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EXTENSIBLE HEAD-REST AND CONTROL FOR DOUBLE MOVEMENT AND TWO POSITION TYPES OF CHAIRS

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FIG. 1.

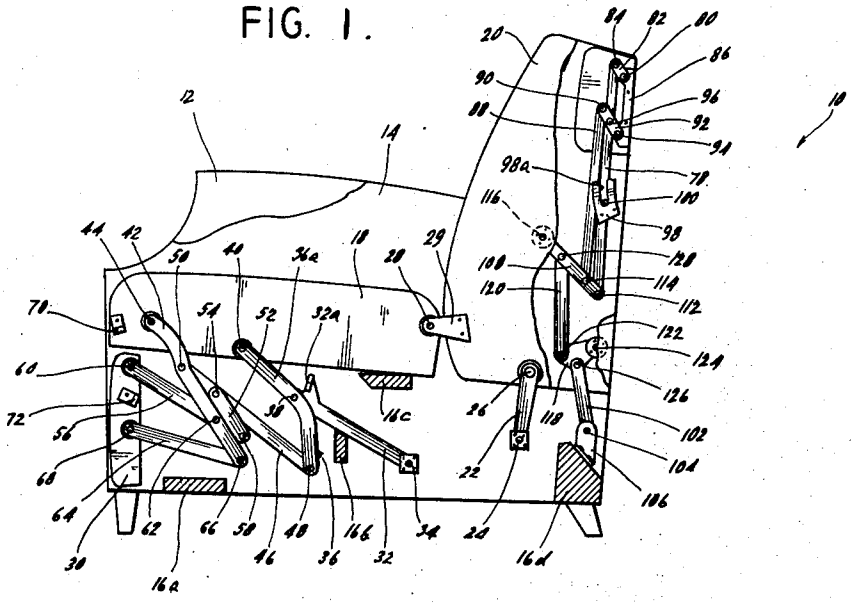
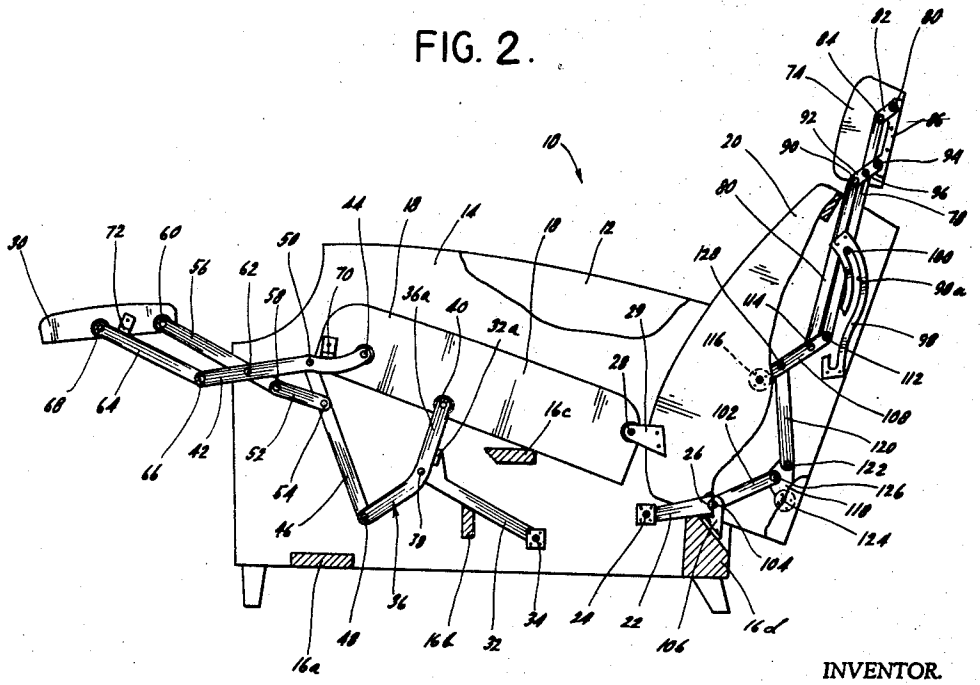


FIG. 2.



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EXTENSIBLE HEAD-REST AND CONTROL FOR DOUBLE MOVEMENT AND TWO POSITION TYPES OF CHAIRS

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FIG. 3.

