

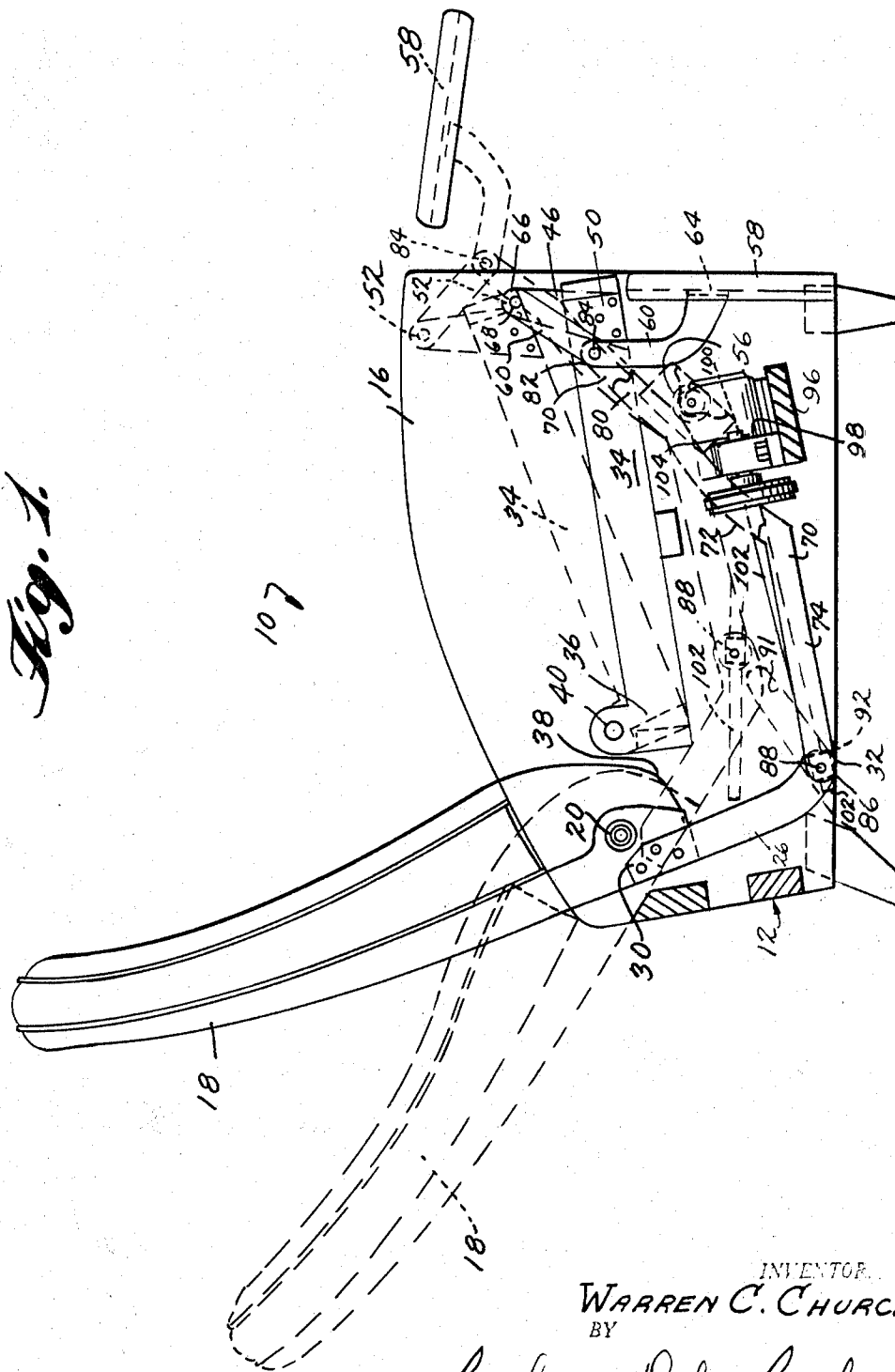
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W. C. CHURCH
RECLINING CHAIR

