May 18, 1965 F. F. SCHLIEPHACKE 3,184,266

MULTIPLE POSITION RECLINING CHAIR

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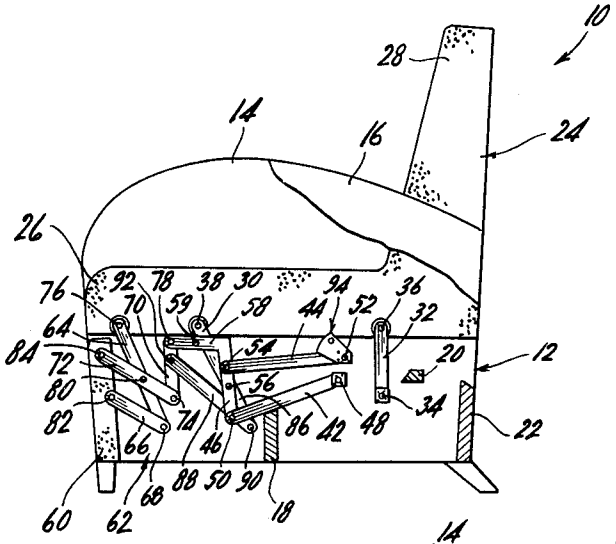


FIG. 1.

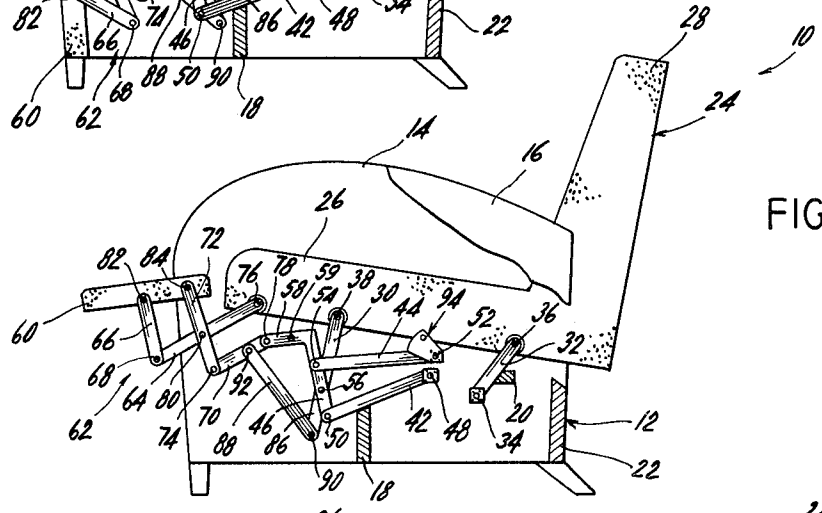


FIG. 2.

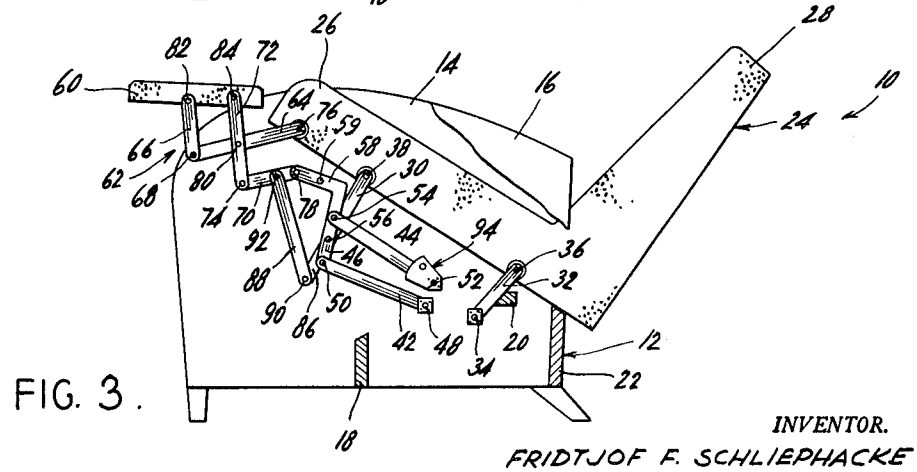


FIG. 3.

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FIG. 4.

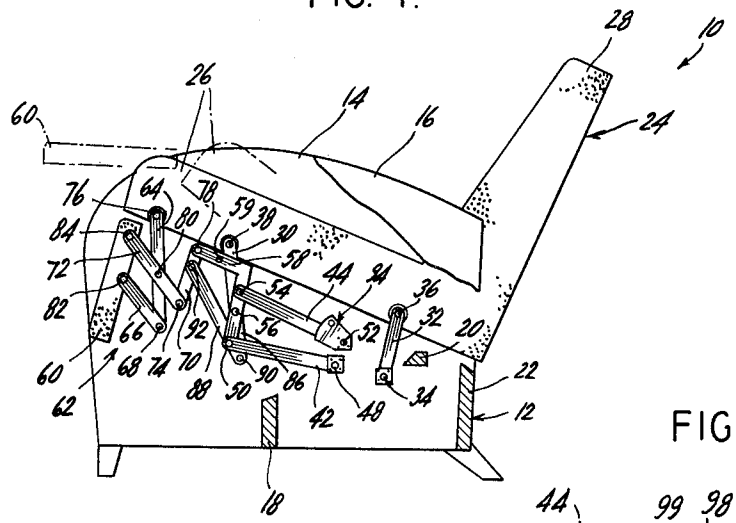


FIG. 9.