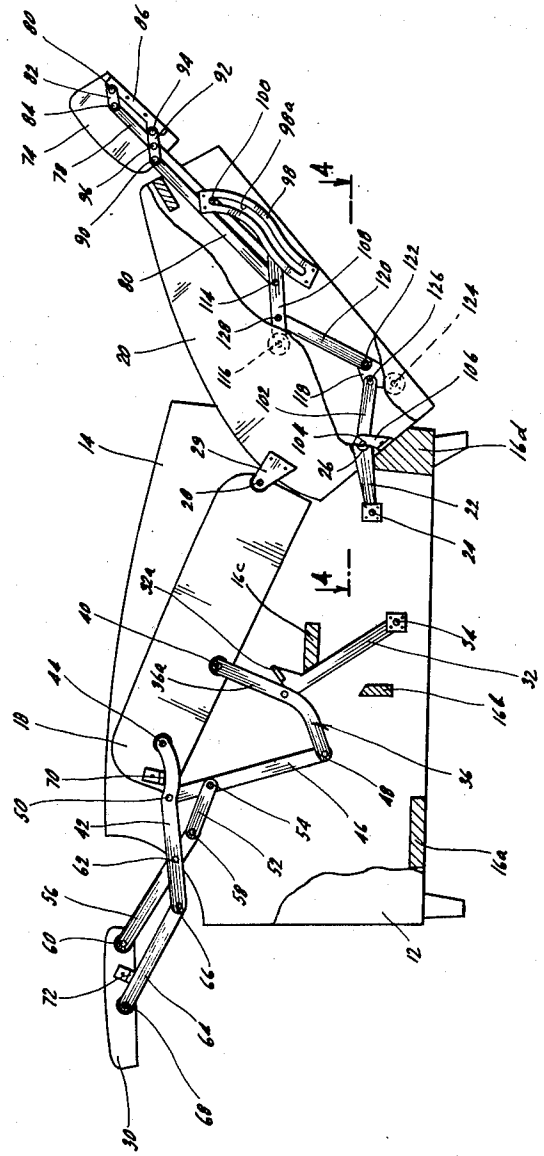
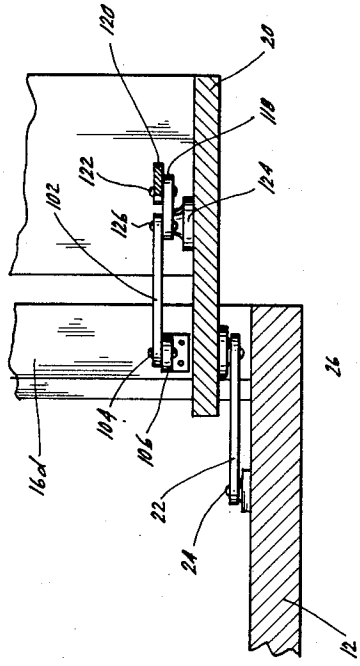


FIG. 4.



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EXTENSIBLE HEAD-REST AND CONTROL FOR DOUBLE MOVEMENT AND TWO POSITION TYPES OF CHAIRS

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FIG. 5.

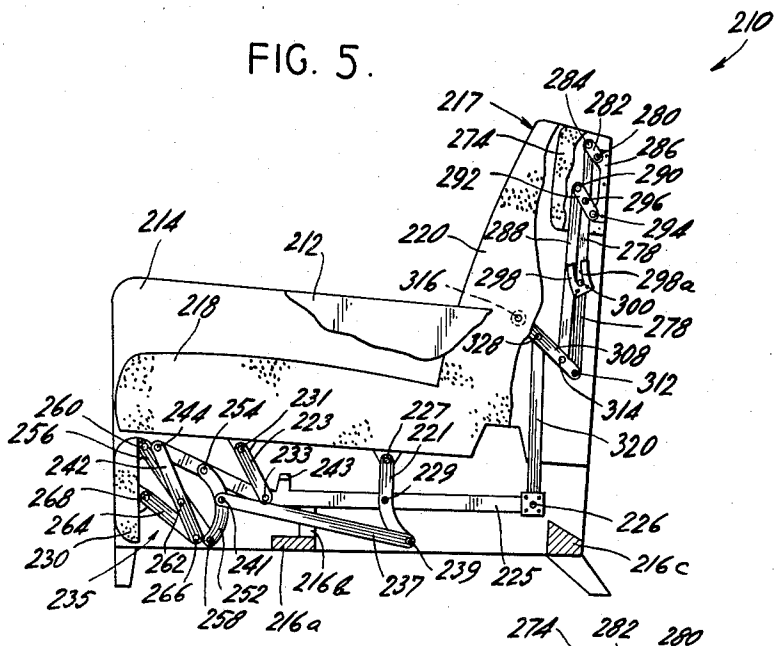


FIG. 6.

