Nov. 17, 1964 P. S. FLETCHER 3,157,431

RECLINING CHAIR OF THE MULTIPLE MOVEMENT TYPE

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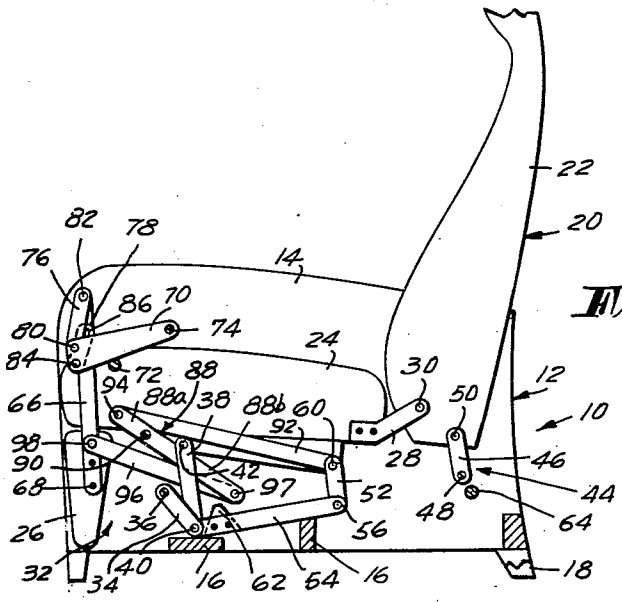


Fig. 1

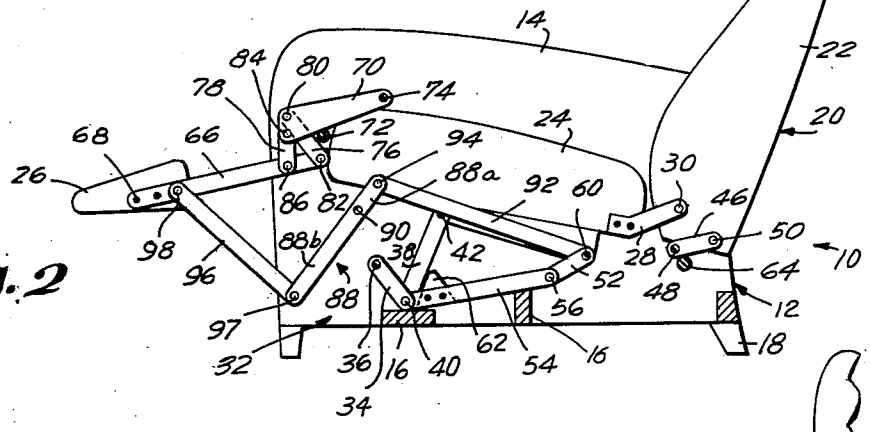


Fig. 2

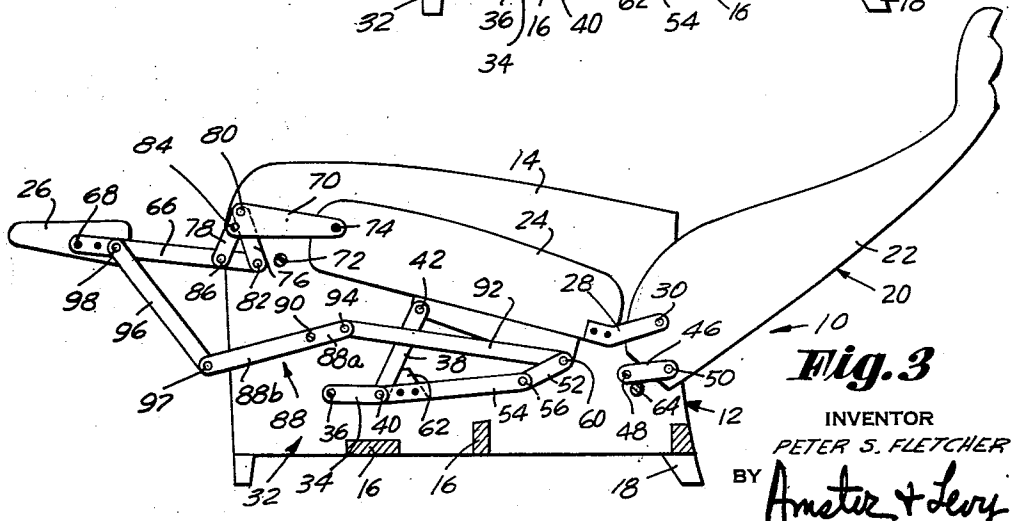


Fig. 3

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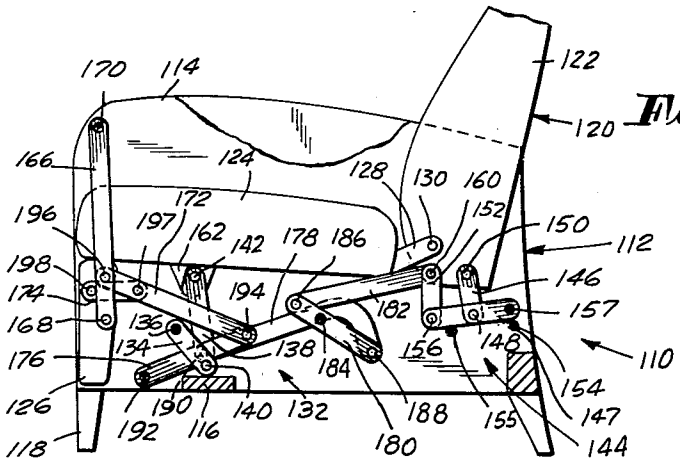