3,476,495

Filed May 17, 1967

3 Sheets-Sheet 1



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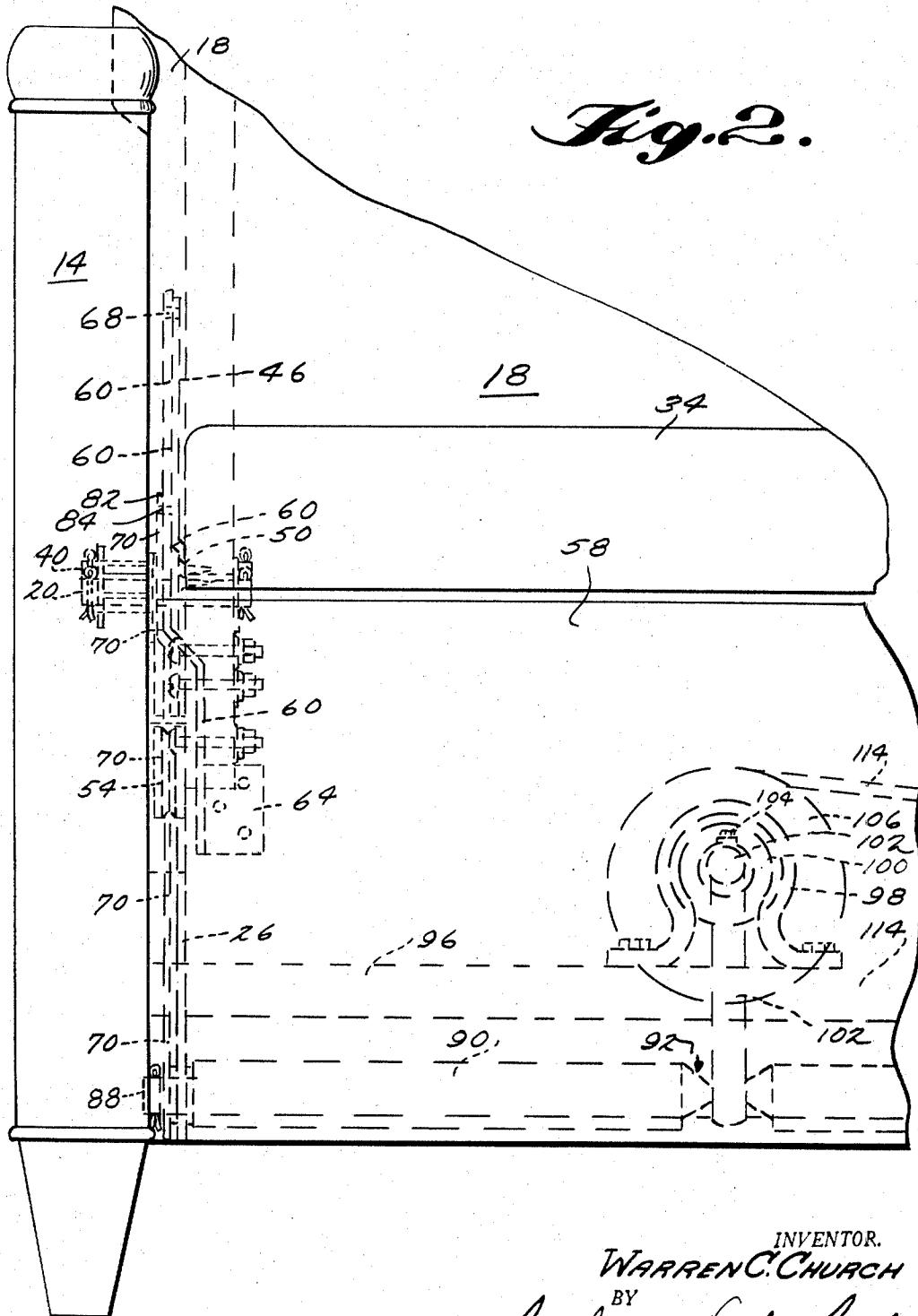
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3 Sheets-Sheet 3

Fig. 3.