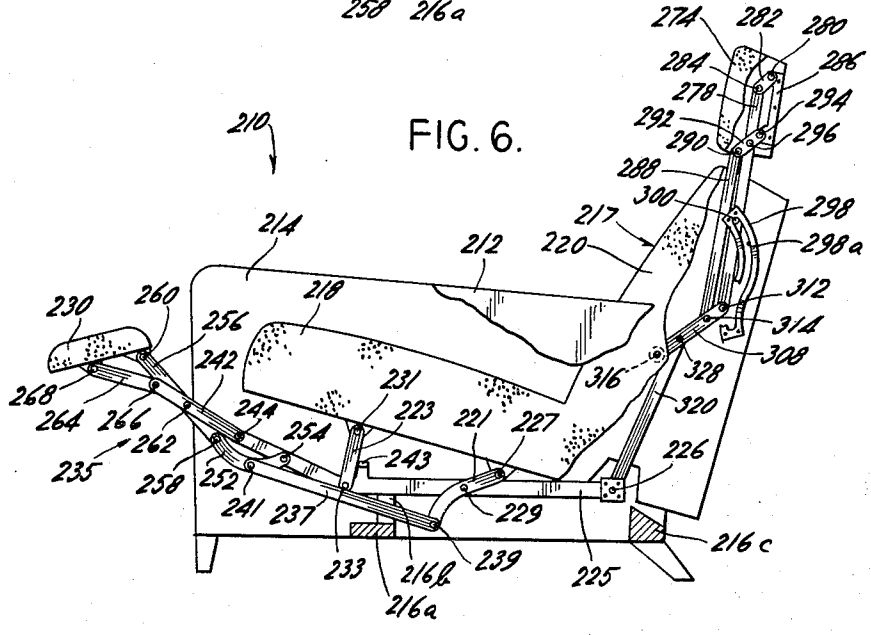


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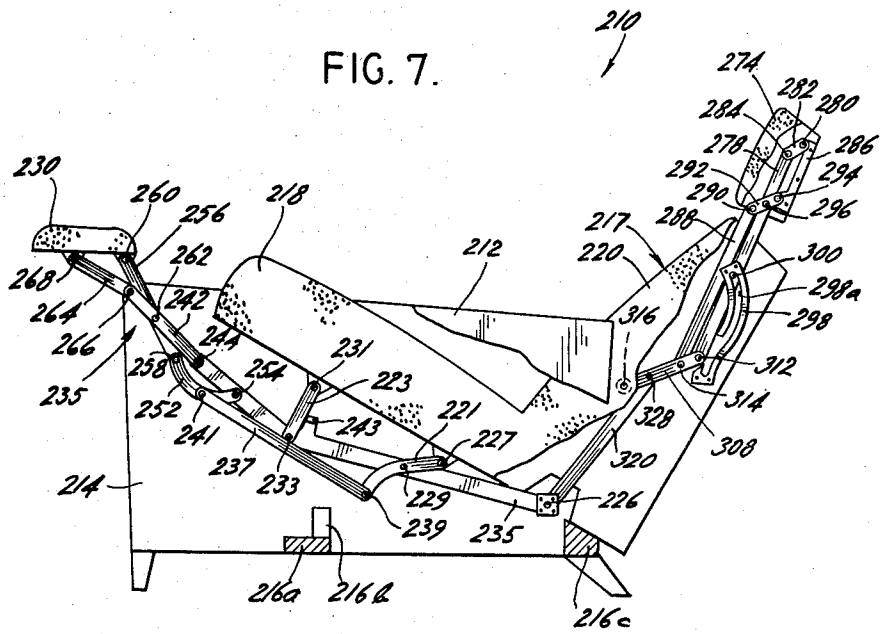
FIG. 7.

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United States Patent Office 3,140,117 Patented July 7, 1964



3,140,117

# EXTENSIBLE HEAD-REST AND CONTROL FOR DOUBLE MOVEMENT AND TWO POSITION TYPES OF CHAIRS

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Filed Sept. 11, 1962, Ser. No. 223,582
10 Claims. (Cl. 297—61)

The present invention relates generally to an improved reclining chair, and in particular to an improved head-rest and control arrangement for a reclining chair wherein the head-rest is automatically displaced to an extended position relative to the back-rest in response to movement of the reclining chair in response to a first phase or portion of the reclining movement. This application is a continuation-in-part of my copending United States Patent application Serial No. 777,656 filed December 2, 1958, and now abandoned.

It is generally known to construct a reclining chair comprising a support and body-supporting means having a back-rest movably mounted on the support such that the back-rest may be moved into various reclined positions under control of the chair occupant. It has been suggested that such reclining chairs incorporate a head-rest positioned adjacent the upper end of the back-rest, and preferably stored within the outline of the back-rest, such that the head-rest may be extended or elevated relative to the back-rest to provide a more comfortable and adequate support for the head of the user. With such extensible head-rest, the back-rest may be made somewhat shorter for esthetic reasons, but the user may be comfortably accommodated when moving into various reclined positions by the additional support afforded by the extended head-rest.

Broadly it is an object of the present invention to provide an improved actuating and control arrangement for elevating the head-rest of a reclining chair relative to the back-rest as a function of the reclining movement of the back-rest.

In my copending application Serial No. 601,885 filed August 3, 1956, and now abandoned, and entitled Movable Reclining Chair With Back-Rest, Seat and Leg-Rest there is disclosed a number of embodiments of reclining chairs of the double-movement type which comprise a support, a body-supporting means including a back rest and seat adapted to be mounted on the support for reclining and inclining movement respectively, and means movably mounting the body-supporting means on the support for a first movement phase from an upright sitting position to an intermediate, tilted sitting position during which there is no appreciable relative angular displacement between the back-rest and seat and for a second movement phase from the tilted position to various reclining positions during which the back-rest is angularly displaced relative to the seat. The intermediate, tilted sitting position established at the end of the first motion phase is suitable for television viewing, reading, knitting and the like. The various reclining positions established during the second movement phase comfortably accommodate the chair occupant in a somewhat stretched out attitude, appropriate for total or complete relexation. Further, in my copending application Serial No. 747,748 filed July 10, 1958, now Patent No. 2,940,509, and entitled Multiple Position Chair, there is disclosed a reclining chair of the two-position type in which the body supporting means is in the form of a rigid seat and back-rest unit which is adapted to be brought first to an intermediate, tilted sitting position and then to a fully tilted position. In the intermediate or tilted sitting position, the body-supporting unit is disposed in an "active" attitude with the user's body being in a substantially upright position in which the eyes are



directed forwardly such that the user may read, knit, view television and the like. In the fully tilted position the body-supporting unit is disposed in an "inactive" position in which the user's body is accommodated in a somewhat more rearwardly tilted position, appropriate for total or complete relaxation.