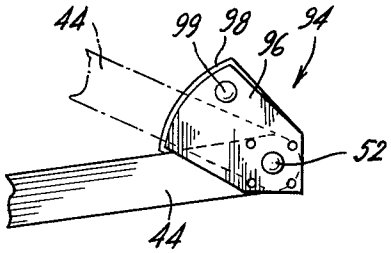
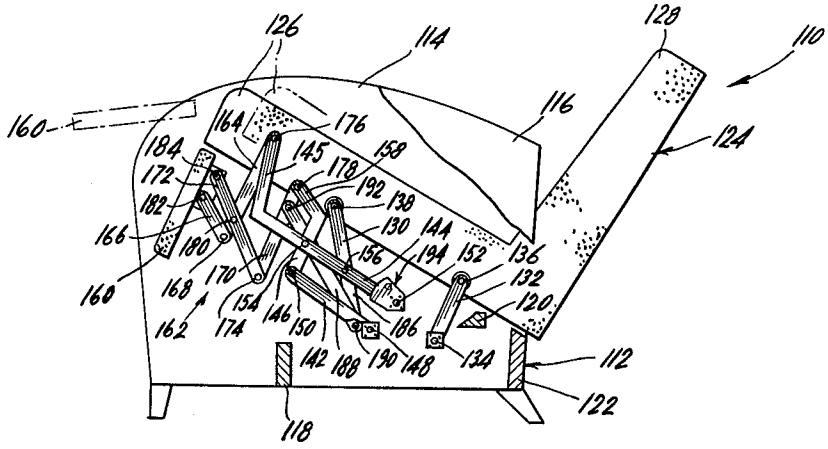


FIG. 8.



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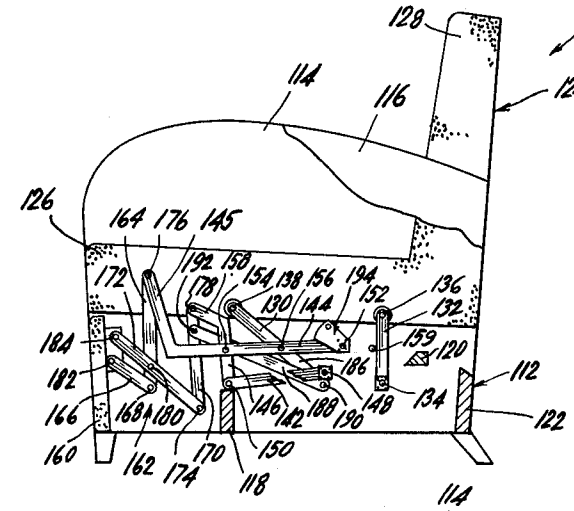


FIG. 5.

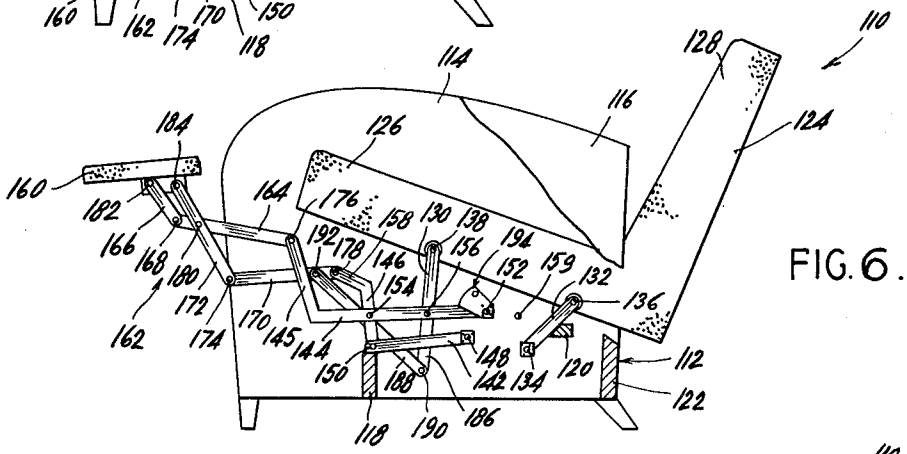


FIG. 6.

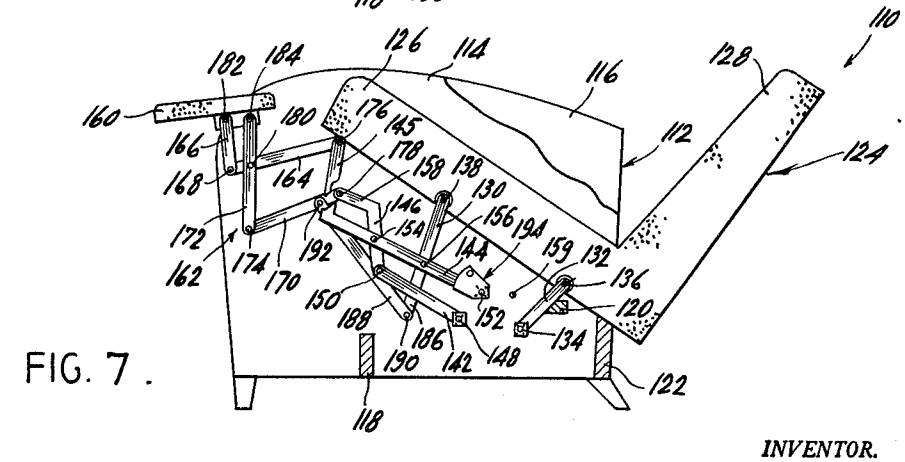


FIG. 7.

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United States Patent Office 3,184,266 Patented May 18, 1965

3,184,266

MULTIPLE POSITION RECLINING CHAIR

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Filed Dec. 28, 1962, Ser. No. 248,105
10 Claims. (Cl. 297—89)

The present invention relates to improvements in reclining chairs and in particular to a novel and improved leg-rest control arrangement for reclining chairs of the multiple position type.

The invention is applicable to multiple position reclining chairs, in which a body-supporting structure, including a seat and back-rest, is movable from an upright sitting position through a first motion phase to an intermediate, tilted sitting position and then through a second motion phase to a reclining or fully-tilted position. A leg-rest is also provided with control means to move the leg-rest from a retracted position beneath the seat to an extended position forwardly of the seat in response to movement of the body-supporting structure through the first motion phase from the upright sitting position to the intermediate tilted sitting position. Thus, in the latter position, while the occupant's body is still substantially upright and properly disposed for reading, viewing television or the like, the occupant's legs are comfortably supported in outstretched condition by the extended leg-rest. The leg-rest control means are also adapted to maintain the leg-rest in extended position relative to the seat when the body-supporting structure is moved through the second motion phase to the reclining position.

