

Aug. 6, 1963

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3,100,126

RECLINING CHAIR AND CONTROL ARRANGEMENT

Filed Nov. 1, 1960

2 Sheets-Sheet 1

FIG. 1.

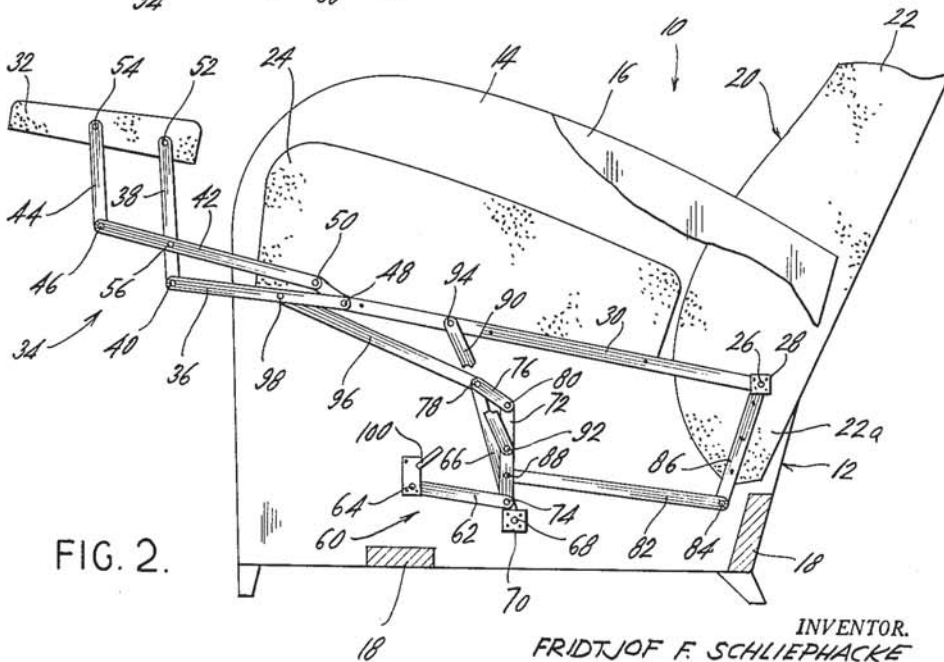
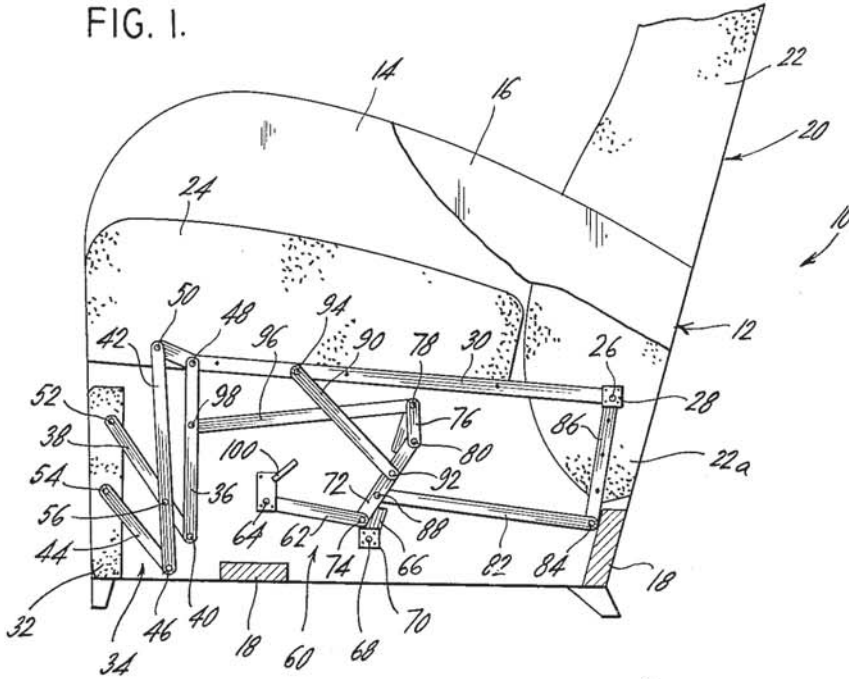


FIG. 2.