Fig. 4

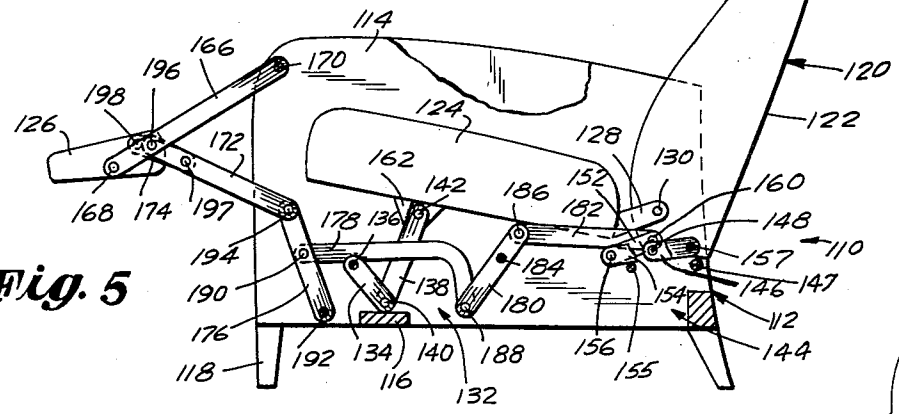


Fig. 5

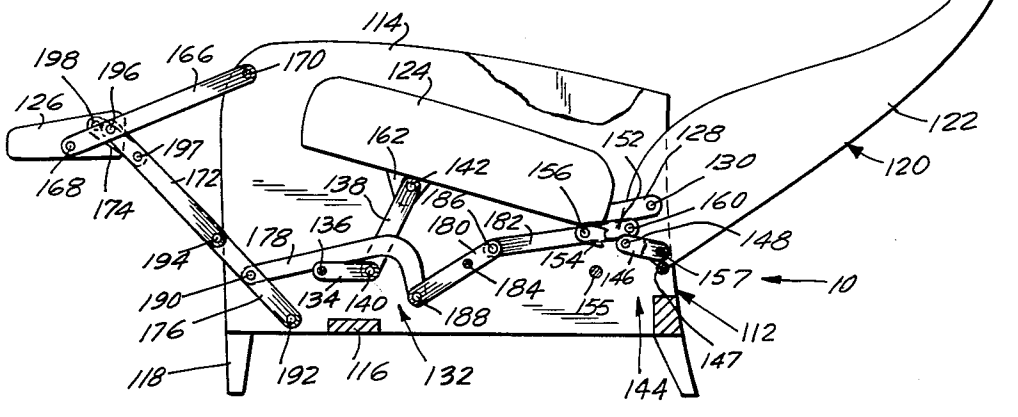


Fig. 6

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Fig. 7

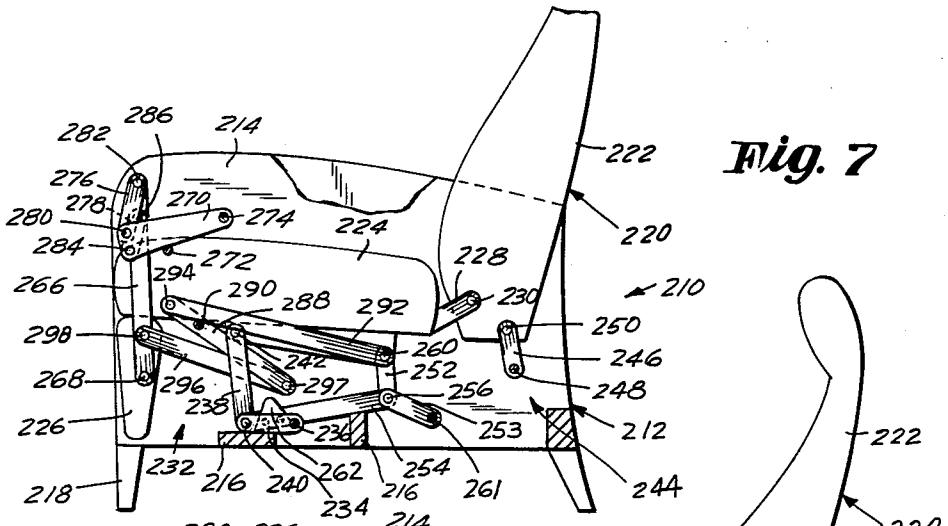


Fig. 8

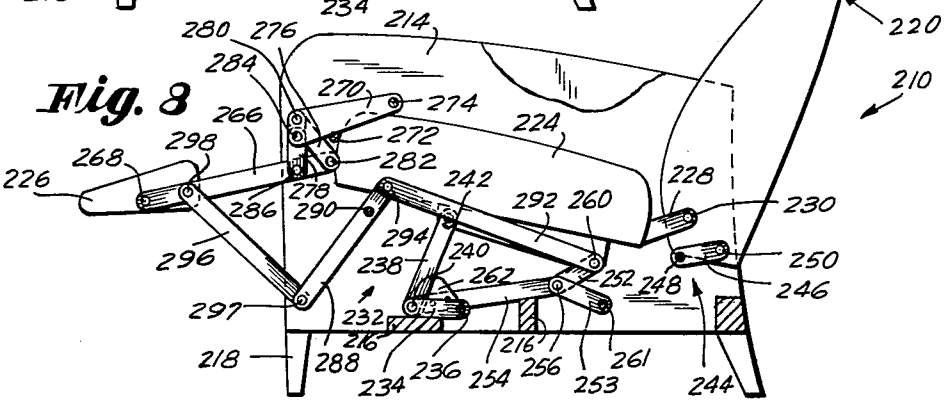
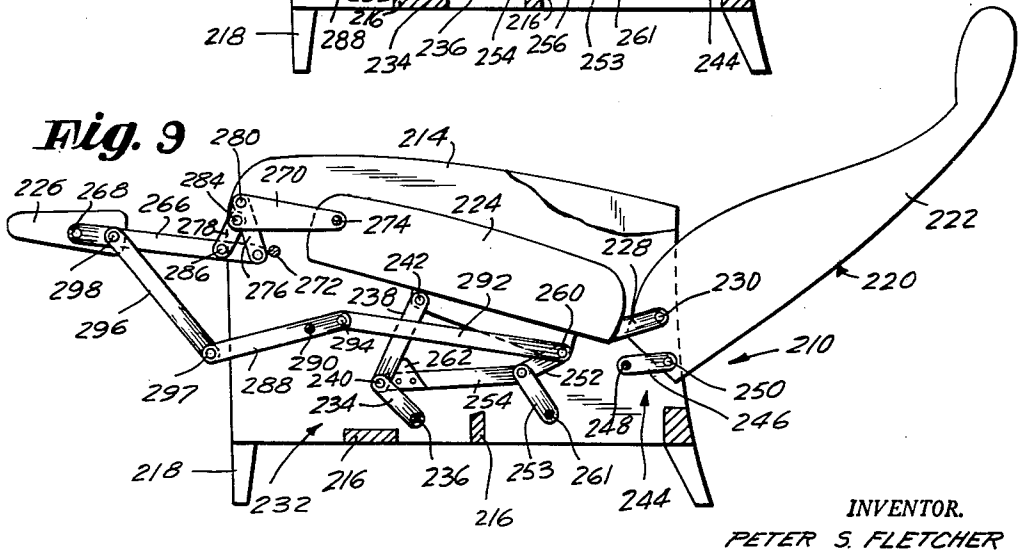


Fig. 9



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3,157,431

RECLINING CHAIR OF THE MULTIPLE MOVEMENT TYPE

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Continuation of application Ser. No. 8,564, Feb. 15, 1960. This application Aug. 5, 1963, Ser. No. 303,201
10 Claims. (Cl. 297—84)

The present invention relates generally to reclining chairs, and in particular to an improved reclining chair of the type including body-supporting means having a movable back-rest and a movable seat which are coordinated with each other to include two distinct phases of chair movement. This is a continuation of my copending application of the same title, Serial No. 8,564, filed on February 15, 1960.

The well known reclining chair comprises a support, body-supporting means including a back-rest and seat movably mounted on the support and a leg-rest mounted beneath the seat and movable into various elevated leg-supported positions in response to chair movement. Heretofore there has been two distinct types of reclining chair, those constructed with a unitary back-rest and seat mounted on a support for movement into various tilted positions and those constructed with a movable back-rest and movable seat and mounted on the support for reclining and inclining movement respectively. Chairs of the type incorporating a unitary back-rest and seat were found to be most suitable for accommodating the chair occupant in a tilted back position, but in a sitting attitude, with the occupant's leg supported on the elevated leg-rest. Chairs of the type incorporating a movable back-rest and movable seat were found to be most suitable for accommodating the chair occupant in a fully reclined or complete relaxation position, with the occupant's legs supported on the leg-rest, in that the angle between the back-rest and seat increased in response to the reclining movement of the chair.