I have found that it may be to advantage to incorporate a head-rest into such double-movement and two-position types of chairs such that a more comfortable and adequate support is provided for the head of the chair occupant. An important criteria is that the head-rest be extended to the head-supporting position at least at the end of the first motion phase of the reclining chair such that in a chair of the double-movement type the head-rest is fully extended in the intermediate, tilted sitting position and in the chair of the two-position type the head-rest is also extended in the corresponding tilted sitting position. A further important criteria is that the head-rest throughout the second phase of the chair movement, whether in the double movement type of chair wherein the angle between the seat and back-rest increases incident to said second motion phase, or in the two-position type of chair wherein the seat and back-rest are rigid with each other but are titled more rearwardly incident to said second motion phase.

Accordingly, it is a further object of the present invention to provide an improved head-rest and control arrangement suitable for incorporation into reclining chairs of the double-movement and two position types. Specifically, it is within the contemplation of the present invention to provide a head-rest and control arrangement for reclining chairs of the double-movement or two-position types wherein the head-rest is moved to an extended head-supporting position during a first phase or portion of the chair movement and remains substantially stationary and in the extended head-supporting position throughout the second phase of the chair movement such that an adequate head support is provided for the chair occupant in the various useful positions of the chair.

In accordance with an illustrative embodiment demonstating features and advantages of the present invention there is provided a reclining chair which comprises a support, body-supporting means including a seat and back-rest movably mounted on the support, coordinating means operatively connected to the body-supporting means and mounting said body-supporting means for movement through a first motion phase during which the seat and back-rest move to an intermediate, tilted sitting position and through a second motion phase during which the seat and back-rest move into various reclining positions, a head-rest, means operatively connected to and mounting the head-rest for movement to an extended head-supporting position relative to the back-rest, and actuating means cooperatively connected to the head-rest and support and operable under control of the body-supporting means for moving the head-rest to the extended head-supporting position in response to the first motion phase of the reclining chair.

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 an illustrative embodiment demonstrating features and advantages of the present invention, wherein:

FIG. 1 is an elevational view, with parts broken away and sectioned, of a typical reclining chair of the double movement type incorporating my improved head-rest control, the chair being shown in the upright sitting position;

FIG. 2 is an elevational view similar to FIG. 1, but showing the reclining chair in the intermediate, tilted

sitting position, with the head rest displaced to the extended head-supporting position;

FIG. 3 is an elevational view similar to FIG. 1, but showing the reclining chair in a fully reclined position, with the head rest remaining in the extended head-supporting position;

FIG. 4 is a sectional view, on an enlarged scale, taken substantially along the line 4—4 of FIG. 3 and looking in the direction of the arrows;

FIG. 5 is an elevational view, with parts broken away and shown in section, of a reclining chair of the multiple-position type incorporating the head-rest control of the present invention, the chair being shown in its upright sitting position;

FIG. 6 is an elevational view similar to FIG. 5 showing the chair thereof in its intermediate, tilting sitting portion, with the head-rest in extended, head-supporting position; and

FIG. 7 is an elevational view, similar to FIG. 5, but showing the chair thereof in fully tilted position with the head-rest remaining in extended, head-supporting position.