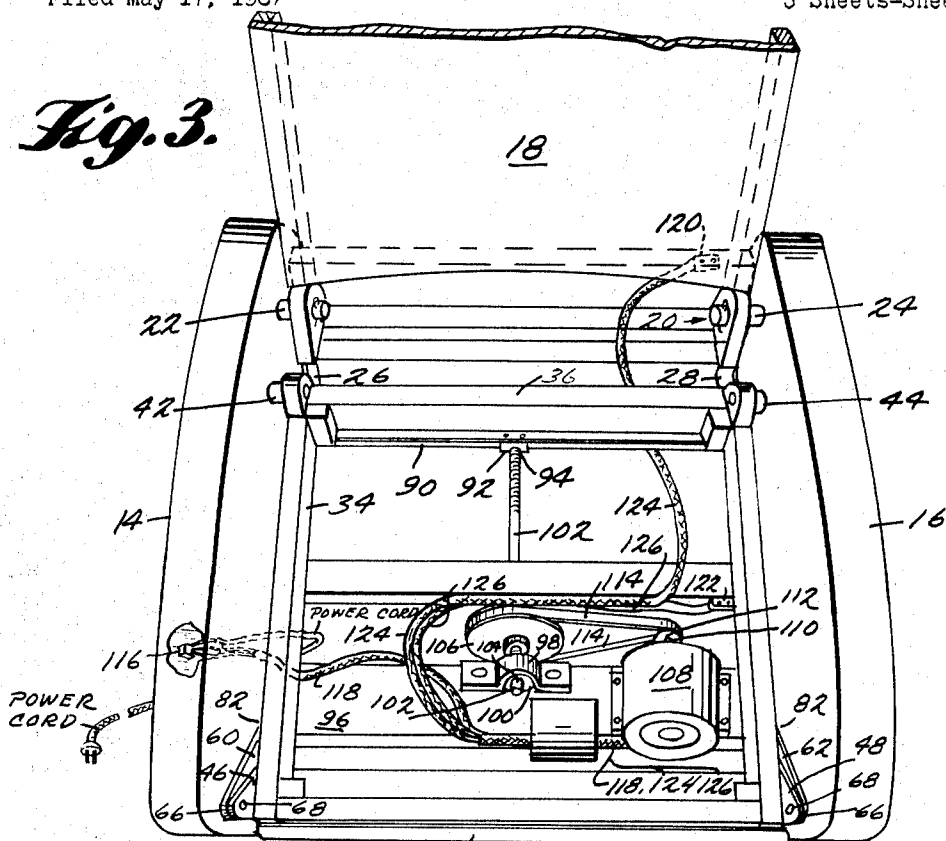
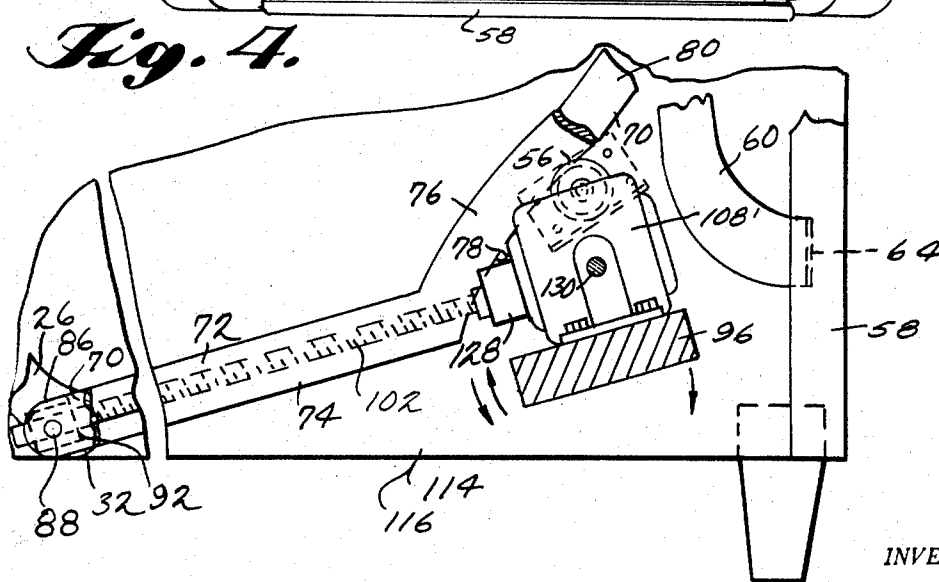


Fig. 4.



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RECLINING CHAIR

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7 Claims

ABSTRACT OF THE DISCLOSURE

The reclining chair back is pivotally connected near its lower end to the chair frame sides as is the chair seat near its rear. An actuator element extends from a pivotal connection to downward extensions of the chair back to pivotal connection to a lifting and lowering element for the foot rest intermediate the ends of the latter. The lifting and lowering element is pivotally connected to the seat near its front. Intermediate its ends, the actuator element has a cam surface which rides on a pulley connected to the chair sides. A motor driven jack screw arrangement oscillates the actuator element forwardly and rearwardly to operate the chair.