Of recent times there has been introduced an improved reclining chair which exhibits attributes of both types of chairs which have been heretofore sold, to wit, those suitable for accommodating the chair occupant in tilted sitting attitude and those suitable for accommodating the chair occupant in a fully reclined or complete relaxation attitude. Provision is made in such chairs of the double movement type for a first movement phase from an upright sitting position to an intermediate, tilted sitting position during which there is substantially no angular displacement between the back-rest and seat, with the leg-rest moving to an elevated leg-supporting position to establish the intermediate, tilted sitting position, and for a second movement phase from the intermediate, tilted sitting position to a fully reclined position during which the angle between the seat and back-rest opens up, with the leg-rest remaining in an elevated leg-supporting position to establish a complete relaxation or fully reclined position for the chair occupant.

Broadly, it is an object of the present invention to provide an improved reclining chair of the double movement type. Specifically, it is within the contemplation of the present invention to provide improved and simplified coordinating mechanisms for establishing two distinct phases of movement in a reclining chair.

In accordance with an illustrative embodiment demonstrating objects and features of the present invention, there is provided a reclining chair which comprises a support, body-supporting means including a seat and back-rest adapted to be mounted on the support for inclining and reclining movement respectively, and a control linkage operatively connected between the support

and the body-supporting means and providing respective first and second paths of movement for the body-supporting means during first and second movement phases. A holding link cooperates with the control linkage during either phase to maintain a substantially rigid relationship between any two preselected links. In the phase in which the rigid relationship of the two preselected links is not desired, the holding link is arranged to be inactive to allow movement to occur between the two preselected links in a manner determined by the control linkage and the desired chair movement.

In a typical construction according to the invention, the body-supporting means is guided during the first movement phase by two links, with the holding link keeping the seat and back-rest rigid with each other. With such construction, it is possible to establish a high order of control over chair balance, and, if necessary, to slightly open up the included angle between the seat and back-rest during the first movement phase in order to attain a more comfortable intermediate, tilted sitting position for the chair. For example, in a reclining chain designed specifically for use at a desk in an office, the included angle between the seat and back-rest in the upright sitting position preferably is arranged relatively close to a right angle in order to provide the most comfortable attitude for the chair occupant when seated at the desk. However, when such chair is moved through the first movement phase to the intermediate, tilted sitting position, such included angle is not suited for optimum comfort; and for such application, provision may be made in accordance with the present invention to slightly open the included angle between the seat and back-rest to afford optimum comfort in the intermediate, tilted sitting position.

The above brief description as well as further objects, features and advantages of the present invention will be more fully appreciated by reference to the following detailed description of several illustrative embodiments according to the present invention, when taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a side elevational view, with parts broken away and sectioned, showing a reclining chair of the double movement type embodying features of the present invention, with the chair shown in the upright sitting position;

FIG. 2 is a side elevational view similar to FIG. 1, but showing the reclining chair in an intermediate, tilted sitting position, with the leg-rest moved to an elevated leg-supporting position;

FIG. 3 is a side elevational view, similar to FIG. 1, but showing the reclining chair in a fully reclined position wherein the back-rest and seat have been angularly displaced relative to each other to establish a complete relaxation position for the chair occupant, with the leg-rest being disposed in an elevated leg-supporting position;

FIG. 4 is a side elevational view, with parts broken away and sectioned, showing a reclining chair of the double movement type embodying features of the present invention, with the chair shown in the upright sitting position;

FIG. 5 is a side elevational view similar to FIG. 4, but showing the reclining chair in an intermediate, tilted sitting position, with the leg-rest moved to an elevated leg-supporting position;

FIG. 6 is a side elevational view, similar to FIG. 4, but showing the reclining chair in a fully reclined position wherein the back-rest and seat have been angularly displaced relative to each other to establish a complete relaxation position for the chair occupant, with the leg-rest being disposed in an elevated leg-supporting position;

FIG. 7 is a side elevational view, with parts broken away and sectioned, showing a reclining chair of the

double movement type embodying features of the present invention, with the chair shown in the upright sitting position;

FIG. 8 is a side elevational view similar to FIG. 7, but showing the reclining chair in an intermediate, tilted sitting position, with the leg-rest moved to an elevated leg-supporting position; and,

FIG. 9 is a side elevational view, similar to FIG. 7, but showing the reclining chair in a fully reclined position wherein the back-rest and seat have been angularly displaced relative to each other to establish a complete relaxation position for the chair occupant, with the leg-rest being disposed in an elevated leg-supporting position.

Referring now specifically to FIGS. 1 to 3 of the drawings, there is shown a first embodiment of reclining chair demonstrating features of the present invention, generally designated by the reference numeral 10, which includes a support or frame 12 having opposite side walls 14 interconnected by suitable cross braces 16 and supported on depending legs 18.

Body-supporting means 20 including a back-rest 22 and a seat 24 are mounted on the support 12 for reclining and inclining movement respectively for a first movement phase from an upright position illustrated in FIG. 1 to an intermediate, tilted sitting position illustrated in FIG. 2 and for a second movement phase from the intermediate, tilted sitting position illustrated in FIG. 2 through a series of reclining positions to a fully reclined or complete relaxation position illustrated in FIG. 3.

Disposed beneath the forward end of the seat 24 is a leg-rest 26 which is mounted for movement from a stored or retracted position shown in FIG. 1 to elevated leg-supporting positions shown in FIGS. 2 and 3. As will be described, the leg-rest 26 is coordinated to the back-rest 22 and the seat 24 for movement into an elevated leg-supporting position in response to the first movement phase of the chair, with the leg-rest remaining substantially in the elevated leg-supporting position as the chair moves from the intermediate, tilted sitting position of FIG. 2 to the fully reclined position of FIG. 3.

In this illustrative embodiment, the seat 24 carries a rearwardly directed rigid hanger arm 28 which is connected to the back-rest 22 at a seat pivot 30. Front guiding means, generally designated by the reference numeral 32, are operatively connected between the support 12 and the seat 24 which front guiding means are operative during the first and second movement phases of the chair. The front guiding means includes a first link 34 extending rearwardly and downwardly from its upper end to its lower end and having a pivotal mount 36 at its upper end on the support 12. Extending upwardly from the lower end of the first link 34 is a second link 38 which has a pivotal connection 40 at its lower end to the lower end of the first link 34 and a pivotal connection 42 at its upper end to the seat 24. The links 34, 38 are arranged such that the intermediate pivotal connection 40 and/or the lower end of the link 34 rests on the cross brace 16 serving as a stop. The link 38 turns in the clockwise direction about the pivotal connection 40, serving as a relatively stationary pivotal mount, during the first movement phase, and the link 34 turns in the counterclockwise direction about the stationary pivotal mount 36 during the second movement phase.

Rear guiding means, generally designated by the reference numeral 44, are operatively connected between the back-rest 22 and the support 12 for guiding the rearward portion of the body-supporting means during the first movement phase, with the rear guiding means remaining stationary relative to the support 12 and providing a back-rest pivot during the second movement phase. In this illustrative embodiment, the rear guiding means 44 includes a rear guiding link 46 which has a pivotal mount 48 at its lower end on the support 12 and a pivotal connection 50 at its upper end to the back-rest 22 at a point

spaced from the seat pivot 30. It will be appreciated that the portion of the back-rest 22 intermediate the seat pivot 30 and the pivotal connection 50 effectively provides a link which is rigid or integral with the back-rest 22.