Referring now specifically to the drawings, and in particular to the embodiment shown in FIGS. 1–4, there is shown a reclining chair **10** of the double-movement type which is of generally known construction and incorporates my improved head-rest and control. Briefly, the reclining chair **10** comprises a support or chair frame including opposite side walls **12, 14** joined together by a number of cross braces **16***a*, **16***b*, **16***c* and **16***d*. A body-supporting means including a seat **18** and a back-rest **20** is movably supported on the chair frame, with the back-rest **20** being pivoted on the chair frame by a rear guiding link **22** having a pivotal mount **24** on the support and a pivotal connection **26** to lower end of the back-rest **20**. The seat **18** normally rests on the cross brace **16***c* serving as a stop and is mounted for inclining movement as a function of the reclining movement of the back-rest **20** at a seat pivot **28** on the forwardly extending rigid hanger **29** fixed to the back-rest **20**. Below the forward end of the seat **18** is a leg-rest **30** which is mounted for movement from a stored position below the forward end of the seat, as shown in FIG. 1, to elevated positions as shown in FIGS. 2 and 3. Interconnected between the back-rest **20**, the seat **18** and the leg-rest **30** is a main controlling and coordinating linkage for inclining the seat **18** and for elevating the leg-rest **30** during the first and second phases of the reclining movement of the chair. Specifically, during the first phase of the chair movement, the seat **18** is inclined such that the angular relationship between the seat **18** and the back-rest **20** remains substantially unchanged, with the leg-rest **30** being elevated such that the chair components move into an intermediate, tilted sitting position, suitable for viewing television, reading and the like (see FIG. 2). During the second phase of the chair movement, the seat **18** is inclined such that the angular relationship between the seat and back-rest increases (that is, the included angle between the seat and back-rest opens up), with the leg-rest **30** remaining elevated, such that a fully reclined position is established suitable for complete relaxation (see FIG. 3). The main controlling and coordinating linkage is seen to include a carrier link **32** which is disposed in a forwardly inclined starting position resting against the cross brace **16***b* serving as a stop and having a pivotal mount **34** at its lower end on the chair frame or support. Pivotally mounted on the carrier link **32** is a double-arm lever **36** which is adapted to turn about a pivot **38** on the upper and forward end of the carrier link **32**. The double-arm lever **36** has an upwardly and forwardly inclined arm **36***a* which has a pivotal connection **40** at its upper end to the seat **18**, which arm serves as a seat control link during the first phase of the chair movement. The rear end of the seat is supported by cross brace **16***c*. As may be appreciated by inspecting FIGS. 1 and 2, pivotal movement of the arm **36***a* about the pivot **38**, with the carrier link **32** remaining stationary and the rear end of the seat resting on cross brace **16***c*, causes a prescribed inclination to be imparted to the seat **18** as a function of the tilting movement of the back-rest **20** until such time as the arm **36***a* abuts the stop **32***a* provided on the adjacent end of the carrier link **32**. During the first phase of the chair movement, the main controlling and coordinating linkage is in the form of a five bar linkage acting as a four bar linkage, which includes as the stationary link thereof the portion of the support intermediate the pivotal mount **24** and the pivot **38**, the arm **36***a* serving as a seat control link, the portion of the seat and back-rest intermediate the pivots **40, 26** (which may be considered as one movable link for the sake of convenience and by virtue of the supporting function of cross brace **16***c*), and the link **22**. The other arm **36***b* of the double-arm lever **36** serves as a driving or connecting link to the leg-rest suspending linkage which is seen to include a hanger arm **42** having a pivotal connection **44** at its upper end to the seat **18**. The leg-rest suspending linkage is swingable through a forward arc under control of a connecting link **46** which has a pivotal connection **48** at its rearward end to the arm **36***b* and a pivotal connection **50** at its forward end to the hanger arm **42** at a point spaced below the pivotal mount **44** on the seat **18**. The leg-rest suspending linkage is completed by a further hanger arm or link **52** which has a pivotal connection **54** at its upper end to the connecting link **46** at a point spaced rearwardly of the pivotal connection **50**, a connecting link **56** which has a pivotal connection **58** at its rearward end to the hanger link **52**, a pivotal connection **60** at its forward end to the leg-rest **30** adjacent the upper end thereof and a pivotal connection **62** intermediate its end at a cross-over point to the hanger arm **42** at a point spaced behind the pivotal connection **50**, and a further connecting link **64** which has a pivotal connection **66** at its rearward end to the lower end of the hanger arm **42** and a pivotal connection **68** at its forward end to the leg-rest **30** at a point spaced from the pivotal connection **60**. A stop **70** is affixed to the seat in position to abut the hanger arm **42** in the intermediate, tilted sitting position shown in FIG. 2 and a further stop **72** is affixed to the leg-rest **30** for abutting the connecting link **64** in the intermediate, tilted sitting position.

The coordination of the chair components by the described linkage, which is subject to a latitude of variation and change and is merely illustrative of a typical double-movement type of reclining chair, is substantially as follow:

When the chair occupant leans against the back-rest **20**, the back-rest **20** is tilted as a function of the geometry of the linkage which is operative during the first phase of movement, with the seat rearwardly displaced and being inclined relative to the support. The rearward displacement of the seat **18** under control of the back-rest **20** causes the double arm lever **36** to turn about its pivotal mount **38** on the carrier link **32**, with the upwardly extending arm **36***a* serving the seat control function and the downwardly extending arm **36***b* actuating the leg-rest suspending linkage. The double-arm lever **36** turns until such time as arm **36***a* abuts the stop **32***a* on the carrier link **32** which establishes the intermediate or tilted sitting position illustrated in FIG. 2 wherein the seat and back-rest are in a rearwardly tilted sitting position, with the leg-rest **30** elevated and projecting forwardly of the seat **18**. Further, the rear guiding or control link **22** moves into relatively fixed position against cross-brace **16***d*, serving as a stop. It is noted that the stops **16***d*, **32***a*, and the leg-rest stops **70, 72** are all positioned to be effective at the same time to accurately establish the intermediate,

tilted sitting position. When the chair occupant further leans against the back-rest **20** to initiate the second phase of the chair movement, the back-rest turns about the pivot **26** at the upper end of the rear guiding or control link **22**, which pivot then serves as the back-rest pivot and remains stationary throughout the second phase of the reclining movement due to the blocking of the link **22**. The blocked leg-rest suspending linkage maintains the leg-rest **30** substantially in the same elevated leg-supporting position, while the seat **18** and the arm **36***a* of the double arm lever **36** which is rigid therewith are guided by the carrier link **32**, which turns about its pivotal mount **34** on the chair frame. The fully reclined or completely relaxed position for the chair, illustrated in FIG. 3, is established when the carrier link **32** is blocked against further movement by coming into contact with the forward end of the cross-brace **16***c* which serves as a stop for limiting movement of the carrier link.