Background of the invention

There is a large and, at first blush, seemingly exhaustive body of United States patent literature on reclining chairs. In some such chairs, the chair seat remains stationary while the chair back and foot rest elevate and recline. In others, the back, seat and foot rest portions of the chair all move together as a unit, for instance angularly of the chair platform or base. In yet other prior art chairs, the back, seat and foot rest portions are adjustable independently of one another. In most of such prior art devices, the adjusting of the chair between its reclining and elevated condition is performed by a chair occupant, for instance, seated in the chair when in an elevated position, firmly gripping the chair arms while pushing backwardly on the chair back with his own back to move the chair to its reclining condition. Linkage friction or a series of detents on at least one linkage member are often employed in such chairs in order to retain them at one or more intermediate positions.

While such chairs are usually easy to cause to recline, the amount of strength and muscular co-ordination needed for bringing the chair from a reclined condition to an elevated or erect condition, is beyond the capabilities of many older persons and those in ill health. Such persons have heretofore been unable to enjoy the comfort of reclining chairs or have had to depend upon physical assistance from others in returning their reclined chair to an erect condition. Since the potential user of the reclining chair in shopping for a reclining chair usually sits in one or more floor samples and tries reclining and erecting them, the difficulty above mentioned is often discovered by the potential customer before he has purchased a reclining chair. Thus, it is believed that the potential market for reclining chairs, among the segment of the population which might otherwise gain the most enjoyment and benefit from the reclining chairs, has not been able to be successfully exploited because of this shortcoming of prior art reclining chairs.

One factor which appears to structurally best characterize the reclining chairs of the prior art is the large number of inter-connected links, springs, lazy tongs and similar parts which are incorporated in prior art reclining chairs in order to accomplish the desired adjustability thereof. The first reaction of one not skilled in the art to an inspection of the working components of prior art reclining chairs might well be that all of those linkages,

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springs, lazy tongs and such elements represent a significant portion of the cost of manufacture of such reclining chairs. However, in fact, besides the contribution to cost, the presence of such linkages, springs, lazy tongs and similar elements impose severe design limitations on prior art reclining chairs so that usually a prior art reclining chair can be spotted for what it is from a considerable distance because of the bulky base or platform area of the chair and sometimes because of exposed linkage members, even when such prior art chairs are in an erect condition.

To even a casual observer of our society, it must be apparent that the exterior design and appearance of furniture articles in addition to the comfort or usefulness provided by the articles, is given great weight by most consumers in choosing furniture. Therefore, it is not an irrational speculation that there exists a body of consumers who crave reclining chairs because of their comfort and usefulness but who would not have a prior art one in their homes because its bulkiness offends their sense of style and design.

Summary of the invention

It is an object of the present invention to provide a reclining chair which overcomes the heretofore unsolved problems respecting prior art reclining chairs as mentioned above, in particular, to provide a chair which can be easily operated in both directions by a broad range of persons from the healthy and robust to the old or ill and one with a positive stop in any position from sitting upright to full reclining.

The chair of the invention includes a frame, a chair back, a chair seat, and in the preferred embodiment shown is provided with a foot rest. The chair back is pivotally connected near its lower end to the frame so that the back can move about a horizontal axis transverse to the frame. The chair seat is connected near its rear end to the frame by a pivotal connection so that the seat can pivot about a horizontal axis transverse to the frame. A long, rigid, longitudinally directed actuator element operatively connects the chair back below its pivotal connection to the frame to the chair seat forwardly of the pivotal connection of the chair seat to the frame, by pivotal connections to these respective members. Support for the forward part of the seat and relative movement control for the chair back and seat front are provided by having a cam follower mounted on the chair frame beneath the seat near the front of the seat and having the actuator element provided with a cam surface which rides upon the cam follower during all phases of reclining and elevating of the chair. Also in the preferred embodiment, a small electric motor is provided, mounted beneath the seat, for reclining and erecting the chair upon command of the user of the chair, for instance via a switch mounted where it can be easily operated by a person sitting in the chair.