In accordance with the present invention, provision is made for precluding appreciable relative movement between the back-rest 22 and the seat 24 during the first movement phase such that the intermediate, tilted sitting position of FIG. 2 is established with substantially no change in the angular relationship between the back-rest and seat, except for small adjustments in the included angle therebetween as may be required for balance and/or for establishing a more comfortable attitude in such intermediate, tilted sitting position. Specifically, a holding link 52 is flexibly mounted for pivotal movement about a relatively fixed pivot during the first movement phase and for inactive displacement relative to the support 12 during the second movement phase. In this illustrative embodiment, the flexible mounting for the holding link 52 includes a mounting link 54 which rests against the adjacent cross brace 16 during the first movement phase. The mounting link 54 is pivotally mounted at its forward end on the front guiding means 32 at the pivotal connection 40 and remains stationary relative to the support during the first movement phase. The holding link 52 has a pivotal connection 56 at its lower end to the rearward end of the flexible mounting link 54 and a pivotal connection 60 at its upper end to the seat 24 at a point rearwardly of the pivotal connection 42. During the first movement phase, the body-supporting means 20 is guided by two links, namely the front guiding link 38 and the rear guiding link 46, with the holding link positioned and pivotally connected to the linkage in such a way that it serves substantially the same function as a stop between the seat and back-rest to effectively maintain a rigid relationship therebetween, i.e., the pivot point 60 is guided by the holding link 52 to move through substantially the same path that it would travel if the seat 24 and back-rest 22 were rigid. The flexibility of the described arrangement can be appreciated in that individual guiding of the seat and back-rest during the first movement phase is possible which enables adjustment in chair balance and/or the angular relationship between the back-rest 22 and the seat 24 during the first movement phase by varying the length of the holding link and/or the location of the pivotal connections.

Provision is made for blocking relative movement between the link 38 of the front guiding means 32 and the seat 24 at the end of the first movement phase and for also blocking turning movement of the rear guiding link 46 about its pivotal mount 48. Specifically, the flexible mounting link 54 carries an upstanding stop 62 located rearwardly of the pivotal connection 40 which stop abuts the front guiding link 38 at the end of the first movement phase and for all intents and purposes, renders the links 38, 54, 52 rigid with each other and with the seat 24 during the second movement phase. Further, a stop 64 is located rearwardly of the pivotal mount 48 of the rear guiding link 46 to abut the link 46 at the end of the first movement phase and to preclude further clockwise movement of such rear guide link about its pivotal mount 48.

The first movement linkage includes as the movable links thereof, the front guiding link 38, the link formed by the portion of the seat 24 and the portion of the back-rest 22 intermediate the pivotal connection 42 and the pivotal connection 50, and the rear guiding link 46, with a stationary link being provided intermediate the pivotal connection 40 and the pivotal mount 48 and with the holding link acting effectively as a stop to maintain the desired rigid relationship between the seat and back-rest. The second movement linkage includes as the movable links thereof, the link 34 of the front guiding means 32, the portion of the seat 24 intermediate the pivotal

connection 40 and the seat pivot 30, and the portion of the back-rest intermediate the seat pivot 30 and the pivotal connection 50, with a stationary link being provided intermediate the pivotal mount 36 and the pivotal connection 50.

In this illustrative embodiment, the leg-rest 26 is mounted for movement from the retracted position of FIG. 1 to the elevated leg-supporting positions illustrated in FIGS. 2 and 3 by a leg-rest mounting linkage including a hanger arm 66 which has a rigid connection 68 adjacent its lower end to the leg-rest 26. The hanger arm 66 is suspended from a carrier link 70 which rests on a stop 72 and has a pivotal mount 74 adjacent its rearward end on the support. The carrier link 70 is connected to the hanger arm 66 by first and second connecting links 76, 78. Specifically, in the position shown in FIG. 1 the connecting link 76 has a pivotal connection 80 at its lower end on the forward end of the carrier link 70 and a pivotal connection 82 at its upper end on the hanger arm 32, while the connecting link 78 has a pivotal connection 84 at its lower end to the carrier link 70 at a point spaced from the pivotal connection 80 and a pivotal connection 86 at its upper end to the hanger arm 66 at a point spaced from the pivotal connection 82. The hanger arm 66 of the leg-rest mounting linkage is coupled to the seat 24 of the body-supporting means 20 by a double-arm actuating lever 88 which has a pivotal mount 90 intermediate its ends on the support. The upwardly extending arm 88*a* of lever 88 is coupled to the seat 24 by a connecting link 92 having a pivotal connection 94 at its forward end to the arm 88*a* and a pivotal connection at its rearward end to the seat 24 coaxially of the pivotal connection 60. The arm 88*b* of the lever 88 is coupled to the hanger arm 66 by a connecting link 96 having a pivotal connection 97 at its rearward end to the arm 88*b* and a pivotal connection 98 at its forward end to the hanger arm 66. During the first movement phase, the carrier link 70 remains stationary relative to the support such that the pivotal connections 80, 84 of the links 76, 78 serve as relatively stationary pivotal mounts for the leg-rest mounting linkage, with the links 76, 78 turning in the clockwise direction incident to turning movement of the double-arm actuating lever 88. At the end of the first movement phase, the leg-rest mounting linkage is blocked by the link 76 coming into contact with the pivot 84 serving as a stop and thereby providing a substantially rigid interconnection between the hanger arm 66 and the carrier link 70. Thereafter the pivotal mount 74 of the carrier link serves as a stationary pivotal mount about which the leg-rest 26 swings during the second movement phase, as may be appreciated by progressively inspecting FIGS. 2 and 3. Thus, the leg-rest 26 moves from the stored position illustrated in FIG. 1 during the first movement phase to the first elevated leg-supporting position illustrated in FIG. 2; and then moves during the second movement phase from the elevated leg-supporting position illustrated in FIG. 2 to a further elevated leg-supporting position illustrated in FIG. 3, the carrier link 70 turning in the clockwise direction about the pivotal mount 74.

For a better understanding of this illustrative embodiment of the present invention, reference will now be made to a typical sequence of operations:

When the chair occupant is seated in the chair 10 and leans against the back-rest 22, the body-supporting means 20 is displaced rearwardly and tilted relative to the support, with substantially no angular displacement between the back-rest 22 and the seat 24. During such first movement phase, the holding link 52 maintains the desired relationship between the back-rest 22 and the seat 24 with no angular change therebetween, or a slight opening of the angle therebetween as previously described. Incident to such rearward movement of body-supporting means 20, the requisite turning movement is imparted to the double-arm lever 88 to move the leg-rest 26 to the elevated leg-supporting position. The end of the first movement phase is established when the link 38 abuts the stop 62 and when simultaneously the rear guiding link 46 abuts the stop 64. At such time, and as illustrated in FIG. 2, the links 38, 54 and 52 become substantially unitary with the seat 24 and effectively the seat and the linkage intermediate the pivotal connection 40 and the seat pivot 30 define a single movable link for the second movement phase. When the rear guiding link 46 abuts the stop 64, the rear guiding link 46 becomes unitary with the support 12 for all intents and purposes, and thereafter the pivotal connection 50 to the back-rest 22 serves as a stationary pivot for the second movement phase.

