 and a downwardly extending end 99. An S-shaped link 101 is secured by a pivot 102 to the upstanding end 98 and a link 103 is secured by a pivot 104 to the downwardly extending end 99, the structure being somewhat similar to that illustrated and described and claimed in the above-mentioned patent.

An arm 105 is secured to the upright 22 of the chair frame 13 by screws, rivets or other reliable securing means 106. The S-shaped link 101 has a headed rivet 107 on the upper end which rests in a slot 108 in the upper end of the arm 105. The S-shaped links 101 are secured to opposite sides of the back frame 14 by screws 109. With this arrangement the back frame 14 is supported by the rivets 107 within the slot 108 of the arms 105 for forward and rearward tilting movement. The back and joined seat frames are moved downwardly between the uprights 21 and supported for pivotal movement when the rivets 107 are disposed within the slots 108. The lower end of the S-shaped link 101 is secured by a pivot 111 to an offset link 112, the opposite end of which is pivoted to the end of a square tubular crossbar 113 to which the end of the link 103 is also pivoted. It is to be understood that similar links 103 and 112 on the opposite side of the seat frame are pivoted to the opposite end of the crossbar 113. The links are secured to studs 110 at the ends of the crossbar by split spring washers 114 or other suitable means. The crossbar 113 has a pair of L-shaped brackets 115, one branch of which is of channel shape to receive the crossbar 113 to which they are clamped by a screw 117. The other branch 118 of the brackets 115 extend outwardly in parallel relation to each other having an aperture in the outer end which receives the trunnions 55 extending from the casing sections 58 and 59 which supports a nut 63 on a lead screw 119 which is the same as that described hereinabove with regards to the lead screw 71 which operates the leg rest linkage systems. A brace link 130 is secured by a pivot to a boss 140 on the cross plate 83, the opposite end being pivotally secured to the square shaft 34. This pivotal relation between the square shaft 34 and the brace links 51 and 130 is obtained through the use of the plastic bushings 120 which have a shoulder on a sleeve, the interior aperture of which is square to engage the square shaft 34. The outer surface of the bushing 120 is cylindrical to engage the cylindrical aperture at the ends of the links which thereby pivot relative to the shaft 34. The lead screw 119 is driven by a motor 122 through a gear reduction unit 121 secured to a platform 123 by screws 126 attached by a stub shaft 124 to space bosses 125 on the cross plate 83. Conductors 127 from the motors 73 and 122 are connected to the switches 60 and 128 on the frame of the chair for operating the motors in either direction of rotation. The lead screw 119 has a pair of stop rings 77 thereon for stopping the forward and rearward movement of the nut to limit the tilting of the seat back to rearward and forward positions. When the switch 128 is operated to drive the motor in a direction to tilt the seat backwardly, the nut will be advanced on the lead screw 119 and move the crossbar 113 forwardly therewith. The links 103 and 112, joined to the bracket 97 and S-shaped link 101 respectively, will move forwardly to tilt the back frame rearwardly and to advance the seat frame 15 forwardly while raising the rear and front ends thereof. This movement will continue until the nut 63 strikes the ring 77 at the end of the lead screw 119 at which time the back frame 14 and the seat frame 15 will be moved to a substantially horizontal position, as illustrated in FIG. 5, which shows the leg rest 16 as being disposed in forward extended position. In this position, the chair can function in emergencies as a bed, especially is this true when the chair is widened a few inches to provide a greater lateral spacing between the arms thereof. With proper padding on the back frame, the seat frame and the leg rest, the surfaces thereof are substantially in a horizontal plane to provide the bed relationship. The chair is especially useful for an invalid since by pressing either switch 87 or 128 the occupant can change his position on the seat to provide greater comfort when desired. If the occupant is so crippled that he cannot reach the switches, it is within the purview of the invention to provide a switch box which may rest on his lap and be operated by the simple movement of a finger.

The brace links 51 and 130 prevent any substantial bending of the square shaft 34 through the operation of the nut 63 when actuating the leg rest. Both ends of the shaft 34 have brackets 131 pivotally secured thereto by the bushing 120. The bracket is a stamping having upper and lower flanges 132 providing flat faces which ride on the top and bottom surfaces of a horizontally disposed slot 133 in the side portions 21 of the chair frame 13. This permits a slight forward and backward movement of the ends of the square shaft 34 within the slot to prevent any binding and to simplifying the assembly of the shaft ends with the side portions 21 of the chair frame. The lead screw 119 for reclining the back and raising and advancing the seat operates from 100 to 200 r.p.m.'s depending upon the load condition. The 10 pitch quadruple threaded lead screw 71 for operating the leg rest operates from 150 to 350 r.p.m.'s depending on the load thereon. It was found that by driving the lead screws at these speeds a satisfactory movement in the change of position of the back and seat frames as well as the leg rest were obtained. The driving of the lead screws may be different from the speeds above mentioned depending upon the linkage arrangement and the speed at which the operations are to occur. The speeds herein mentioned produce the desired movements in the back and seat frames and leg rest for the particular chairs and linkages herein illustrated and described.

We claim:

1. In a motor-operated chair, a base, a chair frame pivoted on said base, a back frame pivoted on said chair frame, a seat frame connected to said back frame and said chair frame, a lead screw driven through a reduction gear by a motor supported on the chair frame, a nut on said lead screw, arm means carried by said nut, a crossbar carried by said arm means, said connection between the back and seat frames being linkage means pivoted to the ends of said crossbar for tilting said back frame and moving said seat frame when the nut is moved on said lead screw.

2. In a motor-operated chair as recited in claim 1, wherein said nut is supported within spring pressed casing sections to which the arm means is pivoted, said nut rotating in said casing sections when retained against movement along the lead screw while the motor is operating.

3. In a motor-operated chair as recited in claim 1, wherein said motor is pivotally mounted on the chair frame.

4. In a motor-operated chair as recited in claim 1, wherein a leg rest supported on spaced link means is attached to the front of said chair frame, a second lead screw driven through reduction gearing by a motor supported on said chair frame, spring pressed casing sections encompassing said nut, a cross-shaft for operating the link means at each side of the chair frame, and an arm fixed on said cross-shaft and pivoted to said casing sections for actuating said leg rest link means which extends and retracts said leg rest to any position forwardly of the chair frame.

5. In a motor-operated chair as recited in claim 4, wherein lead screws have spaced stop rings between which the nut is positioned for limiting its movement therebetween and which rotates within the casing sections when engaged thereby.

6. In a motor-operated chair as recited in claim 5, wherein switch means are provided for each motor for operating them in either direction of rotation from an "off" position.

7. In a motor-operated chair as recited in claim 6, wherein said switch means is mounted on the chair frame.

8. In a motor-operated chair as recited in claim 4, wherein said leg rest motor is pivoted to said chair frame.

9. In a motor-operated chair as recited in claim 4, wherein bracing links are pivotally supported on said chair frame and to said cross-shaft to prevent it from deflecting.

10. In a motor-operated chair as recited in claim 9, wherein brackets are pivoted to the ends of the cross-shaft and positioned in horizontally disposed slots in the chair frame to permit the ends of the cross-shaft to move horizontally when it is deflected when operated.