In many multiple position chairs previously devised, the leg-rest mounting linkage is mounted on the seat and the actuating linkage therefor is dormant during the second motion phase, the leg-rest and its linkage merely follow along with the forward end of the seat as the body-supporting structure turns to the fully-tilted or reclined position. Depending on the nature of the linkage, the leg-rest either remains in the same extended position relative to the seat during the second motion phase or is slightly lowered relative to the front end of the seat as it is brought to the fully-reclined position. It is desirable, however, that the leg-rest control linkage be capable of selectively adjusting the position of the leg-rest during the second motion phase so that the position of the leg-rest in the fully-tilted or reclined position can be suitably located for optimum comfort. Thus, the same basic linkage can be used in a variety of different chairs, but the extended position of the leg-rest can be adjusted to provide the most suitable disposition of the leg-rest to conform to the requirements of the paricular chair.

An object of the present invention is to provide in a multiple position reclining chair novel control means for both the leg-rest and the body-supporting structure, the control means being in the nature of a four-bar linkage mounting the forward portion of the seat on the support frame and being immovable during the first motion phase to act as a fixed portion of the support frame and movable during the second motion phase to permit the body-supporting structure to turn about a different center of rotation.

Another object of the invention is to provide a multiple position reclining chair having a four-bar linkage of the character described and also having a leg-rest mounting linkage of which one end or both ends are mounted on the four-bar linkage and carried thereby.

Still another object of the invention is the provision of a multiple position reclining chair of the character described in which the four-bar linkage includes a forwardly-facing intermediate link which is turned during the second motion phase and which is connected to the leg-rest mounting linkage, such that the leg-rest is given an additional extension actuation during the second motion phase to properly position it relative to the forward end of the seat.

A further object of the invention is the provision of a multiple position reclining chair of the character described in which the control linkage is provided with two degrees of freedom whereby the leg-rest can be moved downwardly from its extended position to the retracted position, if desired, while the body-supporting structure remains in a reclined position.

In accordance with the invention there is provided a multiple position reclining chair in which a body-supporting structure is mounted on a support frame by front and rear guide links. The rear guide link is mounted directly on the support frame while the front guide link is mounted on a four-bar linkage which includes as movable links first and second carrier links pivotally mounted at spaced points on the support frame and an intermediate link pivotally connected between the free ends of the carrier links. The four-bar linkage is arranged to rest immovably on the support frame during the first motion phase while the front guide link turns thereon, and the body-supporting structure is moved rearwardly by both guide links to the intermediate position. In the second motion phase, the rear guide link is blocked from further rearward movement, the four-bar linkage moves upwardly from its supported position, and the body-supporting structure turns about its pivotal connection with the stationary rear guide link. The chair also includes a leg-rest and a linkage mounting the leg-rest for movement between a retracted position beneath the seat and an extended position forwardly of the seat. At least one end of the leg-rest mounting linkage is mounted on an extension of the intermediate link, and the leg-rest mounting linkage is actuated during the first motion phase by the turning movement of the front guide link on the stationary four-bar linkage. During the second motion phase, the intermediate link is turned forwardly as it is raised by the carrier links to selectively actuate the leg-rest mounting linkage and thereby adjust the extended position of the leg-rest relative to the front of the seat in the fully-reclined position.

Additional objects and advantages of the invention will become apparent during the course of the following specification when taken in connection with the accompanying drawings, in which:

FIG. 1 is a side elevational view, with parts broken away and shown in section, of a reclining chair incorporating the seat control and leg-rest control arrangements of the present invention, the chair being shown in an upright sitting position;

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

FIG. 3 is a side elevational view similar to FIGS. 1 and 2, but showing the chair in a fully-tilted or reclined position with the leg-rest extended;

FIG. 4 is a side elevational view similar to FIG. 3, but showing the chair thereof in a reclined position with the leg-rest retracted;

FIG. 5 is a side elevational view, with portions broken away and shown in section, of a reclining chair incorporating a modified type of control arrangement made in accordance with the invention, the chair being shown in its upright sitting position;

FIG. 6 is a side elevational view similar to FIG. 4, but showing the chair thereof in its intermediate, tilted sitting position;

FIG. 7 is a side elevational view similar to FIGS. 4 and

5, but showing the chair thereof in its fully-tilted position with the leg-rest extended;

FIG. 8 is a side elevational view similar to FIG. 7, but showing the chair thereof in a reclined position with the leg-rest retracted; and

FIG. 9 is an enlarged elevational view of the friction device associated with one of the carrier links of the control arrangement, the carrier link being shown in full line in its position of FIG. 2, and in broken line in its position of FIG. 4.

Referring now in detail to the drawings, and in particular to FIGS. 1–3, there is shown a reclining chair incorporating the invention herein and designated generally by the reference numeral **10**. The structure of chair **10** includes a support frame generally designated by reference numeral **12** and having opposed side walls **14** and **16** interconnected by suitable cross-braces **18**, **20** and **22**. The chair **10** also includes a body-supporting structure generally designated by the reference numeral **24** and including a seat **26** and a back-rest **28** formed integrally as a rigid unit. The body-supporting structure **24** is mounted for movement relative to the support frame **12** by a front guide link **30** and a rear guide link **32**, the structure **24** moving from the upright sitting position of FIG. 1 to the intermediate, tilted sitting position shown in FIG. 2 and then to the fully-tilted or reclined position shown in FIG. 3.

At its lower end, the rear guide link **32** has a fixed pivotal mount **34** on the support frame **12**, and at its upper end is connected by pivot **36** to the rear portion of the seat **26**. The front guide link **30** is connected by pivot **38** to the seat **26** at a point spaced forwardly of the pivotal connection **36**. Toward its lower end, the front guide link **30** is mounted on a four-bar linkage which includes a first carrier link **42**, a second carrier link **44**, and an intermediate link **46**. The rear end of the first carrier link **42** is mounted by pivot **48** on the support frame **12** and the forward end thereof is connected by a pivot **50** to the lower end of the intermediate link **46**. The rear end of the second carrier link **44** is mounted by pivot **52** on the support frame at a point spaced above and rearwardly of the pivotal mount **48**. The forward end of the second carrier link **44** is connected by pivot **54** to the intermediate link **46** at a point above the pivot **50**. In the upright sitting position of FIG. 1, both carrier links **42** and **44** extend forwardly from their respective pivotal mounts **48** and **52**, with the second carrier link **44** overlying the first carrier link **42** and being spaced thereabove. The links **42** and **44** are not, however, parallel, the link **42** being downwardly inclined.