Brief description of the drawings

FIGURE 1 is a side elevation view of the reclining chair with the rear arm cut away, one extreme position of the movable elements being shown in full lines and the other extreme thereof being shown in dashed lines;

FIGURE 2 is a fragmentary front elevation view of the chair of FIGURE 1;

FIGURE 3 is a perspective view of the chair with the upholstery removed; and

FIGURE 4 is a fragmentary side elevation view similar to FIGURE 1 of a modification.

Description of the preferred embodiments

With attention FIGURES 1-3, the reclining chair 10 includes a base 12 having two opposed upstanding arms 14, 16. Near the rear of the frame, a chair back 18 is pivotally connected at 20 near the lower end of each side

thereof to the arms 14, 16 of the frame, between them, respectively by joint assemblies 22, 24 which typically include a central axle, washers and spacers, and retaining means at each end of the axle such as cotter pins. At each side of the lower end of the back 18, brackets 26, 28 are fixedly secured at their upper end 30 to the back 18 and project downwardly beyond the lower end of the back 18 terminating in free ends 32.

The chair 10 also includes a seat 34 received between the arms 14, 16 of the frame so as to have the rear edge 36 thereof closely adjacent the lower edge 38 of the chair back 18. Near the rear thereof, the chair seat 34 is pivotally secured to each of the arms 14, 16 at 40 for pivotal motion about the horizontal axis 40 which is transverse to the base 12. The mounting at 40 preferably comprises two assemblies 44, 42 which are substantially the same in construction as the assemblies 22, 24 of the chair back pivot 20.

The seat 34 on each side thereof near the front of the seat is provided with a bracket 46, 48 fixedly secured at the lower end 50 thereof to the seat and having an upper free end 52.

About a third of the way back from the front of the seat 34 toward the rear thereof beneath the seat, a roller 54, 56 is mounted on the facing surfaces of the arms 14, 16 for rotation about a common horizontal axis transverse to the base 12.

The rollers 54, 56 may comprise pulleys. The chair 10 in the preferred embodiment thereof, includes a foot rest 58 which, when the chair is in an erect condition, is generally vertically oriented flat against the front of the chair in line with the front of the seat. The foot rest is secured to the chair via bracket 60, 62 which are fixedly secured to the rear of the foot rest near each side thereof at the lower ends 64 of the brackets 60, 62. The brackets 60, 62 have free upper ends 66, each respective foot rest bracket upper end 66 being pivotally secured at 68 to a respective seat bracket upper end 62 for relative pivotal movement about the axis 68 horizontal and transverse to the base 12. Suitable pivoting means for the axis 68 may comprise holes through the respective ends 66, 52 and conventional nut and bolt assemblies, rivets or the like received through the openings.

The actuating and support mechanism for the chair 10 also includes long actuator elements 70, 72 which may be made of material similar to that of the brackets 26, 28; 60, 62; 46, 48, i.e. steel plate or the like. Each actuator element 70, 72 is relatively rigid and includes a substantially straight rear portion 74 which extends for approximately half of the length of the respective element and integral cam portion 76 which extends forwardly and upwardly from the portion 74 at about a 120° angle. Each portion 76 is provided with a downwardly, forwardly concave arcuate cam surface 78 generated about an axis which is horizontal and transverse to the base 12. Each portion 76 comprises approximately one-third of its respective element 70, 72 and at its forward end merges into a short straight portion 80 which projects forwardly and slightly upwardly from the respective portion 76 so as to form approximately 160° angle therewith.

The forward end 82 of each respective element 70, 72 is pivotally secured at 84 to respective of the foot rest brackets 60, 62 approximately midway between the ends of the foot rest brackets 60, 62. The pivotal connections at 82 provide for pivotal movement about a horizontal axis transverse to the base 12, the structure of the connections 82 being similar to those provided at 68.

It should now be noticed that the cam follower rollers 54, 56 and cam surfaces 78 of the elements 70, 72 portions 76 are so relatively oriented and positioned, that during all phases of operation of the chair the cam surfaces 78 are in rolling contact with the respective rollers 54, 56.

The rear ends 86 of the respective element 70, 72 are pivotally connected at 88 to the lower ends 32 of the

respective brackets 26, 28 of the chair back. The connections 88 are so constructed as to provide for relative pivotal movement about a horizontal axis transverse to the base 12. As best seen in FIGURE 3, the connection 88 includes a channel member 90 which extends horizontally transversely between the brackets 26 and 28 at the lower ends 32 thereof. The axle and fastening means of the connection 88 terminate short of the arms 14, 16 and are not connected to the arms 14, 16. In fact, in order to allow for ease of assembly of the connection at 88 the arms 14, 16 are preferably notched out at 91 to expose the site of the connection 88 from exteriorly of the base 12 prior to its being upholstered.