When the chair occupant exerts continued pressure with the chair in the intermediate, tilted sitting position of FIG. 2, the back-rest 22 begins to turn about the relatively fixed or stationary pivotal mount 50, with the seat 24 being guided by the second movement link 34 which turns in the counterclockwise direction about the pivotal mount 36. As may be appreciated by progressively inspecting FIGS. 2 and 3, the action of the front guiding means 32 is to guide the seat 24 generally upwardly while the back-rest 22 is turning about the pivotal connection 50 such that the included angle between the back-rest and seat opens up to establish the fully reclined position of FIG. 3. The second movement phase continues until such time as the second movement linkage is blocked, for example, by contact with a further stationary stop or by the movement of the second movement link 34 into substantial alignment with the link defined between the pivotal connection 40 and the seat pivot 30. During such second movement, a relatively small thrust is imparted to the leg-rest linkage which is effective to turn the carrier link 70 from its position resting against the stop 72 through a slight upward arc to establish a further elevated position for the leg-rest 26.

When the chair occupant desires to restore the chair to the upright sitting position illustrated in FIG. 1, the occupant leans forward such that the back-rest, seat and leg-rest move through the reverse sequence with the chair first moving into the intermediate, tilted sitting position of FIG. 2 and then returning to the upright sitting position illustrated in FIG. 1.

It will be appreciated that the holding link 52 and its flexible mounting functions during the first movement phase to provide a substantially rigid relationship between two movable members of the control linkage (i.e. the link portions provided by the seat and back-rest); and during the second movement phase the holding link is functionally inactive, that is, it does not serve to guide the body-supporting means in its movement so as to maintain the aforementioned rigid relationship between the two movable members of the control linkage but allows them to move in a manner determined by the guiding action of the control linkage in the second movement phase. By appropriate design of the control linkage, a high order of flexibility is afforded in the control of the body-supporting means with the use of such holding links, as compared for example to chairs of the type wherein the rigid relationship for the seat and back-rest of the body-supporting means is established during the first movement phase by the provision of a stop.

Referring now specifically to FIGS. 4 to 6 of the drawings, there is shown a second embodiment of reclining chair demonstrating features of the present invention, generally designated by the reference numeral 110, which includes a support or frame 112 having opposite side walls 114 interconnected by suitable cross braces 116 and supported on depending legs 118.

Body-supporting means 120 including a back-rest 122 and a seat 124 are mounted on the support 112 for reclining and inclining movement respectively for a first movement phase from an upright sitting position illustrated in FIG. 4 to an intermediate, tilted sitting position illustrated in FIG. 5 and for a second movement phase

from the intermediate, tilted sitting position illustrated in FIG. 5 through a series of reclining positions to a fully reclined or complete relaxation position illustrated in FIG. 6.

Disposed beneath the forward end of the seat 124 is a leg-rest 126 which is mounted for movement from a stored or retracted position shown in FIG. 4 to elevated leg-supporting positions shown in FIGS. 5 and 6. As will be described, the leg-rest 126 is coordinated to the back-rest 122 and the seat 124 for movement into an elevated leg-supporting position in response to the first movement phase of the chair, with the leg-rest remaining substantially in the elevated leg-supporting position as the chair moves from the intermediate, tilted sitting position of FIG. 5 to the fully reclined position of FIG. 6.

In this illustrative embodiment, the seat 124 carries a rearwardly directed rigid hanger arm 128 which is connected to the back-rest 122 at a seat pivot 130. Front guiding means, generally designated by the reference numeral 132, are operatively connected between the support 112 and the seat 124 which front guiding means are operative during the first and second movement phases of the chair. The front guiding means includes a first link 134 extending rearwardly and downwardly from its upper end to its lower end and having a pivotal mount 136 at its upper end on the support 112. Extending upwardly from the lower end of the first link 134 is a second link 138 which has a pivotal connection 140 at its lower end to the lower end of the first link 134 and a pivotal connection 142 at its upper end to the seat 124. The links 134, 138 are arranged such that the intermedite pivotal connection 140 and/or the lower end of the link 134 rests on the cross brace 116 serving as a stop. The link 138 turns in the clockwise direction about the pivotal connection 140 serving as a relatively stationary pivotal mount during the first movement phase, and the link 134 turns in the counterclockwise direction about the stationary pivotal mount 136 during the second movement phase.

Rear guiding means, generally designated by the reference numerals 144, are operatively connected between the back-rest 122 and the support 112 for guiding the rearward portion of the body-supporting means during the first movement phase, with the rear guiding means providing a back-rest pivot during the second movement phase. In this illustrative embodiment, the rear guiding means 144 includes a rear guiding link 146 which has a relatively fixed pivotal mount 148 at its lower end on a flexible mounting link 154 and a pivotal connection 150 at its upper end to the back-rest 122 at a point spaced from the seat pivot 130. It will be appreciated that the portion of the back-rest 122 intermediate the seat pivot 130 and the pivotal connection 150 effectively provides a link rigid or integral with the back-rest 122.

Provision is made for precluding appreciable relative movement between the back-rest 122 and the seat 124 during the first movement phase such that the intermediate, tilted sitting position of FIG. 5 is established with substantially no change in the angular relationship between the back-rest and seat, except for some small adjustments in the included angle therebetween as may be required for balance and/or for establishing a more comfortable attitude in such intermediate, tilted sitting position. Specifically, a holding link 152 is mounted on the mounting link 154 for pivotal movement about a relatively fixed pivot during the first movement phase and for inactive displacement relative to the support during the second movement phase. In the upright sitting position and during the first movement phase, the mounting link 154 rests against a stop 155 and is pivotally mounted at its rearward end on the support at a pivotal mount 157 for movement relative to the support during the second movement phase. The holding link 152 has a pivotal connection 156 at its lower end to the forward end of the flexible mounting link 154 and a pivotal connection 160 at its upper end to the back-rest 122 at a point forwardly of the pivotal connection 150. Effectively, during the first movement phase the body-supporting means 120 is guided by two links, namely the front guiding link 138 and the rear guiding link 146. The front and rear guide links determine the movement of seat and back-rest, and the holding link maintains the rigid relationship between seat and back-rest during this movement. The flexibility of the described arrangement will be appreciated in that individual guiding of the seat and back-rest during the first movement phase is possible which enables adjustment in chair balance and/or the angular relationship between the back-rest 122 and the seat 124 during the first movement phase.

Provision is made for blocking relative movement between the link 138 of the front guiding means 132 and the seat 124 at the end of the first movement phase. Specifically, the seat 124 carries a depending stop 162 forwardly of the pivotal connection 142 which stop abuts the front guiding link 138 at the end of the first movement phase and renders the link 138 rigid with the seat during the second movement phase. Provision is also made for blocking the rear guide link 146 by means of the stop 147.