As was previously indicated, the first carrier link **42**, second carrier link **44**, and intermediate link **46** serve as three movable links of a four-bar supporting linkage which includes, as the stationary link thereof, the portion of the support frame **12** between the fixed pivots **48** and **52**. The front guide link **30** is mounted on this four-bar linkage; for example, in the embodiment of FIGS. 1–3, the front guide link is mounted by pivot **56** on the intermediate link **46** at a point between the pivots **50** and **54**. The intermediate link **46** has at its top end an extension **58** which extends perpendicularly forward thereof. The extension **58** has an inwardly-projecting pin **59** which engages the front guide link **30** in the upright sitting position of FIG. 1 and acts as a stop to prevent the body-supporting unit **24** from moving forwardly from this position under the body weight of the occupant.

The chair **10** also includes a leg-rest **60** and a leg-rest mounting linkage generally designated by reference numeral **62** which is adapted to guide the leg-rest between a retracted position beneath the seat to an elevated leg-supporting position forwardly of the seat in response to movement of the body-supporting structure **24**. This leg-rest mounting linkage **62** may be of any conventional type, but for purposes of illustration, is shown as a double-four-bar or lazy tong type of linkage. Specifically, the leg-rest mounting linkage **62** includes a first pair of mounting links **64** and **66** having a pivotal connection **68** at their adjacent ends and a second pair of mounting links **70** and **72** having a pivotal connection **74** at their adjacent ends. The mounting link **64** has a pivotal mount **76** at its upper end of the seat **26**, while the mounting link **70** has a pivotal mount **78** on the forward end of the perpendicular extension **58** of the intermediate link **46**. Intermediate its ends, the mounting link **64** crosses over the mounting link **72** and has a pivotal connection **80** thereto at the crossing-over point. The mounting link **66** has a pivotal connection **82** at its forward end to the leg-rest **60**, while the mounting link **72** has a pivotal connection **84** at its forward end to the leg-rest **60**, at a point spaced from the pivotal connection **82**.

Actuating means are provided for elevating the leg-rest **60** during the first motion phase from the retracted position shown in FIG. 1 to the extended leg-supporting position shown in FIG. 2. Such actuating means includes a depending extension **86** of the front guide link **30** extending beyond the pivot **56**, and an actuating link **88** connected to said extension **86** by a pivot **90**. The opposite end of the actuating link **88** is connected by pivot **92** to the leg-rest mounting link **70** at a point spaced below the pivotal mount **78** of said link **70**.

In the upright sitting position of FIG. 1, the first carrier link **42** rests upon the cross-bar **18** in a forwardly and downwardly-extending position, so that the four-bar linkage formed by the carrier links **42**, **44** and the intermediate link **46** serve as a fixed and immovable portion of the support frame. The rear guide link **32** extends vertically upward from its pivotal mount **34**, and the front guide link **30** extends upwardly and forwardly from its pivotal mount **56** toward the seat **26**. The body-supporting unit **24** is therefore supported in a level sitting position. The leg-rest mounting links **64** and **70** extend downwardly from their respective pivotal mounts **76** and **78** on the seat **26** and intermediate link extension **58** respectively, thereby positioning the leg-rest **60** in its retracted position in which it is substantially vertically disposed beneath the forward end portion of the seat **26**. The leg-rest actuating link **88** extends forwardly and upwardly from the front guide link extension **86** to the mounting link **70**.

When the occupant of the chair in the upright sitting position of FIG. 1 wishes to assume a more comfortable sitting position with his legs supported in outstretched condition, he applies rearward pressure against the body-supporting structure **24**. The body-supporting structure then moves rearwardly through a first motion phase, guided by the front guide link **30** and rear guide link **32**. During this first motion phase, the first carrier link **42** remains resting upon the cross-bar **18**, and the four-bar linkage formed by carrier links **42**, **44** and the intermediate link **46** remains stationary and serves as a fixed portion of the support frame. The front guide link **30** turns rearwardly and upwardly about its pivotal mount **56** upon this four-bar linkage, to guide the forward portion of the seat **26** rearwardly and also to elevate the same slightly. At the same time, the rear guide link **32** turns rearwardly and downwardly upon its pivotal mount **34** on the support frame **12** to guide the rear portion of the seat **26** rearwardly and also to lower it slightly. Thus, in the intermediate, tilted sitting position of FIG. 2, the body-supporting structure **24** has moved rearwardly from its position of FIG. 1 and has also been slightly tilted, although it is still in a substantially sitting position whereby the occupant's body is still upright and is properly disposed for viewing television, reading, or the like.

During the first motion phase, the leg-rest mounting link **64** is carried rearwardly with the forward portion of the seat through its pivotal mount **76**, while the pivotal mount **78** of the other leg-rest mounting link **70** remains stationary upon the immovable intermediate link extension **58**. However, as the front guide link **30** turns rear-

wardly, its bottom extension 86 turns forwardly and upwardly, moving actuating link 88 in an upward direction. Said actuating link 88 exerts a pushing force at point 92 against the leg-rest mounting link 70, thereby causing the link 70 to turn upwardly and forwardly about its pivotal mount 78 and causing the leg-rest mouting linkage 62 to move the leg-rest 60 to its extended, leg-supporting position of FIG. 2. In this position, the leg-rest 60 is located forwardly of the front end of the seat 26 and is almost at the level thereof, in proper position to comfortably support the outstretched legs of the occupant.

The intermediate, tilted sitting position of FIG. 2 is determined by engagement of the rear guide link 32 with the cross-bar 20. This halts further simultaneous rearward pivoting movement of the guide links 30 and 32, and constrains further movement of the body-supporting structure 24 to pivoting movement about another center of rotation through a second motion phase, in a manner to be presently described.