In accordance with an illustrative embodiment demonstrating features of the invention, a head-rest **74** is disposed in a stored or retracted position accommodated within the upper rear corner of the back-rest **20**, as seen in FIG. 1. The head-rest **74** is mounted with its upper face substantially coplanar or flush with the upper face of the back-rest by a mounting linkage, which is seen to embody a primary mounting link **78** having a pivotal connection **84** at its upper end to a connecting link **82** which in turn has a pivotal connection **80** to a bracket **86** fixed to the head-rest **74**, and a secondary mounting link **88** having a pivotal connection **90** at its upper end to one end of a connecting link **92** which has a pivotal connection **94** at its other end to the bracket **86** on the head-rest **74**. The connecting link **92** crosses over the primary mounting link **78** and has a pivotal connection **96** thereto for coordinating the links **78**, **82**, **88** and **92** which provides a double-four bar extensible mounting linkage for the head-rest **74**. The mounting linkage extends substantially lengthwise of the backrest **20** and is engaged by a guide means which is operatively connected between one of the mounting links and the back-rest **20** such that the head-rest **74** is constrained to move along the prescribed path from the retracted or stored position, illustrated in FIG. 1, to the extended or head-supporting position illustrated in FIGS. 2 and 3. Preferably the guide means includes an elongated guide plate **98** having a guide slot **98***a* formed therein, which guide plate is affixed to the adjacent side frame of the back-rest, with a pin **100** being carried by the primary mounting link **78** and being guidingly engaged within the slot **98***a*. The pin and slot interconnection is arranged such that the pin **100** is at the lowermost end of the slot **98***a* to establish the stored position for the head-rest as illustrated in FIG. 1. The slot **98***a* extends substantially lengthwise and upwardly on the back-rest **20** and is of such a length and contour that it guides the head-rest **74** first upwardly to a clearance position relative to the upper end of the back-rest and then forwardly to the extended or head-supporting position wherein the front surface of the head-rest **24** is properly oriented relative to the back-rest **20** (see FIGS. 2 and 3) for supporting the head of the chair occupant.

Operatively connected between the frame or support **12**, **14**, the back-rest **20**, and the mounting linkage is an actuating mechanism or linkage which imparts a further restraint to the mounting linkage and is effective to move the head-rest between the retracted and extended positions. The actuating mechanism or linkage includes an actuating link **102** which is disposed in a slightly forwardly inclined position and has a pivotal mount **104** on a bracket **106** fixed to the rear cross brace **16***d* of the chair frame. An actuating and guiding link **108** is operatively connected to the actuating link **102** by a toggle linkage, with the actuating and guiding link **108** having respective pivotal connections **112**, **114** adjacent one end thereof to the primary and secondary mounting links **78**, **88** of the head-rest mounting linkage and a pivotal connection **116** at the other end thereof to the back-rest **20**. The toggle linkage includes a driver plate **118** and a connecting link **120** having a pivotal connection **122** to the driver plate. The driver plate or link of the toggle linkage has a pivotal mount **124** on the back-rest **20** and a pivotal connection **126** intermediate its ends to the actuating link **102**, with the connecting link **120** having a pivotal connection **128** to the actuating and guiding link **108** intermediate its ends. The portion of the driver plate **118** intermediate the pivotal mount **124** and the pivotal connection **122** constitutes the driver of the toggle linkage which is constrained to move in a rotary path about the pivotal mount **124** and exerts an axial force on the connecting link **120** which is coupled to the actuating and guiding link **108**. The rotary motion of the driver intermediate the pivots **124**, **122** is such that the effective lever arm (which is the perpendicular distance from the line of action of the connecting link **120** to the center of rotation **124** of the driver) is less when the driver is in its final position (see FIG. 2) than in its initial position (see FIG. 1). The axial force produced in the connecting link **120** is transmitted to the head-rest **74** via the mounting linkage, with the toggle effect occuring between the upright sitting position illustrated in FIG. 1 and a tilted position in advance of the intermediate, tilted sitting position illustrated in FIG. 2.

By employing this toggle effect in the illustrative double-movement type of chair, the head-rest **74** is brought to the extended head-supporting position relative to the back-rest **20** during the first portion of the first phase of the chair movement and in advance of the arrival of the chair at the intermediate, tilted sitting position illustrated in FIG. 2. This may be appreciated by noting the relative position of the toggle links and the pivots **124**, **122**, **128** in the intermediate, tilted sitting position of FIG. 2 wherein the toggle links are somewhat past the dead-center position, with the intermediate or knee pivot **122** having moved through the dead center position relative to the pivots **124**, **128**. This is indicative of the fact that the toggle action began to accur at some time prior to the arrival of the chair at the intermediate, tilted sitting position, for the chair occupant.

The head-rest and control arrangement is such that the head-rest remains in a substantially stationary extended head-supporting position relative to the back-rest during the second phase of the chair movement, as may be appreciated by progressively comparing FIGS. 2 and 3. This is achieved by mounting the actuating link **102** with the pivotal mount **104** located such that the pivotal connection **26** of the rear guiding link **22** to the back-rest (when the rear guiding link **22** is in the relatively stationary position which it assumes at the end of the first phase of the chair movement) is coaxial with the pivotal mount, it being recalled that the pivot **26** serves as a substantially stationary back-rest pivot during the second phase of the chair movement. As seen best in FIG. 4, the pivotal connection **26** to the adjacent side of the back-rest **20** moves into a position coaxially and outwardly of the pivotal mount **104** for the actuating link **102** at the end of the first phase of the chair movement. Analysis of the head-rest and control arrangement for this general type of double movement chair indicates that the actuating of the head-rest is produced by the relative motion between the back-rest pivot (e.g. pivot **26**) and the pivotal mount (e.g. **104**) of the head-rest control linkage on the chair frame or support. Since there is no relative movement of these pivots during the second phase of the chair movement in that the pivot **26** moves into a coaxial position relative to the pivotal mount **104**, the head-rest **74** remains substantially stationary relative to the back-rest during the second phase of the chair movement.