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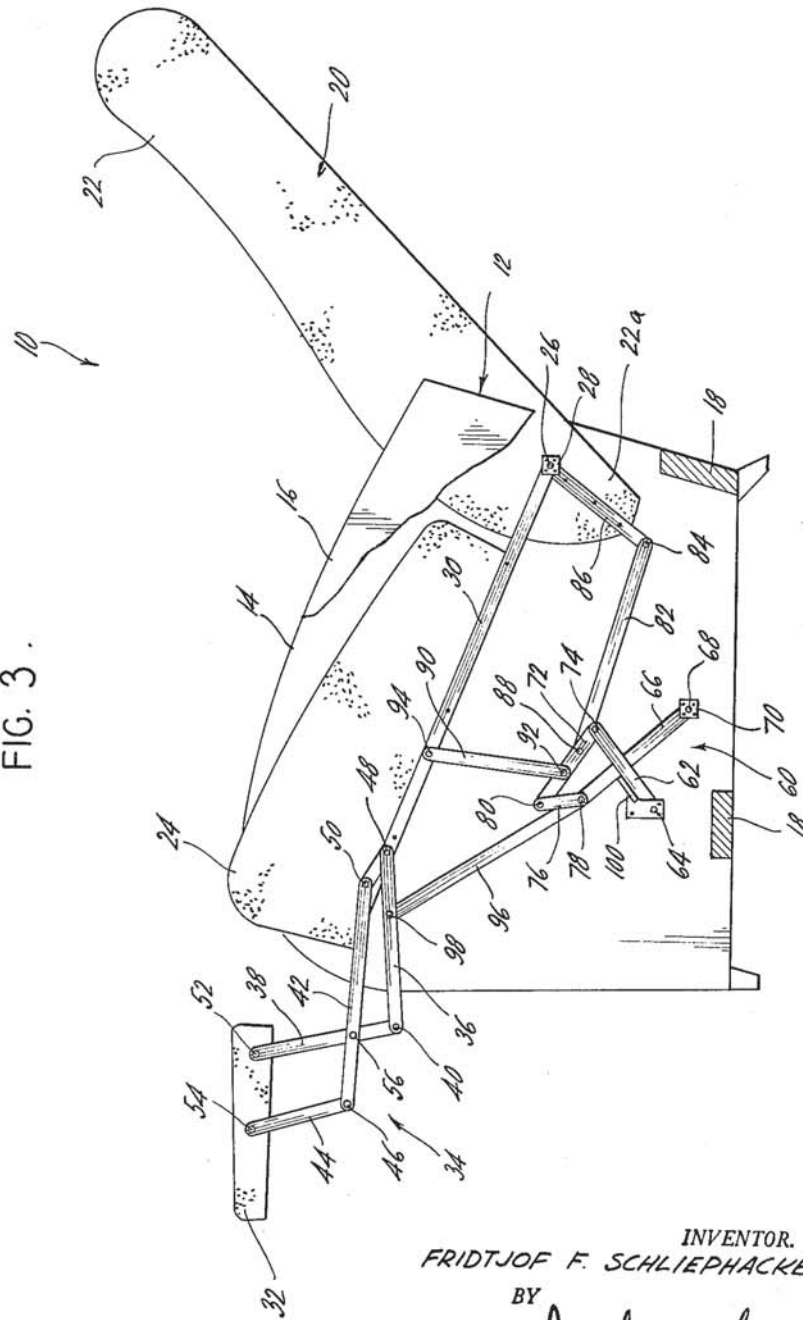
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2 Sheets-Sheet 2

FIG. 3.



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## RECLINING CHAIR AND CONTROL ARRANGEMENT

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Filed Nov. 1, 1960, Ser. No. 66,500  
4 Claims. (Cl. 297-89)

The present invention relates to reclining chairs, and in particular to an improved leg-rest and seat control arrangement for a reclining chair of the type including body-supporting means having a seat and back-rest movably mounted on a support and a leg-rest coordinated to move to elevated leg-supporting positions in response to movement of the body-supporting means. Advantageously, chairs according to the present invention are capable of attaining desirable positions of the body-supporting means and the leg-rest for comfortably accommodating the chair occupant.