When the occupant of the chair wishes to assume a more comfortable positon for optimum relaxation, he applies further rearward pressure against the body-supporting structure 24. Since the rear guide link 32 is now restrained from further rearward turning movement by its engagement with the cross-bar 20, further rearward movement of the body-supporting structure 24 is now limited to turning movement about its pivotal connection 36 with the stationary rear guide link. 32. During this second motion phase, the forward portion of the seat 26 is elevated, carrying upwardly with it the front guide link 30, which in turn raises the intermediate link 46 through pivot 56 and thus the four-bar linkage formed by the carrier links 42, 44 and the intermediate link 46. Thus, the first carrier link 42 is lifted from its supported position on the cross-bar 18 and turns upwardly about its pivotal mount 48, while the second carrier link 44 turns upwardly about its pivotal mount 52.

In its supported position of FIG. 2, the first carrier link 42 is downwardly inclined to an appreciable extent. In turning upwardly to its raised position of FIG. 3, the carrier link 42 passes through a horizontal attitude and is raised slightly thereabove. Its end pivot 50 therefore travels through a forwardly-moving path. In contrast, the second carrier link 44 in the position of FIG. 2 is only slightly inclined downwardly from the horizontal. In moving to its raised position of FIG. 3, the second carrier link 44 passes quickly through a horizontal position and then is inclined upwardly so that its end pivot 44 travels through a rearwardly-moving path. Since the pivot 50 moves forwardly while the pivot 54 moves rearwardly, the lower end of the intermediate link is pushed forwardly and the upper end thereof is pulled rearwardly. The intermediate link thus is rotated slightly about its pivotal mount 56 in a clockwise direction as viewed in FIGS. 2 and 3.

This clockwise movement of intermediate link 46, during the second motion phase of the chair, has an adjusting effect upon the position of the extended leg-rest 60 relative to the seat 26 in the fully-tilted or reclined position. When the seat 26 turns about pivot 36 in the second motion phase, its elevating forward position raises the leg-rest mounting link 64 through pivot 76, as well as at its connected links 66 and 72. In addition, the forward portion of seat 26 raises the front guide link 30 and the connected links 46, 88 and 70. Thus, the entire leg-rest mounting linkage 62, as well as the leg-rest 60, is carried upwardly by forward portion of the seat as the seat 26 moves to the fully-tilted or reclined position. However, the clockwise movement of intermediate link 46 causes a rearward motion of its top extension 58 which in turn pulls leg-rest link 70 in a rearward direction. This rearward movement of the leg-rest link 70 causes an adjustment in the relative disposition of the links of the leg-rest mounting linkage 62 in such a manner that the angle of the leg-rest 60 relative to the seat 26 is varied. Thus, while the seat is appreciably more inclined in the position of FIG. 3 than it was in FIG. 2, the plane of the leg-rest 60 is maintained substantially horizontal. The leg-rest is also lowered a slight distance relative to the front end of the seat.

The specific angular relationships of the links of the four-bar linkage have been illustrated for purposes of example only. It will be appreciated by those skilled in the art that the relative lengths and relative angular dispositions of the links 42, 44 and 46 may be varied to produce a variety of selected adjusting movements of the leg-rest during the second motion phase. For example, if the first carrier link 42 were made horizontal and the second carrier link 44 downwardly inclined, the extension 58 of the intermediate link 46 would move forwardly instead of rearwardly to produce a different adjusting movement of the leg-rest.

The end of the second motion phase is established by engagement of the rear portion of the body-supporting structure 24 with the cross-brace 22, the structure 24 being then disposed in the fully-tilted or reclined position of FIG. 3. To return to the intermediate position of FIG. 2, it is only necessary for the occupant to shift his weight forwardly. To return from the intermediate position to the upright sitting position of FIG. 1, the occupant exerts downward pressure upon the leg-rest and urges his weight further forwardly by grasping the side frames 14 and 16.

However, the construction of the chair is such that, with the body-supporting structure 24 remaining in an inclined or substantially reclined position close to the fully-reclined position of FIG. 3, it is possible for the chair occupant to move the leg-rest 60 downwardly through an infinite variety of lesser-extended positions to the retracted position, if he so desires. This reclined position of the chair with the leg-rest retracted is shown in FIG. 4 and is the result of the two degrees of freedom inherent in the linkages of multiple position chairs of this type.

Disregarding such factors as friction, balance, and chair and body weight, the linkage mechanism in the position of FIG. 3 is not fully constrained. Because of the necessity of having the chair move through two different motion phases, the mechanism is provided with two degrees of freedom. That is to say, the body-supporting structure 24 can be made to turn forwardly about the stationary pivot 36, in a reverse of the second motion phase until it reaches the intermediate, tilted sitting position of FIG. 2, and the leg-rest will remain extended. As an alternative, the front guide link 30 and rear guide link 32 can be made to turn forwardly in unison from the position of FIG. 3, with the front guide link 30 lowering the leg-rest to any selected partially-retracted position or even to the fully-retracted position while the body-supporting structure 24 is still in an inclined or reclined attitude.

To achieve the latter movement, a friction member 94 is provided at the pivotal mount of one of the carrier links, for example the pivotal mount 52 of the second carrier link 44. This friction member 94 may be in the nature of a pair of friction plates 96 and 98 which are rigidly connected to each other in spaced relationship by pivot 52 as well as a stud 99. The plate 96 is secured to the support frame 12 by screws, rivets or other suitable means.

When the body-supporting structure 24 is moved to the fully reclined position of FIG. 3, the second carrier link 44 is elevated by the front guide link 30, as previously explained. The friction member 94 is arranged to provide a minimum amount of friction during the beginning of this movement and to gradually increase the friction at pivot 52, until the maximum friction is achieved at the fully-reclined position. The leverage produced by the body-supporting structure 24 as the

fully-reclined position is approached, is sufficient to overcome the frictional resistance of the member **94**. In FIG. 9, the second carrier link **44** is shown in full line in the position which it assumes in the intermediate, tilted sitting position of FIG. 2. In this position, only the extreme outer end thereof is located between the friction plates **96** and **98**. As the link **44** turns upwardly, however, during the second motion phase, an increasingly larger area thereof is located between the friction plates, until, in the fully-reclined position (shown in broken line in FIG. 9), a maximum portion of link **44** is located between said friction plates and is compressed thereby.