In this illustrative embodiment, the leg-rest 126 is mounted for movement from the retracted position of FIG. 4 to the elevated leg-supporting positions of FIGS. 5 and 6 by a leg-rest mounting linkage which includes a hanger arm 166 which has a pivotal connection 168 at its lower end to the leg-rest 126 and a pivotal mount 170 at its upper end on the support 112. The hanger arm 166 and the leg-rest 126 are coupled via a chain of links to the body-supporting means 120, which chain of links includes connecting links 172, 174, a guiding link 176, a further connecting link 178, a double-arm actuating lever 180, and a still further connecting link 182. Specifically, the double-arm lever 180 has a pivotal mount 184 intermediate its ends on the support, with one arm thereof having a pivotal connection 186 to the adjacent end of the connecting link 182. The other end of the connecting link 182 is pivotally connected to the back-rest 122 coaxially of the pivotal connection 160. The other arm of the double-arm level 180 has a pivotal connection 188 to the rearward end of the connecting link 178, with the forward end of the link 178 having a pivotal connection 190 to the guiding link 176 intermediate the ends thereof. The guiding link 176 has a pivotal mount 192 at its lower end on the support, with the upper end thereof having a pivotal connection 194 to the rearward end of the connecting link 172. The connecting link 172 has a pivotal connection 196 adjacent its forward end to the hanger arm 166 at a point spced above the pivotal connection 168. Finally, the connecting link 174 has a pivotal connection 197 at its rearward end to the connecting link 172 intermediate the ends thereof, and a pivotal connection 198 at its forward end to the leg-rest at a point spaced above the pivotal connection 168. During the first and second movement phases, and in response to reclining movement of the back-rest 120, a turning movement is imparted to the double-arm lever 180 which, via the connecting link 178 turns the guiding link 176 in the counterclockwise direction about its pivotal mount 192 to impart an upward and forward thrust via the connecting links 172, 174 to the arm 166 and leg-rest 126, such that the leg-rest moves to successive elevated leg-supporting positions, as shown in FIGS. 5 and 6.

For a better understanding of this illustrative embodiment of the present invention, reference will now be made to a typical sequence of operation:

When the chair occupant is seated in the chair 110 and leans against the back-rest 122 of the body-supporting means 120, the body-supporting means is displaced rearwardly and tilted relative to the support, with substantially no angular displacement between the back-rest 122 and the seat 124. During such first movement phase, the

holding link 152 maintains the desired relationship between the back-rest 122 and the seat 124, with no angular change therebetween or a slight opening of the angle therebetween. Incident to such rearward movement of body-supporting means 120, the requisite turning movement is imparted to the double-arm level 130 to move the leg-rest 126 to the elevated leg-supporting position. The end of the first movement phase is established when the link 138 abuts the stop 162. At such time, and as illustrated in FIG. 5, the link 138 becomes substantially unitary with the seat 124 and effectively they define a single movable link for the second movement phase intermediate the pivotal connection 140 and the seat pivot 130. Simultaneously, the pivotal connection 150 moves into coaxial relation with the pivotal mount 157 of the mounting link 154 and the rear guiding link 146 abuts the stop 147. Thereafter the pivotal connection 150 to the back-rest 122 serves as a relatively stationary pivot for the second movement phase.

When the chair occupant exerts continued pressure, with the chair in the intermediate, tilted sitting position of FIG. 6, the back-rest 122 begins to turn about the relatively fixed or stationary pivotal mount or axis at 150, with the seat 124 being guided by the link 134 which turns in the counterclockwise direction about the pivotal mount 136. As may be appreciated by progressively inspecting FIGS. 5 and 6, the action of the front guiding means 132 is to guide the seat 124 generally upwardly while the back-rest 122 is turning about the pivotal connection 150 such that the included angle between the back-rest and seat opens up to establish the fully reclined position of FIG. 6.

Referring now specifically to FIGS. 7 to 9 of the drawings, there is shown a third embodiment of reclining chair demonstrating features of the present invention, generally designated by the reference numeral 210, which includes a support or frame 212 having opposite side walls 214 interconnected by suitable cross braces 216 and supported on depending legs 218.

Body-supporting means 220 including a back-rest 222 and a seat 224 are mounted on the support 212 for reclining and inclining movement respectively for a first movement phase from an upright sitting position illustrated in FIG. 7 to an intermediate, tilted sitting position illustrated in FIG. 8 and for a second movement phase from the intermediate, tilted sitting position illustrated in FIG. 8 through a series of reclining positions to a fully reclined or complete relaxation position illustrated in FIG. 9.

Disposed beneath the forward end of the seat 224 is a leg-rest 226 which is mounted for movement from a stored or retracted position shown in FIG. 7 to elevated leg-supporting position shown in FIGS. 8 and 9. As will be described, the leg-rest 226 is coordinated to the back-rest 222 and the seat 224 for movement into an elevated leg-supporting position in response to the first movement phase of the chair, with the leg-rest 226 remaining substantially in the elevated leg-supporting position as the chair moves from the intermediate, tilted sitting position of FIG. 8 to the fully reclined position of FIG. 9. The seat 224 carries a rearwardly directed rigid hanger arm 228 which is connected to the back-rest 222 at a seat pivot 230. Front guiding means, generally designated by the reference numeral 232, are operatively connected between the support 212 and the seat 224 which front guiding means are operative during the first and second movement phases of the chair. In this illustrative embodiment, the front guiding means includes a first link 234 extending substantially horizontally and having a pivotal mount 236 at its rearward end on the support 212. Extending upwardly from the front end of the first link 234 is a second link 238 which has a pivotal connection 240 at its lower end to the front end of the first link 234 and the pivotal connection 242 at its upper end to the seat 224. The link 234 is arranged to rest on the cross brace 216 serving as a stop during the first movement phase. The link 238 turns in the clockwise direction about the pivotal connection 240 serving as a relatively stationary pivotal mount during the first movement phase, and the link 234 turns in the clockwise direction about the stationary pivotal mount 236 during the second movement phase.

Rear guiding means, generally designated by the reference numeral 244, are operatively connected between the back-rest 222 and the support 212 for guiding the rearward portion of the body-supporting means during the first movement phase, with the rear guiding means remaining stationary relative to the support and providing a back-rest pivot during the second movement phase. In this illustrative embodiment, the rear guiding means 244 includes a rear guiding link 246 which as a pivotal mount 248 at its lower end on the support 212 and a pivotal connection 250 at its upper end to the back-rest 222 at a point spaced from the seat pivot 230.

In accordance with this embodiment of the present invention, provision is made for precluding appreciable relative movement between the back-rest 222 and the seat 224 during the first movement phase such that the intermediate, tilted sitting position of FIG. 8 is established with substantially no change in the angular relationship between the back-rest and seat, and for precluding appreciable relative movement between the rear guide means and the support during the second movement phase. Specifically, there is provided a first holding link 252 which is mounted for pivotal movement about a relatively fixed pivot during the first phase and for inactive displacement relative to the support during the second movement phase. The flexible mounting arrangement for the first holding link 252 in this illustrative embodiment includes a mounting link 254 which rests against the adjacent cross brace 216 during the first movement phase and is movably mounted at its forward end on the front guiding means 232 and at its rearward and on a second holding link 253. Specifically, the adjacent ends of the first and second holding links 252, 253 have a common pivotal connection 255 to the rearward end of the mounting link 254, with the forward end thereof having a pivotal connection to the adjacent ends of the links 234, 238 at the pivotal connection 240. The first holding link 252 has a pivotal connection 260 at its upper end to the seat 224, while the second holding link has a pivotal mount 261 at its lower end on the support. Effectively during the first movement phase the movement of the body-supporting means is determined by two links, namely the front guiding link 238, and the rear guiding link 246, with the mounting link 254 remaining stationary and resting against the cross brace 216 and with the holding link 252 maintaining a substantially rigid relationship between the seat 224 and the back-rest 222.