Typically, the channel members 90 may have a washer secured to each end thereof through which a central axle extends and protrudes, the bracket ends 32 being received on the axle via appropriate holes formed therein, a spacer washer then being received on each axle protrusion adjacent the respective bracket ends 32, then the actuator elements 70, 72 being received thereon via appropriate openings in the ends 86 and followed by a further spacer washer and all held in place by means such as a cotter pin. Inasmuch as the details of the structure of the connection 88 are not part of the present invention, this description is believed sufficient together with the diagrammatic showing in the drawing.

It should be understood from the description of the chair 10 thus far, that if the back 18 were moved from the full line position thereof to the dotted line position thereof that the bracket ends 32 would be moved forwardly and somewhat upwardly, thus oscillating the actuator element 70, 72 forwardly urging the cam surfaces 78 along the rollers 54, 56 thus pushing the front of the chair seat up causing the seat to assume the tilted position shown in dashed lines as well as bring the foot rest from the retracted position shown in full lines and described above, to the forwardly extending, generally horizontal condition shown in dashed lines in FIGURE 1. Similarly, it should be understood that moving the chair back 18 from the dashed line position thereof to the full line position thereof will oscillate the actuator element 70, 72 rearwardly thus lowering the seat front, making the seat generally horizontal as shown in full lines in FIGURE 1 and returning the foot rest to the retracted position shown in full lines in FIGURE 1.

In the preferred embodiment shown in the drawings, the chair 10 is further provided with electric motor means for selectively operating the chair between the extremes shown in dotted lines and full lines and for stationing the chair at any position between the two extremes shown. In the embodiment of FIGURES 1-3, the motor means includes a jack screw receiver 92 fixedly secured to the channel member 90 midway therealong. The jack screw receiver has means defining a longitudinally directed internally threaded opening 94 therethrough. Because the channel member 90 is rotatable about the connection axis 88, it should be apparent that the jack screw receiver opening 94 will tilt as the member 90 moves.

Toward the front of the chair of FIGURES 1-3, the frame 12 is provided with a transverse cross piece 96 fixedly connected at the ends thereof to the arms 14, 16 near the bottom of the frame 12. As best seen in FIGURE 3, a bearing assembly including an omega-shaped yoke 98 encompassing a part spherical element 100 are mounted on the cross tie 96 centrally thereof by means such as screws received vertically downwardly through the legs of the yoke. The ball member or part spherical member 100 of the bearing has means defining a central opening therethrough which receives the forward end of a jack screw 102. The bearing element 100 is fixedly secured to the jack screw forward end so as to rotate as a unit therewith. For instance, the forward portion of the jack screw 102 may have a short segment of reduced diameter received in the opening through the part spherical element and a nut 104 backed up by a lock washer thread-

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ably received on the protruding forward tip of the jack screw. Just rearwardly of the bearing, a pulley 106 is fixedly mounted on the jack screw 102 for rotation therewith. Also as best seen in FIGURE 3, a fractional horsepower electric motor 108 is mounted on the cross-tie 96 so as to have its output shaft 110 extending rearwardly generally parallel to the jack screw 102. A pulley 112 is fixedly mounted on the output shaft 110 of the motor 108 in alignment with the pulley 106 on the jack screw 102. An endless flexible drive belt 114 is entrained about the pulleys 112, 106. The motor 108 is of the reversible type, being operable to selectively rotate the output shaft 110 in a clockwise and counter-clockwise sense. It should now be apparent that operation of the motor in one sense rotates the jack screw in one sense causing the jack screw to thread further into the opening 94 in the threaded receiver 90 thus pulling the bracket 26, 28, lower ends 32 forwardly, reclining the back 18 while simultaneously oscillating the actuator element 70, 72 forwardly, raising the front of the seat 34 and elevating the foot rest 58. Similarly, operation of the motor in the opposite sense causes rotation of the jack screw in the opposite sense, threading it out of the opening 94 in the receiver 90 thus pushing the bracket 26, 28, lower ends 32 rearwardly erecting the back 18 while simultaneously oscillating the actuator element 70, 72 rearwardly, lowering the front of the seat and returning the foot rest 58 toward its lower, retracted position.