The specific form of friction member **94** is shown by way of preferred example. As an alternative, the friction member may be in the nature of a resilient disc of progressively increasing cross-section.

In moving down from the full-reclined position of FIG. 3, therefore, the maximum friction provided by the member **94** is sufficient to oppose the downward turning of link **44** about pivot **52**, and thus oppose the tendency of the body-supporting structure **24** to turn downwardly about pivot **36**. Because the linkage has two degrees of freedom, the occupant can, therefore, by applying downward pressure upon the leg-rest **60**, cause the body-supporting structure to follow a different path of movement. As the leg-rest is depressed, its mounting linkage **62** moves the actuating link **88** downwardly, causing the actuating link **30** to turn forwardly and carry the seat **26** in an upward and forward direction, the rear guide link **32** also turning forwardly to guide the rear portion of the seat. Since the friction member **94** retains the second carrier link **44** in its elevated position, the four-bar linkage provides a stationary pivot **56** for the turning movement of the front guide link **30**.

The leg-rest **60** may be stopped in any partially-retracted position, or may be moved down to the fully-retracted position, as shown in FIGURE 4, while the body-supporting structure **24** remains in a reclined attitude.

Referring now specifically to FIGS. 5 through 8, there is shown a reclining chair incorporating a modified form of control mechanism made in accordance with the invention herein and designated generally by the reference numeral **110**. The chair **110** again includes a support frame **112** having opposed side walls **114** and **116** interconnected by suitable cross-braces **118**, **120**, and **122**, and a body-supporting structure **124** including an integrally-formed seat **126** and back-rest **128**. The body-supporting structure **124** is mounted by a front guide link **130** and a rear guide link **132** for movement relative to the support frame **112** from the upright sitting position of FIG. 5 to the intermediate, tilted sitting position shown in FIG. 6 and then to the fully-tilted or reclined position shown in FIG. 7.

The rear guide link **132** is again provided with a fixed pivotal mount **134** on the support frame **112**, and a pivotal connection **136** to the rear portion of the seat **126**. The front guide link **130** is connected by pivot **138** to the seat **126** at a point spaced forwardly of the pivotal connection **136**. A four-bar linkage is again provided for supporting the front guide link **130**, this four-bar linkage again including a first carrier link **142**, a second carrier link **144**, and an intermediate link **146**. The rear end of the first carrier link **142** is mounted by pivot **148** on the support frame **112** and the forward end thereof is connected by a pivot **150** to the lower end of the intermediate link **146**. The rear end of the second carrier link **144** is mounted by pivot **152** on the support frame at a point spaced above and rearwardly of the pivotal mount **148**. Toward its forward end, the second carrier link **144** is connected by pivot **154** to a point on the intermediate link **146** spaced above the pivot **150**. The intermediate link **146** in this instance has an upwardly-inclined top extension **158**. In this instance, the first carrier link **142** is not inclined downwardly to such an extent as in the previous embodiment of FIGS. 1–4, and in the upright sitting position of FIG. 5, both carrier links **142** and **144** extend forwardly and substantially horizontally from their respective pivotal mounts **148** and **152**. A stop member **159**, mounted on the support frame **112**, engages the rear guide link **132** in the upright sitting position of FIG. 5 to prevent forward movement of the body-supporting structure **124** under the weight of the occupant's body.

The first carrier link **142**, second carrier link **144**, and intermediate link **146** again serve as three movable links of a four-bar supporting linkage, with the stationary link thereof constituting the portion of the support frame **112** between the fixed pivots **148** and **152**. The front guide link **130** is again carried by this four-bar linkage, but in this embodiment it is pivotally connected by pivot **156** to an intermediate point on the second carrier link **144**.

The chair **110** again includes a leg-rest **160** carried by a leg-rest mounting linkage **162** for movement between the retracted position of FIG. 5 and the extended positions of FIGS. 6 and 7. The leg-rest mounting linkage **162** is similar to that shown in FIGS. 1–3, and includes a first pair of mounting links **164** and **166** having a pivotal connection **168** at their adjacent ends and a second pair of mountinglinks **170** and **172** having a pivotal connection **174** at their adjacent ends. The upper ends of the mounting link **170** is mounted by pivot **178** on the end of the intermediate link extension **158**. In this instance, however, the other mounting link **164**, instead of being mounted on the seat as in the previous embodiment, is mounted by pivot **176** on an upwardly-extending front extension **145** of the second carrier link **144**. Intermediate their ends, the mounting links **164** and **172** cross each other and are connected by pivot **180** at their crossing-over point. The mounting links **166** and **172** are connected to spaced points on leg-rest **160** by respective pivots **182** and **184**.

Means are again provided for actuating the leg-rest mounting linkage **162** in such a manner as to elevate the leg-rest **160** during the first motion phase from the retracted position shown in FIG. 5 to the extended leg-supporting position shown in FIG. 6. Such actuating means comprises an actuating link **188** connected at one end by pivot **192** to the mounting link **170**, and connected at its other end by pivot **190** to a bottom extension **186** of front guide link **130** which extends below the pivot **156**.

In the upright sitting position of FIG. 4, the first carrier link **142** again rests upon the cross-bar **118** so that the four-bar linkage formed by the carrier links **142**, **144** and the intermediate link **146** serve as a fixed and immovable portion of the support frame. The rear guide link **132** is upstanding from its pivotal mount **134**, and the front guide link **130** extends upwardly and forwardly from its pivotal mount **156** toward the seat **126**. The leg-rest actuating link **188** extends forwardly and upwardly from the front guide link **130** to the mounting link **170**, and the leg-rest **160** is supported by the leg-rest linkage **162** in a retracted position beneath the forward portion of seat **126**.