Provision is made for blocking relative movement between the link 238 of the front guiding means 232 and the seat 224 at the end of the first movement phase. Specifically, the flexible mounting link 254 carries an upstanding stop 262 rearwardly of the pivotal connection 240 which stop abuts the front guiding link 238 at the end of the first movement phase and renders the links 238, 254, 252 rigid with each other and with the seat 224 during the second movement phase.

During the second movement phase, the second holding link 253 is effective to hold the rear guiding link 246 substantially rigid with the support. The second holding link 253 functionally replaces the stop 64 shown in the first embodiment, and during the second movement phase, substantially precludes turning movement of the rear guiding link 246 about its pivotal mount 248, such that the pivotal connection 250 thereof to the back-rest 222 effectively serves as a back-rest pivot during the second movement phase. Although the second holding link 253 may be considered to be part of the second movement linkage wherein the mounting link 254, the seat and the blocked links therebetween comprise one movable link and wherein the second movement link 234 and the

second holding link 253 comprise two further movable links of the second movement linkage, it will be appreciated that substantially the same guiding action during the second movement phase may be realized with the elimination of the link 253 and the provision of a stop to abut the rear guiding link 246 at the end of the first movement phase.

The first movement guiding linkage includes as the movable links thereof, the front guiding link 238, the portion of the seat 224 and the portion of the back-rest 222 intermediate the pivotal connection 242 and the pivotal connection 250, and the rear guiding link 246, with a relatively stationary link being provided intermediate the pivotal connection 240 and the pivotal mount 248 and with the first holding link 252 maintaining the substantially rigid relationship between the seat and back-rest. The second movement guiding linkage includes the link 234 of the front guiding means 232, the portion of the seat 224 intermediate the pivotal connection 240 and the seat pivot 230 and the portion of the back-rest intermediate the seat pivot 230 and the pivotal connection 250 as the movable links thereof, with a stationary link being provided intermediate the pivotal mount 236 and the pivotal connection 250 and with the second holding link 253 keeping the rear guide link 246 effectively rigid with the support.

In this illustrative embodiment, the leg-rest 226 is mounted for movement from the retracted position of FIG. 7 to the elevated leg-supporting positions illustrated in FIGS. 8 and 9 by a leg-rest mounting linkage which includes a hanger arm 266 which has a pivotal connection 268 adjacent its lower end to the leg-rest 226. The hanger arm 266 is suspended from a carrier link 270 which rests on a stop 272 and has a pivotal mount 274 adjacent its rearward end on the support. The carrier link 270 is connected to the hanger arm 266 by first and second connecting links 276, 278. Specifically, in the position shown in FIG. 7 the connecting link 276 has a pivotal connection 280 adjacent its lower end on the forward end of the carrier link 270 and a pivotal connection 282 to the upper end of the hanger arm 266, while the connecting link 278 has a pivotal connection 284 at its lower end to the carrier link 270 at a point spaced from the pivotal connection 280 and a pivotal connection 286 at its upper end to the hanger arm 266 at a point spaced from the pivotal connection 282. The hanger arm 266 of the leg-rest mounting linkage is coupled to the seat 224 of the body-supporting means by a double-arm actuating lever 288 which has a pivotal mount 290 intermediate its ends on the support, with the upwardly extending arm thereof being coupled to the seat by a connecting link 292 having a pivotal connection 294 at its forward end to the arm and a pivotal connection at its rearward end to the seat 224 coaxially of the pivotal connection 260. The other arm of the double-arm lever 288 is coupled to the hanger arm 266 by a connecting link 296 having a pivotal connection 297 at its rearward end to the arm and a pivotal connection 298 at its forward end to the hanger arm 266. During the first movement phase the carrier link 270 remains stationary relative to the support such that the pivotal connections 280, 284 of the links 276, 278 serve as relatively stationary pivotal mounts for the leg-rest mounting linkage, with the links 276, 278 turning in the clockwise direction incident to turning movement of the double-arm actuating lever 288. At the end of the first movement phase, the leg-rest mounting linkage is blocked by the link 276 coming into contact with the pivot 284 serving as a stop and thereby providing a substantially rigid interconnection between the hanger arm 266 and the carrier link 270, with the pivotal mount 274 of the carrier link serving as a stationary pivotal mount about which the leg-rest 226 swings during the second movement phase, as may be appreciated by progressively inspecting FIGS. 8 and 9.

Since the operation of this embodiment is substantially identical to that illustrated in FIGS. 1 to 3 except for the function of the second holding link 253 as previously described, a résumé of a typical sequence of operations is dispensed with in the interests of brevity.

From the foregoing it will be appreciated that there is provided in accordance with the present invention, a control linkage for reclining chairs of the multiple movement type wherein one or more holding links are effective to maintain the requisite relationships between the seat and back-rest of the body-supporting means during one or the other of the movement phases, which holding links, in a sense, functionally replace physical stops. At first consideration it might appear that the use of one or more stops would be simpler, but it has been found that the provision of such stops in the actual production of hardware for such reclining chairs, which stops are accurately disposed and of sufficient strength, is neither cheap nor relatively easy to accomplish.

Further, the use of such holding links affords a certain amount of flexibility in the control linkage, wherein, as previously pointed out, it may be advisable to make small adjustments in the angular relationship between the back-rest and seat during the first movement phase to more optimally position the seat and back-rest in relation to each other at the beginning and end of such first movement phase and/or for the purposes of controlling chair balance. Such holding link, having served its intended function in one movement phase, becomes inactive during the other movement phase.

A latitude of modification, change and substitution is tended in the foregoing disclosure and in some instances some features of the invention will be employed without a corresponding use of other features. Accordingly it is appropriate that the appended claims be construed broadly and in a manner consistent with the spirit and scope of the invention herein.

What I claim is:

1. A reclining chair comprising a support, body-supporting means including a seat and back-rest adapted to be mounted on said support for inclining and reclining movement respectively, a control linkage operatively connected between said support and said body-supporting means and providing respective first and second paths of movement for said body-supporting means during first and second movement phases, a holding link, means operatively connected to and flexibly mounting said holding link on one of said control linkage and said support for turning movement during said first movement phase, means operatively connecting said holding link to said body-supporting means, said holding link cooperating with said control linkage during said first movement phase to maintain a substantially rigid relationship between said seat and back-rest, said holding link being inactive to maintain said rigid relationship between said seat and back-rest during said second movement phase.

2. A reclining chair comprising a support, a body-supporting means including a seat and back-rest adapted to be mounted on said support for inclining and reclining movement respectively, a control linkage operatively connected between said support and said body-supporting means and providing respective first and second paths of movement for said body-supporting means during first and second movement phases, a holding link, means operatively connected to and flexibly mounting said holding link on a link of said control linkage for turning movement during said first movement phase, means operatively connecting said holding link to said seat of said body-supporting means, said holding link cooperating with said control linkage during said first movement phase to maintain a substantially rigid relationship between said seat and back-rest, said holding link being inactive to maintain said rigid relationship between said seat and back-rest during said second movement phase.