For operation of the motor 108, the chair may be provided at any convenient spot thereon with appropriate switch means such as the switch 116 shown mounted on the outside of the arm 14 near the top thereof, near the front of the chair. In the embodiment shown, the switch 116 is of the type which has an actuator which can be depressed toward two opposite conditions but when released will return to an intermediate, "off" position. Thus, for instance, to elevate the chair, the user sitting in the chair need only press the switch forwardly until the motor has brought the chair to the desired orientation. Similarly, to recline the chair, the user sitting in the chair need only push the switch actuator rearwardly until the motor has reclined the chair to the desired orientation. It is important to note that with the chair of the present invention, elevation of the chair is just as easy as reclining of the chair and the user is not restricted to using the chair in one of a few pre-selected orientations such as are provided by the detent means on the links of prior art reclining chairs since the motor 108 can function to provide elevating and reclining increments of any size between the pre-selected extremes of fully reclined and fully elevated conditions.

In FIGURE 3, the wires 118 connect the switch 116 to the motor 108. Also, a first limit switch 120 is fixedly mounted on the frame 12, for instance, behind the back 18 just above the pivot 20, where the limit switch 120 actuator can be contacted by the chair back 18 as it reaches its pre-selected, fully reclined condition. Similarly, a limit switch 122 is mounted on the frame 12, for instance beneath the seat 34 midway therealong for contact of the actuator of the limit switch 122 by the bottom of the seat 34 as the seat reaches the generally horizontal condition thereof which corresponds to the fully elevated extreme of the chair back. The limit switches 120, 122 are wired to the electric motor 108 at 124, 126 so that when the chair has been fully elevated or fully reclined, the appropriate limit switch 120 or 122 will be actuated to cut out that side of the switch 116 which would tend, if further operated, to move the chair past the respective extreme.

Further with respect to the operation of the chair 10, it should be noted that the provision of the cam followers 54, 56 acting upon the cam surfaces 78 of the actuator elements 70, 72, not only continuously provides for support of the forward portion of the seat 34 but also causes the elevation and retraction of the foot rest 58 to be sub-

stantially proportional, respectively, to the reclining and elevation of the seat back 18 between all points in the paths of operation thereof. In many prior art reclining chairs, the complicated, inter-connecting linkages of the chair actuating elements cause the foot rest to be moved much more quickly than the back and seat during parts of the chair operation and much more slowly than the seat and back during other parts of the path. These sudden movements are often disconcerting to unsuspecting users.

A modification for the electric motor means which elevate and recline the chair 10 of the invention, is shown in FIGURE 4. In the modified embodiment of FIGURE 4, the forward end of the jack screw 102 proceeds directly into the gear box 128 of a gear head motor 108' which is mounted on the cross tie 96 centrally thereof. A cross tie 96, in turn, is pivotally connected at each end thereof by pivot joints 130 to the arms 114, 116 of the base 12 for pivotal motion about a horizontal axis transverse to the base 12. Accordingly, it can be seen that the bearings 98, 100, the pulleys 106 and 112 and the drive belt 114 of the embodiment shown in FIGURES 1-3 have been eliminated. The construction and operation of the modified embodiment shown in FIGURE 4 is otherwise similar to that shown in FIGURES 1-3.

It should now be apparent that the chair 10 as described hereinabove possesses each of the attributes set forth in the specification under the heading "Summary of the invention" hereinbefore. The reclining chair of the invention can be modified to some extent without departing from the principles of the invention as they have been outlined and explained in this specification.

I claim:

1. A reclining chair including: a frame; a chair back; and a chair seat; means pivotally connecting the chair back near the lower end thereof to the frame for pivotal movement about a horizontal axis transverse to the frame; means pivotally connecting the chair seat near the rear thereof to the frame for pivotal movement about a horizontal axis transverse to the frame; bracket means affixed to and extending downwardly from the chair back; a rigid actuator element extending longitudinally of the frame; means pivotally connecting the actuator element at the rear end thereof to the bracket means near the lower extent thereof; and means pivotally connecting the actuator element at the front end thereof to the chair seat near the front end thereof and support means on said frame beneath said chair seat supportively engaging the actuator element, thereby indirectly supporting the chair seat near the front end of the chair seat, whereby pivoting of said chair back in a reclining sense elevates the front of the chair seat and pivoting said chair back in an elevating sense lowers the front of the chair seat; a jack screw receiver pivotally connected to said bracket means affixed to and extending downwardly from the chair back, said jack screw receiver having means defining an internally threaded opening therethrough, said opening extending longitudinally of said frame, said jack screw receiver being pivotable about a horizontal axis transverse to the frame; an electric motor mounted on said frame; a jack screw; said jack screw being threadably received in the threaded opening of said jack screw receiver; means operatively connecting said jack screw to said electric motor for rotation and counter-rotation of said jack screw by said electric motor; and switch means mounted on said chair and operatively connected to said electric motor for initiating and terminating operation of said electric motor.