The well known reclining chair includes a support, body-supporting means movably mounted on the support, and a leg-rest normally disposed in a stored position and movable to an elevated leg-supporting position incident to the movement of the body-supporting means. The body-supporting means may take the form of either a unitary or rigid body-supporting unit, or a separate seat and separate back-rest mounted for inclining and reclining movement respectively. The body-supporting means and the leg-rest are coordinated such that for each increment of movement of the body-supporting means rearwardly to various reclining positions, there is a corresponding movement of the leg-rest toward the elevated leg-supporting position. These chairs of the single movement type are arranged such that the leg-rest arrives at the required elevated leg-supporting position when the body-supporting means has moved to the fully reclined position. In a typical chair, the back-rest is disposed at an angle of approximately 45° to the floor line in the fully reclined position of the chair, while the leg-rest swings to a position substantially horizontal and parallel to the floor line, with the seat either maintaining a rigid relationship to the back-rest or being inclined such that the included angle between the seat and back-rest increases to establish an appropriate attitude for the chair occupant for complete relaxation. As a practical matter, the leg-rest should not move substantially beyond the horizontal attitude relative to the floor, or beyond a prescribed orientation in relation to the seat, in that the legs should be accommodated in an elevated, but slightly bent, position for optimum comfort. Thus, in a well constructed single movement reclining chair of conventional design, although there are many intermediate positions between the upright or sitting position and the fully reclined position, as a practical matter the only position appropriate for proper relaxation is the reclining position, or one close thereto, wherein the leg-rest is sufficiently elevated to appropriately support the legs of the chair occupant.

Of recent times there has been developed the multiple movement reclining chair which is specifically designed to attain at least one intermediate position in which the leg-rest is elevated. Such multiple movement chairs may be of the type incorporating a unitary back-rest and seat wherein there are first and second movement phases, the chair moving from a sitting position with the leg-rest stored to an intermediate, tilted sitting position with the leg-rest elevated during the first movement phase; and with the chair moving from the intermediate, tilted sitting position through various reclining positions to a fully reclined position during the second movement phase with the leg-rest remaining in an elevated leg-supporting position. Further, such chairs may be of the type incor-

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porating a movable seat and movable back-rest wherein there are first and second movement phases, with the chair moving from an upright sitting position to an intermediate, tilted sitting position during the first movement phase, with the leg-rest moving into the elevated position and with substantially no change in the angular relationship between the seat and back-rest; and wherein there is a second movement phase with the chair moving from the intermediate, tilted sitting position through a series of reclining positions to a fully reclined position, with the leg-rest remaining elevated and with an increase in the angular relationship between the seat and back-rest during the second movement phase. Such multiple movement reclining chairs usually are relatively complicated and expensive to construct, and require special provision to establish the order of or sequence of operations for the mechanisms which control the movable components of the chair.

Broadly, it is an object of the present invention to provide an improved reclining chair of the multiple position or multiple movement type which is capable of attaining one or more intermediate positions in which the chair occupant is accommodated in an attitude with the legs elevated. Specifically, it is within the contemplation of the present invention to provide an improved seat and leg-rest control arrangement for a reclining chair which enables the substantially continuous movement through a number of intermediate positions wherein the seat, back-rest and leg-rest of the chair are optimally positioned relative to each other and to the chair frame or support for comfortably accommodating the chair occupant in attitudes appropriate for television viewing, reading, sewing or the like, and/or complete relaxation.

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 mounted on the support for inclining and reclining movement respectively, and means for coordinating the inclining movement of the seat and the reclining movement of the back-rest to establish a first movement phase wherein the body-supporting means moves from a sitting position to an intermediate, tilted sitting position and a second movement phase wherein a body-supporting means moves from the intermediate, tilted sitting position to a reclining position. The coordinating means or linkage includes a carrier member mounted on the support at a carrier pivot, a first guiding link pivotally mounted on the support at a stationary first pivot, a second guiding link pivotally connected to the carrier member at a second pivotal mount, and an intermediate connecting link connecting the first and second guiding links. Connecting means are operatively connected between the back-rest and one of the guiding links and seat control means are operatively connected to the seat and to one of the guiding and intermediate links. The first guiding link, the second guiding link and the intermediate connecting links serve as three movable links of a four-bar linkage during the first movement phase wherein the carrier member remains substantially stationary, such that the portion of the chair intermediate the first and second pivotal mounts provides a stationary link for the four-bar linkage. The first guiding link, the second guiding link, the intermediate connecting link and the carrier member serve as four movable links of a five-bar linkage during the second movement phase, wherein the carrier member turns about the carrier pivot such that the portion of the chair intermediate the first pivotal mount and the carrier pivot serves as a stationary link of the five-bar linkage. Advantageously, the first and second linkages which respectively guide the body-supporting means during the first and