When the occupant of the chair in the upright sitting position of FIG. 5 applies rearward pressure against the body-supporting structure **124**, the body-supporting structure moves rearwardly through a first motion phase, guided by the front guide link **130** and rear guide link **132**. During this first motion phase, the first carrier link **142** remains resting upon the cross-bar **118**, and the four-bar linkage formed by carrier links **142**, **144** and the intermediate link **146** remains stationary and serves as a fixed portion of the support frame. The front guide link **130** turns rearwardly and upwardly about its pivotal mount **156** upon the second carrier link **144** of this four-bar linkage, to guide the forward portion of the seat **126** rearwardly. In the intermediate, tilted position of FIG. 6, the body-supporting structure **124** has moved rearwardly from its position of FIG. 5 and has also been slightly tilted by the guide links **130** and **132**, although it is still

in a substantially sitting position with the occupant's body supported in upright condition and properly disposed for viewing television, reading, or the like.

During the first motion phase, the leg-rest mounting linkage **162** is supported on two stationary pivots, namely the pivot **176** on the second carrier link extension **145**, and the pivot **178** on the intermediate link extension **158**. As the front guide link **130** turns rearwardly, its bottom extension **186** turns forwardly and upwardly, moving actuating link **188** in an upward direction to actuate the mounting linkage **162** and move the leg-rest **160** to its extended, leg-supporting position of FIG. 6. In this position, the leg-rest **160** is spaced well forwardly of the front end of the seat **126** and is substantially at the level thereof.

The intermediate, tilted sitting position of FIG. 6 is determined by engagement of the rear guide link **132** with the cross-bar **120**, the latter halting further simultaneous rearward pivoting movement of the guide links **130** and **132**.

When the occupant of the chair applies further rearward pressure against the body-supporting structure **124**, the rear guide link **132** is restrained from further rearward turning movement by its engagement with the cross-bar **120**, and further rearward movement of the body-supporting structure **124** is limited to turning movement about its pivotal connection **136** with the stationary rear guide link **132**. During this second motion phase, the forward portion of the seat **126** is elevated, carrying upwardly with it the front guide link **130**, which in turn raises the second carrier link **144** and thus the four-bar linkage formed by the carrier links **142**, **144** and the intermediate link **146**. Since the second carrier link **144** between pivots **152** and **154** has a greater length than the first carrier link **142**, the pivot **154** on the second carrier link **144** travels through a greater arc than the free end of the first carrier link **142** so that the pivot **154** moves a greater distance away from the pivotal mount **148** than does the pivot **150**. Thus as the intermediate link **146** is lifted, it is also turned in a counter-clockwise direction relative to the body-supporting structure **124**, the lower end of link **146** being moved slightly rearwardly, and the upper extension **158** of link **146** being moved forwardly. This forward movement of extension **158** moves link **170** in a forward direction, which in turn causes link **172** to turn about pivot **180** in a clockwise direction. As a result of this movement the leg-rest **160** is maintained in a substantially level or horizontal attitude, but is drawn inwardly toward the front edge of the seat **126**, as shown in FIG. 7.

The fully tilted position of FIG. 7 is reached when the rear portion of the body-supporting structure **124** engages and is stopped by the cross-brace **122**. To return to the upright sitting position of FIG. 5, the occupant shifts his weight forwardly to bring the body-supporting structure to the intermediate position, and then applies downward pressure on the leg-rest to return the structure to the upright sitting position.

A friction member **194** is again provided at the pivotal mount **152** of the second carrier link **144**. This friction member **194** is identical in construction to the friction member **94** shown in FIG. 9 and previously described. It functions to permit the leg-rest **160** to be lowered from its extended position while the body-supporting structure **124** is still in a reclined position.

In the fully-reclined position of FIG. 7, the friction member **194** is providing the maximum amount of friction, and thus opposes the tendency of the body-supporting structure **124** to turn downwardly about pivot **136**. If the occupant desires to lower the leg-rest **160** in this position, he applies downward pressure with his legs upon the leg-rest and, grapsing the arms of the chair, urges his body weight forwardly and upwardly. The front and rear guide links **130** and **132** therefore turn forwardly in unison, guiding the body-supporting structure forwardly and lowering the leg-rest. This movement may be continued until the chair reaches the position of FIG. 8, in which the leg rest **160** is fully retracted.

While preferred embodiments of the invention have been shown and described herein, it is obvious that numerous omissions, changes and additions may be made in such embodiments without departing from the spirit and scope of the invention.

What I claim is:

1. A multiple position reclining chair comprising a support frame, a body-supporting structure including a seat and back-rest mounted for movement through a first motion phase from an upright sitting position to an intermediate, tilted sitting position and through a second motion phase to a fully reclined position, a pair of spaced carrier links extending forwardly of said chair and pivotally mounted at their rear ends at spaced points on the support frame, an intermediate link extending between and pivotally connected to the forward ends of said carrier links, said intermediate link and carrier links constituting a four-bar linkage, means supporting said four-bar linkage in a stationary position during the first motion phase, front and rear guide means supporting the body-supporting structure and guiding the same for movement during the first motion phase, said front guide means including a front guide link pivotally mounted on the four-bar linkage and pivotally connected to the forward portion of the seat, said front guide link having an extension depending below its pivotal mount on said four-bar linkage, a leg-rest, a leg-rest linkage carrying said leg-rest, one link of said leg-rest linkage being pivotally mounted on said intermediate link at a mounting pivot, and an actuating link pivotally connecting said front guide link extension with said leg-rest linkage, said front guide link turning on the stationary four-bar linkage during the first motion phase to elevate the leg-rest to an extended position forwardly of the seat, said four-bar linkage and said front guide link being raised as a unit with the forward portion of the seat during the second motion phase to maintain the leg-rest in its extended position forwardly of the seat, said four-bar linkage being arranged to turn said intermediate link relative to the seat as the four-bar linkage is raised during the second motion phase, whereby to displace said mounting pivot and adjust the position of the extended leg-rest relative to the seat.