3. A reclining chair comprising a support, a body-supporting means including a seat and back-rest adapted

to be mounted on said support for inclining and reclining movement respectively, a control linkage operatively connected between said support and said body-supporting means and providing respective first and second paths of movement for said body-supporting means during first and second movement phases, a holding link, means flexibly mounting said holding link on said support for turning movement during said first movement phase, means operatively connecting said holding link to said back-rest of said body-supporting means, said holding link cooperating with said control linkage during said first movement phase to maintain a substantially rigid relationship between said seat and back-rest, said holding link being inactive to maintain said rigid relationship between said seat and back-rest during said second movement phase.

4. A reclining chair comprising a support, a body-supporting means including a seat and back-rest adapted to be mounted on said support for inclining and reclining movement respectively, a control linkage operatively connected between said support and said body-supporting means and providing respective first and second paths of movement for said body-supporting means during first and second movement phases, first and second holding links, means flexibly mounting said first holding link on a link of said control linkage for turning movement during said first movement phase, means flexibly mounting said second holding link on said support for turning movement during said second movement phase, means coupling said second holding link to a link of said control linkage, means operatively connecting said first holding link to said body-supporting means, said first holding link cooperating with said control linkage during said first movement phase to maintain a substantially rigid relationship between said seat and back-rest, said holding link being inactive to maintain said rigid relationship between said seat and back-rest during said second movement phase.

5. A reclining chair of the multiple movement type comprising a support, body-supporting means including a seat and back-rest adapted to be mounted for inclining and reclining movements respectively, a first movement linkage operatively connected to said body-supporting means for guiding said body-supporting means during a first movement phase, a second movement linkage operatively connected to said body-supporting means for guiding said body-supporting means during a second movement phase, a holding link, means flexibly mounting said holding link on said second movement linkage for pivotal movement during said first movement phase and for displacement relative to said support during said second movement phase, and means operatively connecting said holding link to said body-supporting means, said holding link pivoting during said first movement phase and cooperating with said first movement linkage for maintaining a substantially rigid relationship between said seat and back-rest during said first movement phase, said holding link being inactive to maintain said rigid relationship between said seat and back-rest during said second movement phase.

6. A reclining chair comprising a support, body-supporting means including a seat and a back-rest having a pivotal connection therebetween and adapted to be mounted for inclining and reclining movement respectively during first and second movement phases, a mounting link, means including a second movement link movably mounting said mounting link on said support, a holding link, means pivotally mounting said holding link on said mounting link, means pivotally connecting said holding link to one of said seat and back-rest, front guiding means pivotally mounted on said second movement link and pivotally connected to said seat, rear guiding means pivotally mounted on said support and pivotally connected to said back-rest, said front and rear guiding means and said holding link moving during said first movement phase and maintaining a substantial rigid relationship between said seat and back-rest with said second movement link and said mounting link remaining stationary, said holding link being inactive to maintain said rigid relationship between said seat and back-rest during said second movement phase, said second movement link and said mounting link moving relative to said support and said back-rest turning about its pivotal connection to said rear guiding means during said second movement phase to progressively increase the angular relationship between said seat and back-rest.

7. A reclining chair of the multiple movement type comprising a support, body-supporting means including a seat and back-rest adapted for tilting movement with respect to said support, a control linkage having said support as the stationary link thereof and movable links including said seat and back-rest, said control linkage being operative to guide said body-supporting means through a first movement phase from an upright sitting position to an intermediate, tilted sitting position and through a second movement phase from said tilted sitting position to a fully reclined position, a holding link, said holding link being operatively connected to two links in said control linkage to hold any two preselected links in said control linkage in a substantially rigid relationship during one of said first and second phases, said holding link being inactive for holding said preselected links in said rigid relationship to allow movement to occur between said two preselected links in a manner determined by said control linkage during the other of said first and second phases.

8. A reclining chair of the multiple movement type comprising a support, body-supporting means including a seat and back-rest adapted for tilting movement with respect to said support, a control linkage having said support as the stationary link thereof and movable links including said seat and back-rest, said control linkage being operative to guide said body-supporting means through a first movement phase from an upright sitting position to an intermediate, tilted sitting position and through a second movement phase from said tilted sitting position to a fully reclined position, a holding link, means operatively connecting said holding link to two links in said control linkage to hold said seat and said back-rest in substantially rigid relationship during said first phase, said holding link being inactive for holding said seat and said back-rest in said rigid relationship to allow said control linkage to guide said seat and back-rest to open up the angle therebetween to establish said fully reclined position during said second phase.

9. A reclining chair comprising a support, a body-supporting means including a seat and a back-rest having a pivotal connection therebetween, a second movement link, means pivotally mounting said second movement link on said support, a mounting link, means pivotally and movably mounting said mounting link on said second movement link, a holding link, means pivotally mounting said holding link on said mounting link, means pivotally connecting said holding link to said body-supporting means, front guiding means pivotally mounted on said mounting link and pivotally connected to said seat, and rear guiding means pivotally mounted on said support and pivotally connected to said back-rest, said front and rear guiding means and said holding link moving during a first movement phase and maintaining a substantial rigid relationship between said seat and back-rest with said second movement link and said mounting link remaining stationary, said holding link being inactive during said second movement phase, said second movement link and said mounting link moving relative to said support and said back-rest turning about its pivotal connection to said rear guiding means during a second movement phase to progressively increase the angular relationship between said seat and back-rest.

10. A reclining chair comprising a support, body-supporting means including a seat and a back-rest having a pivotal connection therebetween, a second movement link, means pivotally mounting said second movement link on

said support, a mounting link, means pivotally and movably mounting said mounting link on said second movement link, a holding link, means pivotally mounting said holding link on said mounting link, means pivotally connecting said holding link to said body-supporting means, front guiding means pivotally mounted on said mounting link and pivotally connected to said seat, rear guiding means pivotally mounted on said support and pivotally connected to said back-rest, said front and rear guiding means and said holding link moving during a first movement phase and maintaining a substantial rigid relationship between said seat and back-rest with said second movement link and said mounting link remaining stationary, said holding link being inactive during said second movement phase, said second movement link and said mounting link moving relative to said support and said back-rest turning about its pivotal connection to said rear guiding means during a second movement phase to progressively increase the angular relationship between said seat and back-rest, a leg-rest, a leg-rest linkage mounting said leg-rest for movement to an elevated leg-supporting position during said first movement phase, and means coupling said leg-rest linkage to said seat of said body-supporting means.

References Cited in the file of this patent

UNITED STATES PATENTS

2,615,497	Luckhardt	Oct. 28, 1952
2,918,109	Schliephacke	Dec. 22, 1959
2,918,113	Lorenz	Dec. 22, 1959
2,940,509	Fletcher	June 14, 1960
2,940,510	Schliephacke	June 14, 1960
2,941,581	Fletcher	June 21, 1960
2,973,027	Navalle et al.	Feb. 28, 1961