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second movement phases provide for substantially no angular change between the seat and back-rest from the sitting position to the intermediate, tilted sitting position and for an increase in the included angle therebetween from the tilted sitting position to the various reclining positions. As a further feature of the invention, a leg-rest is mounted for movement from a stored position to various elevated leg-supporting positions and is operatively connected to the intermediate connecting link for movement from the stored position into the various elevated leg-supporting positions in response to movement of the body-supporting means through the first and second movement phases.

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 a presently preferred by nonetheless illustrative embodiment of the present invention, when taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a side elevational view of a reclining chair embodying features of the present invention shown with one side thereof removed and illustrated in the upright or sitting position;

FIG. 2 is a side elevational view similar to FIG. 1, but showing the chair in an intermediate, tilted sitting position; and

FIG. 3 is a side elevational view similar to FIG. 2 but showing the chair in a fully reclined position.

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

The body-supporting means, generally designated by the reference numeral 20 and including a back-rest 22 and a seat 24, is mounted on the support for movement from the upright or sitting position illustrated in FIG. 1 through a number of intermediate, tilted sitting positions (a typical one being illustrated in FIG. 2) into the reclining position illustrated in FIG. 3. In this illustrative embodiment, the back-rest 22 includes a depending extension 22a and is mounted on the support at a back-rest pivot 26 by an appropriate bracket 28 for reclining movement. The seat 24 in turn is mounted for inclining movement about a seat pivot coaxially with the back-rest pivot 26 through the provision of an elongated rearwardly directed seat bracket 30 which is secured to the seat 24 and appropriately journaled at its rearward end at the back-rest pivot 26.

Disposed beneath the forward end of the seat 24 is a leg-rest 32 which is mounted for movement from the stored or retracted position illustrated in FIG. 1 to the elevated leg-supporting positions illustrated in FIGS. 2 and 3. In this illustrative embodiment, the leg-rest 32 is mounted for movement from the stored or retracted position to the elevated leg-supporting positions by a double four-bar linkage, generally designated by the reference numeral 34. The leg-rest mounting linkage 34 includes a first pair of links 36, 38 having a pivotal connection 40 at their adjacent ends and a second pair of links 42, 44 having a pivotal connection 46 at their adjacent ends. The first links 36, 42 of the respective link pairs are pivotally mounted on the bracket 30 rigid with the seat 24 at suspending pivots 48, 50, while the second links 38, 44 are pivotally connected to the leg-rest 32 at spaced locations 52, 54. The link 42 of the second link pair crosses over the link 38 of the first link pair and is pivotally connected thereto at a coordinating pivot 56. Although one particular leg-rest mounting linkage has been illustrated, it will be appreciated that various types of leg-rest mounting linkages may be employed in the present chair.

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Means generally designated by the reference numeral 60 are provided for coordinating the inclining movement of the seat 24 and the reclining movement of the back-rest 22 to establish a first movement phase (compare FIGS. 1 and 2) wherein the body-supporting means or unit 20 moves from a sitting position to an intermediate, tilted sitting position with substantially no angular change between the seat 24 and the back-rest 22 and a second movement phase (compare FIGS. 2 and 3) from the intermediate, tilted sitting position through a series of reclining positions to a fully reclined position during which the included angle between the seat 24 and the back-rest 22 increases. The coordinating means or linkage 60 includes a carrier member 62 which is disposed substantially horizontally in the sitting position of the chair and is mounted on the support 12 at a carrier pivot 64 by an appropriate mounting bracket. Provision is made for establishing a substantially stationary position for the carrier member 62 when in the sitting position. In this illustrative arrangement, the stationary position is established by positioning the rearward end of the carrier member 62 to rest against the bracket or plate of a pivotal mount for one of the further links of the coordinating linkage, as will subsequently be described.