2. A multiple position reclining chair comprising a support frame, a body-supporting structure including a seat and back-rest mounted for movement through a first motion phase from an upright sitting position to an intermediate, tilted sitting position and through a second motion phase to a fully reclined position, a pair of vertically-spaced carrier links extending forwardly of said chair and pivotally mounted at their rear ends at spaced points on the support frame, an intermediate link extending between said carrier links and pivotally connected to the forward end of the uppermost carrier link at a first pivot and to the forward end of the other carrier link at a second pivot, said intermediate link and carrier links constituting a four-bar linkage, said intermediate link having a forwardly-directed extension projecting beyond its first pivot, means supporting said four-bar linkage in a stationary position during the first motion phase, front and rear guide means supporting the body-supporting structure and guiding the same for movement during the first motion phase, said front guide means including a front guide link pivotally mounted on the four-bar linkage and pivotally connected to the forward portion of the seat, said front guide link having an extension projecting below its pivotal mount on said four-bar linkage, a leg-rest, a leg-rest linkage carrying said leg-rest and guiding the same for movement between a retracted position beneath the seat and an extended position forwardly of said seat, one link of said leg-rest linkage being pivotally mounted on the intermediate link extension, and an actuating link pivotally connecting said front guide link extension with the leg-rest linkage for elevating the leg-rest to its extended posi-

tion as the front guide link turns upon the stationary four-bar linkage during the first motion phase, the body-supporting unit turning about the rear guide means during the second motion phase to elevate the front guide link, four-bar linkage, and leg-rest linkage in unison, whereby the leg-rest is retained in extended position, the upward movement of said carrier links during the second motion phase moving said first pivot relative to said second pivot to turn said intermediate link relative to the seat, whereby the position of the extended leg-rest is adjusted relative to the forward end of the seat in the fully reclined position.

3. A multiple position reclining chair according to claim 2 in which the front guide link is mounted on the intermediate link of the four-bar linkage.

4. A multiple position reclining chair according to claim 2 in which the front guide link is mounted on one of the carrier links of the four-bar linkage.

5. A multipie position reclining chair comprising a support frame, a body-supporting structure including a seat and back-rest mounted for movement through a first motion phase from an upright sitting position to an intermediate, tilted sitting position and through a second motion phase to a fully reclined position, a pair of spaced carrier links extending forwardly of said chair and pivotally mounted at their rear ends at spaced points on the support frame, an intermediate link extending between and pivotally connected to the forward ends of said carrier links, said intermediate link having a forwardly-directed extension projecting beyond its pivotal connection with the uppermost carrier link, said intermediate link and carrier links constituting a four-bar linkage, means supporting said four-bar linkage in a stationary position during the first motion phase, a pair of guide links pivotally connected to spaced points on the seat, the front guide link being pivotally mounted on the four-bar linkage and the rear guide link being pivotally mounted on the support frame, said guide links turning rearwardly in unison during the first motion phase to guide the body-supporting structure, means blocking further rearward turning movement of the rear guide link at the intermediate, tilted sitting position, whereby the body-supporting structure turns about its pivotal connection with the stationary rear guide link during he second motion phase, a leg-rest, a leg-rest mounting linkage carrying said leg-rest, said mounting linkage comprising a first pair of spaced links pivotally connected to spaced points on the leg-rest and a second pair of links connected to said first pair, one link of said second pair being pivotally mounted on the intermediate link extension, the other link of said second pair being pivotally mounted on a movable portion of the chair other than said intermediate link, said front guide link having a depending extension projecting below its pivotal mount on said four-bar linkage, and an actuating link pivotally connecting said front guide link extension with said leg-rest mounting linkage for elevating said leg-rest to an extended position forwardly of the seat during the first motion phase as the front guide link turns on the stationary four-bar linkage, the front guide link, four-bar linkage and leg-rest mounting linkage being carried upwardly with the forward end of the seat during the second motion phase, whereby the leg-rest is maintained in its extended position, the upward turning movement of the carrier links in the second motion phase

turning the intermediate link relative thereto, whereby the intermediate link extension adjusts the position of the extended leg-rest relative to the forward end of the seat in the fully-reclined position.

6. A multiple position reclining chair according to claim 5 in which one link of the second pair of links of the leg-rest mounting linkage is pivotally mounted on the intermediate link extension and the other link thereof is pivotally mounted on the forward end of the seat.

7. A multiple position reclining chair according to claim 5 in which said uppermost carrier link has a forward, upwardly-extending projection, one link of the second pair of links of the leg-rest mounting linkage being pivotally mounted on said intermediate link extension and the other link thereof being pivotally mounted on said carrier link extension.

8. A multiple position reclining chair according to claim 5 in which said actuating link and front guide link are operative to provide said leg-rest with two degrees of freedom during the second motion phase, whereby said leg-rest may be depressed toward its retracted position in the fully reclined position of said body-supporting structure, the downward movement of the leg-rest causing said front guide link to turn forwardly on the elevated four-bar linkage, whereby the leg-rest is moved downwardly from its extended position while the body-supporting structure remains in a reclined position.

9. A multiple position reclining chair according to claim 8 in which friction means are provided in engagement with one of the movable parts of the chair to automatically provide progressively increasing friction upon said movable parts as the body-supporting structure moves from the intermediate, tilted sitting position to the fully-reclined position, whereby to oppose downward turning movement of the body-supporting structure about its pivotal connection with the rear guide link from the fully reclined position and thereby cause the front and rear guide links to turn forwardly when downward pressure is applied to the extended leg-rest in the fully-reclined position.

10. A multiple position reclining chair according to claim 8 in which friction means are provided at the pivotal mount of one of said carrier links, said friction means being operative to automatically provide progressively increasing friction upon said one carrier link as the latter moves from the intermediate, tilted sitting position to the fully-reclined position, whereby to resist the downward movement of the four-bar linkage from its elevated position and thereby oppose downward turning movement of the body-supporting structure in the fully-reclined position about said pivotal connection between the body-suppotring structure and the rear guide link.

References Cited by the Examiner

UNITED STATES PATENTS

3,043,621	7/62	Fletcher	297—85
3,061,367	10/62	Schliephacke	297—89
3,065,989	11/62	Mohler	297—88
3,069,201	12/62	Belisle et al.	297—85
3,084,974	4/63	Belisle et al.	297—89

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