2. The reclining chair of claim 1 wherein the means pivotally connecting the actuator elements at the front end thereof to the chair seat near the front end thereof comprises: bracket means affixed to and extending upwardly from the chair seat at the front thereof; a foot rest; bracket means affixed to and extending upwardly from said foot rest; means pivotally connecting the bracket means of said chair seat at the upper end thereof to the

bracket means of said foot rest at the upper end thereof for pivotal movement about a horizontal axis transverse to the frame; the actuator element at the front end thereof being pivotally connected to said foot rest bracket intermediate said foot rest and said foot rest bracket upper end for pivotal movement about a horizontal axis transverse to the frame.

3. The reclining chair of claim 1 wherein said electric motor is a reversible electric motor having an output shaft; a pulley mounted on said output shaft; a universal joint comprising a yoke encompassing a part spherical element; said yoke being mounted on said frame and said part spherical element being mounted on said jack screw at the forward end of said screw; a pulley mounted on said jack screw near said part spherical element; and an endless belt drivingly entrained about both of said pulleys, for transmitting rotational and counter-rotational motion from said electric motor to said jack screw.

4. The reclining chair of claim 1 wherein said electric motor is provided with output gear box means; means mounting said motor on said frame for pivotal movement of the motor about a horizontal axis transverse to the frame; said gear box means being operatively connected to said jack screw for effecting rotation and counter-rotation of said jack screw.

5. In a reclining chair having a back and a seat respectively pivotally connected at near the lower end thereof and near the rear end thereof to each of two opposed upstanding sides of a chair frame, the improvement comprising: a rigid actuator element pivotally operatively connected to the back below the lower end thereof, extending forwardly and upwardly therefrom and pivotally operatively connected to the seat near the front thereof by means including bracket means affixed to and extending upwardly from at least one side of the chair seat at the front thereof, a rigid link pivotally connected to the chair seat bracket means near the upper end thereof for pivotal movement about a horizontal axis transverse to the frame, said rigid link also being pivotally connected, below the upper end thereof to the forward end of said rigid actuator element for pivotal movement about a horizontal axis transverse to the frame; a cam follower mounted on the chair frame, between said sides, below the seat; and a cam surface defined on the actuator element intermediate the ends thereof engaging the cam follower, said actuator element receiving support from said cam follower; said rigid actuator element being connected to said back below the lower end of the left side of said back and being con-

nected to said seat near the left side of the front thereof; said cam follower being mounted on said chair left side, facing said chair right side; a second rigid actuator element pivotally operatively connected to the back below the lower end of the right side thereof, extending forwardly and upwardly therefrom and pivotally operatively connected to the seat near the front of the right side thereof; a second cam follower mounted on the chair frame, on the right side of said chair frame facing the left side of said chair frame, below the seat; and a cam surface defined on the second actuator element intermediate the ends thereof engaging the second cam follower, said second actuator element receiving support from said second cam follower, the means for oscillating the first-mentioned actuator element forwardly and rearwardly being constructed and arranged to also oscillate the second actuator element forwardly and rearwardly with the cam surface thereof in contact with the second cam follower.

6. The reclining chair of claim 5 wherein the means for oscillating the actuator element forwardly and rearwardly comprises: an electric motor having a reversibly rotatable output means drivingly connected to said actuator element for intimate adjustment of said chair back and seat between reclined and elevated extremes thereof.

7. The reclining chair of claim 6 having a first limit switch and a second limit switch mounted on the frame thereof and operatively connected to said motor for respectively terminating further reclining and further elevating when predetermined extremes of reclining and elevating have been attained as sensed by engagement of said limit switches by movable elements of said chair.

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JAMES T. McCALL, Primary Examiner

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