Disposed adjacent the rearward end of the carrier member 62 is a first guiding link 66 which is pivotally mounted on the support 12 at a stationary first pivotal mount 68 via an appropriate mounting bracket 70 which abuts the under surface of the rearward end of the carrier member 62 and serve as a positioning stop therefor. Extending generally upwardly from the rearward end of the carrier member 62 is a second guiding link 72 which is pivotally connected to the rearward end of the carrier member 62 at a second pivotal mount or connection 74. Extending between the upper ends of the first and second guiding links 66, 72 is an intermediate connecting link 76 which has a pivotal connection 78 at its upper end to the upper end of the first guiding link 66 and a pivotal connection 80 at its lower end to the upper end of the second guiding link 72.

Provision is made for connecting one of the guiding links 66, 72 to the back-rest for actuating the coordinating linkage 60. In this illustrative arrangement, the connecting means takes the form of a connecting link 82 which has a pivotal connection 84 at its rearward end to a bracket 86 rigid with the depending extension 22a of the back-rest 22 and a pivotal connection 88 at its forward end to the second guiding link 72. The second guiding link 72 is also connected to the seat 24 via a seat control link 90 which is disposed in an upwardly and forwardly inclined position and has a pivotal connection 92 at its lower end to the second guiding link 72 and a pivotal connection 94 at its upper end to the seat 24. The linkage is completed by the provision of a leg-rest connecting link 96 which has a pivotal connection at its rearward end to the intermediate connecting link 76 at the pivotal connection 78 between such link and the first guiding link 66 and a pivotal connection 98 at its forward end to the link 36 of the leg-rest mounting link 34.

The movement of the five bar linkage which is operative during the second movement phase is terminated in the fully reclined position of FIG. 3 by a stop 100 fixed to the bracket for the carrier pivot 64. The stop 100 precludes further counterclockwise turning movement of both the carrier member 62 and the guiding link 66.

The described coordinating means 60 may be considered to include first and second linkages which are operative continuously during first and second movement phases of the chair. Specifically, during the first movement phase, the first guiding link 66, the second guiding link 72 and the intermediate connecting link 76 serve as the three movable links of a four-bar linkage, with the carrier member 62 remaining substantially stationary and with the portion of the chair intermediate the pivotal mount 68 and the pivotal connection 74 serving as a sta-

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tionary link for the four-bar linkage. When the second guiding link 72 reaches a substantially vertical position, as shown in FIG. 2, continued actuation initiates a second movement phase. During the second movement phase, during which there is an appreciable turning movement of the carrier member 62 about the carrier pivot 74, the first guiding link 66, the second guiding link 72, the intermediate connecting link 76 and the carrier member or link 62 serve as four movable links of a five-bar linkage, with the portion of the chair intermediate the pivotal mount 68 and the carrier pivot 64 providing a stationary link for such five-bar linkage.

In order to facilitate a more thorough understanding of the present invention, a typical sequence of operations will now be described:

When the chair occupant is seated in the chair and leans against the back-rest 22, there is a clockwise turning movement of the back-rest extension 22a and the rigid back-rest bracket 86 about the back-rest or main pivot 26 which in turn imparts a forward thrust to the connecting link 82. This tends to turn the second guiding link 72 in the counterclockwise direction about the pivotal connection 74 to the carrier member 62 serving as a relatively stationary pivotal mount. This in turn brings about the actuation of the four-bar linkage which is effective during the first portion or phase of the chair movement. In response to the counterclockwise turning movement of the second guiding link 72, an appropriate control is imparted to the seat via the seat control link 90. Further in response to the movement of the four-bar guiding linkage, an appropriate control is also imparted via the leg-rest connecting link 96 to the leg-rest mounting linkage 34 and thus to the leg-rest 32. The leg-rest rapidly moves to an elevated leg-supporting position, as shown in FIG. 2, while the seat 24 and back-rest 22 have inclined and reclined to establish and intermediate, tilted sitting position appropriate for television viewing and the like, with substantially no change in the angular relationship between the seat and back-rest. Although there is no distinct stop at the position illustrated in FIG. 2 in that the coordinating linkage is of a continuous type, it is possible to select one intermediate, tilted sitting position and to cause a friction device or the like to engage in such position and to give the chair occupant the feeling of moving into a discreet position, appropriate for television viewing and the like, with substantially no change in the angular relationship between the seat and back-rest. However, it will be appreciated that there are numerous chair positions which occur before and after that illustrated in FIG. 2 in which the back-rest 22, the seat 24 and the leg-rest 32 are appropriately oriented relative to each other for comfortably accommodating the chair occupant for television viewing, sewing, reading and the like. Continued pressure against the back-rest will initiate a further or second phase of the chair movement during which there is an appreciable turning movement of the carrier member 62 about the carrier pivot 64 and a slow down in the further inclination of the seat 24, despite the substantially uniform continuous reclining of the back-rest 22. During such second movement phase, the seat 24 tends to lag in its inclining movement in relation to the rearward and reclining movement of the back-rest 22 to open up or increase the angle between the seat and back-rest. The control imparted to the leg-rest during such second or further movement phase of the chair is such as to maintain the leg-rest 32 in an appropriate oriented and elevated leg-supporting position relative to the seat. In point of fact, by comparing the relative positions of the seat 24 and the leg-rest 32 in FIGS. 2 and 3, it will be appreciated that the leg-rest has been somewhat lowered in its orientation relative to the seat 24 to avoid the possible tendency of over-straightening the legs of the chair occupant incident to the further elevation of the leg-rest during the latter portion of chair movement. The chair movement is terminated

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in the reclining position of FIG. 3 when the stop 100 abuts the carrier member 62 and the guiding link 66.

When the chair occupant desires to restore the chair to the upright or sitting position, it is merely necessary to urge the weight somewhat forwardly and press against the leg-rest, whereupon the reverse sequence of operations may be initiated, with the chair occupant moving through the infinite number of chair positions including the illustrative intermediate position of FIG. 2 to the upright or sitting position illustrated in FIG. 1.

A latitude of modification, change and substitution is intended 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, means mounting said seat and back-rest for inclining and reclining movement respectively, and means for coordinating the inclining movement of said seat and the reclining movement of said back-rest to establish a first movement phase wherein said body-supporting means moves from a sitting position to an intermediate, tilted sitting position with substantially no angular change between said seat and back-rest and a second movement phase from said intermediate, tilted sitting position to a reclining position wherein the included angle between said seat and back-rest increases, the coordinating means including a carrier member, means pivotally mounting said carrier member on said support at a carrier pivot, a first guiding link, means pivotally mounting said first guiding link on said support at a stationary first pivotal mount, a second guiding link, means pivotally connecting said second guiding link to said carrier member at a second pivotal mount, an intermediate connecting link pivotally connected to said first and second guiding links, connecting means between said back-rest and one of said guiding links, and seat control means operatively connected to said seat and to one of said guiding and intermediate links, said first guiding link, said second guiding link and said intermediate connecting link serving as three movable links of a four-bar linkage during said first movement phase wherein said carrier member remains substantially stationary such that the portion of the chair intermediate said first and second pivotal mounts provides a stationary link for said four-bar linkage, said first guiding link, said second guiding link, said intermediate connecting link and said carrier member serving as four movable links of a five-bar linkage during said second movement phase wherein said carrier member turns about said carrier pivot such that the portion of the chair intermediate said first pivotal mount and said carrier pivot serves as a stationary link of said five-bar linkage.

2. A reclining chair comprising a support, body-supporting means including a seat and back-rest, means including a pivot mounting said seat and back-rest for inclining and reclining movement respectively, and means for coordinating the inclining movement of said seat and the reclining movement of said back-rest to establish a first movement phase wherein said body-supporting means moves from a sitting position to an intermediate, tilted sitting position with substantially no angular change between said seat and back-rest and a second movement phase from said intermediate, tilted sitting position to a reclining position wherein the included angle between said seat and back-rest increases, the coordinating means including a carrier member, means pivotally mounting said carrier member on said support at a carrier pivot, means for establishing a stationary position for said carrier member in said sitting position, a first guiding link, means pivotally mounting said first guiding link on said support at a stationary first pivotal mount, a second