In actual use as the chair occupant leans against the back-rest to initiate the first phase of the reclining movement, the seat and back-rest are respectively guided to maintain the required angular relationship between the

seat and back-rest during the first phase of the chair movement, with the back-rest pivot **26** for the second motion phase moving relative to the pivot **104** of the head-rest **74**, with the actuating link **102** turning in the clockwise direction about the pivotal mount **104** in the support and with the link **108** turning in the counterclockwise direction about the pivotal mount **116** on the back-rest **20**. The toggle linkage is operated such that the effective lever arm of the driver is less in the intermediate, tilted sitting position of FIG. 2, with the knee pivot **122** moving through and past a dead center position relative to the pivots **124**, **128**. The actuating links **102**, **108** and the toggle linkage achieve the extension of the head-rest mounting linkage, with the head-rest **74** moving upwardly relative to the back-rest and then forwardly to the extended position illustrated in FIG. 2. During the second phase of the chair movement, the head-rest control receives no actuating force and the head-rest **74** remains substantially stationary and in the required head-supporting position until such time as the chair is returned to the intermediate, tilted sitting position. At such time, and in response to a downward pressure on the leg-rest **30** and a corresponding return of the chair to the upright sitting position, the head-rest is again retracted to the stored position illustrated in FIG. 1.

FIGS. 5–7 illustrate a reclining chair **210** of the two-position type (that is, having a rigidly connected seat and back-rest), which also incorporates the improved head-rest and control of the present invention.

The reclining chair **210** comprises a support or chair frame including opposite side walls **212** and **214** joined together by cross braces **216***a*, **216***b* and **216***c*. A body-supporting unit **217** including a rigidly-formed seat **218** and back-rest **220** is movably mounted on the chair frame by a pair of spaced guiding links **221** and **223** mounted on a support bar **225** which in turn is pivotally mounted at its rear end on the chair frame by a pivot **226**. The rear guiding link **221** is mounted on the bottom of seat **218** by a pivot **227** and is connected intermediate its ends to the support bar **225** by a pivot **229**. The front guiding link **223** is mounted on the bottom of the seat by a pivot **231** located forwardly of the pivot **227**. The lower end of the link **223** is connected to the support bar **225** by a pivot **233**.

The chair also includes a leg-rest **230** which is mounted for movement from a stored positon beneath the forward end of the seat **218**, as shown in FIG. 5, to the elevated positions shown in FIGS. 6 and 7. The leg-rest **230** is supported by the leg-rest linkage **235** which is carried by the forward end of the support bar **225**. The leg-rest linkage **235** includes a pair of links **256** and **264** which are connected at spaced points to the leg-rest **230** by respective pivots **260** and **268**. At its opposite end the link **264** is connected to the end of a link **242** by a pivot **266**, and at its opposite end the link **256** is connected to a link **252** by a pivot **258**. The support bar **225** extends forwardly from the pivot **226**, and to this forwardly-extending portion the links **242** and **252** are connected at spaced points by respective pivots **244** and **254**.

The rear guiding link **221** extends downwardly below the pivot **229** and at its free end is connected to a controlling link **237** by a pivot **239**. The opposite end of the controlling link **237** is connected to an intermediate portion of the link **252** by a pivot **241**. The links **242** and **256** cross each other and are connected at their crossing over point by a pivot **262**.

As shown in FIG. 5, the support bar **225** is normally maintained in a horizontal position and rests upon the cross bar **216***b* at a point to the rear of the pivot **233**. To bring the body-supporting unit **217** from its upright sitting position of FIG. 5 to the intermediate, tilted sitting position of FIG. 6, the user shifts his weight rearwardly and applies rearward pressure to the back-rest **220**. This causes the body-supporting unit **217** to move rearwardly, the guiding links **221** and **223** pivoting rearwardly on the stationary support bar **225** for this purpose. The guiding links carry the body-supporting unit **217** in a compound rearward movement in which the forward end of the seat **218** is guided in a substantially horizontal rearward path by the front guiding link **223** and the rear end of the seat is guided in a rearward and downward path by the rear guiding link **221**. In the intermediate, tilted sitting position, the front guiding link **223** engages a stop member **243** which is rigidly fixed to the support bar **225**, the stop member **243** preventing further pivoting movement of the front guiding link **223** and defining the limit of the intermediate, tilted sitting position.

As the upper portion of the rear guiding link **221** pivots rearwardly about pivot **229** in moving toward the intermediate position, the lower portion of said link **221** pivots forwardly, moving the controlling link **237** forwardly and causing said controlling link to raise the leg-rest linkage **235** until the leg-rest **230** has reached its extended position of FIG. 6.