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guiding link, means pivotally connecting said second guiding link to said carrier member at a second pivotal mount, an intermediate connecting link pivotally connected to said first and second guiding links, connecting means between said back-rest and one of said guiding links, seat control means operatively connected to said seat and to one of said guiding and intermediate links, said first guiding link, said second guiding link and said intermediate connecting link serving as three movable links of a four-bar linkage during said first movement phase wherein said carrier member remains substantially stationary such that the portion of the chair intermediate said first and second pivotal mounts provides a stationary link for said four-bar linkage, said first guiding link, said second guiding link, said intermediate connecting link and said carrier member serving as four movable links of a five-bar linkage during said second movement phase wherein said carrier member turns about said carrier pivot such that the portion of the chair intermediate said first pivotal mount and said carrier pivot serves as a stationary link of said five-bar linkage, a leg-rest, means operatively connected to said leg-rest and mounting said leg-rest for movement from a stored position when said body-supporting means is in said sitting position to elevated leg-supporting positions when said body-supporting means moves into said intermediate tilted sitting position and said reclining position respectively, and means operatively connected to said leg-rest mounting linkage and to said intermediate connecting link for moving said leg-rest to said elevated leg-supporting positions during said first and second movement phases.

3. A reclining chair comprising a support, body-supporting means including a seat and back-rest, means mounting said seat and back-rest for inclining and reclining movement respectively, and means for coordinating the inclining movement of said seat and the reclining movement of said back-rest to establish a first movement phase wherein said body-supporting means moves from a sitting position to an intermediate, tilted sitting position and a second movement phase wherein said body-supporting means moves from said intermediate, tilted sitting position to a reclining position, the coordinating means including a carrier member, means pivotally mounting said carrier member on said support at a carrier pivot, a guiding link, means pivotally mounting said guiding link on said support at a stationary pivotal mount, a chain of connecting links having a first pivotal connection to said back-rest, a second pivotal connection to said carrier member, and a third pivotal connection to said guiding link, and seat control means operatively connected to said seat and to one of said chain of connecting links, the reclining movement of said back-rest during said first movement phase being effective to turn said guiding link about said stationary pivotal mount and to turn said chain of connecting links substantially about said second pivotal connection serving as a substantially stationary pivotal mount to incline said seat, the reclining movement of said back-rest during said second movement phase being effective to turn said guiding link about said stationary pivotal mount and to turn said carrier member about said carrier pivot.

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4. A reclining chair comprising a support, body-supporting means including a seat and back-rest, means including a pivot mounting said seat and back-rest for inclining and reclining movement respectively, and means for coordinating the inclining movement of said seat and the reclining movement of said back-rest to establish a first movement phase wherein said body-supporting means moves from a sitting position to an intermediate, tilted sitting position with substantially no angular change between said seat and back-rest and a second movement phase wherein said body-supporting means moves from said intermediate, tilted sitting position to a reclining position with the included angle between said seat and back-rest increasing, the coordinating means including a carrier member, means pivotally mounting said carrier member on said support at a carrier pivot, means for establishing a stationary position for said carrier member in said sitting position, a guiding link, means pivotally mounting said guiding link on said support at a stationary pivotal mount, a chain of connecting links having a first pivotal connection to said back-rest at a point spaced below said pivot, a second pivotal connection to said carrier member, and a third pivotal connection to said guiding link, seat control means operatively connected to said seat and to one of said chain of connecting links, the reclining movement of said back-rest during said first movement phase being effective to turn said guiding link about said stationary pivotal mount and to turn said chain of connecting links about said second pivotal connection serving as a substantially stationary pivotal mount to incline said seat at a rate for maintaining the substantially fixed angular relationship between said seat and back-rest, the reclining movement of said back-rest during said second movement phase being effective to turn said guiding link about said stationary pivotal mount and to turn said carrier member about said carrier pivot to increase the angular relationship between said seat and back-rest, a leg-rest, means operatively connected to said leg-rest and mounting the same for movement from a stored position when said body-supporting means is in said sitting position to elevated leg-supporting positions when said body-supporting means moves into said intermediate tilted sitting and reclining positions respectively, and means operatively connected to said leg-rest mounting linkage and to said coordinating means for moving said leg-rest to said elevated leg-supporting positions during said first and second movement phases.

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