If the occupant in the intermediate, tilted sitting position of the chair now wishes to move to a fully reclined position, he applies further rearward pressure upon the backrest **220**. However, the front guiding link **223** is now locked from further pivoting movement on the support bar **225** by engagement with the stop **243**, and the body-supporting unit **217** is thus prevented from moving rearwardly relative to said support bar **225**. The body-supporting unit **217** is thus now required to pivot about the single pivot point **226**. Thus, the body-supporting unit **217** maintains a fixed relationship to the support bar **225** and the entire unit and linkage structure pivots as a unit about the pivot **226**. Since the rear guiding link **221** maintains its inclined position relative to the support bar **225**, the leg-rest linkage is maintained in its extended position and the leg-rest continues to be positioned at a point forwardly and at the level of the front of the seat.

In accordance with the invention herein, a headrest **274** is disposed in a stored or retracted position within the upper rear corner of the back-rest **220**, as shown in FIG. 5, with its upper face substantially flush with the upper surface of the back-rest. The head-rest **274** is mounted by a mounting linkage similar to that illustrated in connection with the embodiment of FIGS. 1–4, and including a primary link **278** connected at its upper end by pivot **284** to a connecting link **282** which in turn has a pivotal connection **280** to a bracket **286** fixed to the head-rest **274**, and a secondary mounting link **288** connected at its upper end by pivot **290** to one end of a connecting link **292** which has a pivotal connection **294** at its other end to the bracket **286**. The connecting link **292** crosses over the primary mounting link **278** and has a pivotal connection **296** thereto, providing an extensible mounting linkage for the head-rest **274** consisting of links **278**, **282**, **288** and **292**.

The mounting linkage for the head-rest **274** is engaged by a guide means in the form of an elongated guide plate **298** formed with a guide slot **298***a* affixed to the back-rest **220**, with a pin **300** carried by the primary mounting link **278** and extending into the slot **298***a*.

The head-rest mounting linkage is operated by an actuating mechanism or linkage which includes an actuating and guiding link **308** which is pivotally connected by pivots **312**, **314** to the respective primary and secondary mounting links **278**, **288** and is connected by pivot **316** to the back-rest **220**. The actuating mechanism also includes an actuating link **320** which has a pivotal mount **226** concentric with the pivotal mount of the support bar **225** and is connected to the guiding link **308** by pivot **328**.

When the chair **210** is brought to its intermediate, tilted sitting position of FIG. 6, the rear portion of the body-supporting unit **217** is moved rearwardly and downwardly in the compound movement previously described, as determined by the guiding links **221** and **223**. This movement carries the link **308** downwardly relative to the actuating link **320** which is mounted on the fixed pivot **226**.

The actuating link **320** turns rearwardly about pivot **226** to accommodate the rearward movement of link **308**, but opposes the downward movement thereof at point **328** and in effect pushes upwardly on the link **308** at this point. This causes the link **308** to turn upward or in a counter-clockwise direction as viewed in FIGS. 5 and 6, about its pivotal mount **316** on the back-rest **220**. The upward movement of link **308** brings the head-rest to the extended head-supporting position relative to the back-rest **220** in the intermediate position of the body-supporting unit **217** shown in FIG. 6, through the extensible head-rest mounting linkage **278, 282, 288** and **292**.

The head-rest **274** remains in a substantially stationary extended head-supporting position relative to the back-rest during the second phase of reclining movement, as shown in FIG. 7. This is achieved by mounting the actuating link **320** concentrically with the support bar **225** at fixed pivot **226**. Since the fixed pivot **226** serves as a stationary pivot for the support bar **225** and the body-supporting unit **217** carried thereby, during the second motion phase, as well as the pivot for the actuating link **320** and the connected head-rest linkage mounted on the back-rest **220**, it will be appreciated that the actuating link **320** will exert no further turning force on the link **308**. That is to say, the link **308** carried by the back-rest **220**, and the actuating link **320** both turn about the same point defined by the common pivot **226** as the body-supporting unit moves from the intermediate position of FIG. 6 to the fully tilted position of FIG. 7. During this second motion phase, therefore, the head-rest **274** remains stationary in its extended position relative to the back-rest **220** without further actuation and merely follows the rearward and downward movement of the back-rest as a rigid extension thereof.

Although the head-rest actuating and mounting linkage of the invention has been shown, by way of example, incorporated in representative chairs of the double-movement and multiple-position types, it will be appreciated that the invention is intended and devised to be incorporated in any double-movement or multiple-position chair having two distinct paths of movement, the second of which constitutes a pivotal movement of the back-rest around a relatively stationary point. The invention can thus be applied to many different chair structures of this type, for example, those disclosed in the issued patents and pending applications of applicant.

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.

I claim:

1. In a reclining chair of the type comprising a support, body-supporting means including a seat and back-rest adapted to be movably mounted on said support for inclining and reclining movement respectively, and coordinating means operatively connected to said body-supporting means and to said support and mounting said body-supporting means for movement through a first motion phase into an intermediate reclining position and through a second motion phase into a further reclining position, said coordinating means including first guiding means for guiding the back-rest in a first path of motion in the first motion phase, second guiding means providing a stationary pivotal mount for the back-rest in the second motion phase for movement of the back-rest in a second, different path of motion, and means for blocking movement of said first guiding means at the end of said first motion phase such that further movement of said back-rest in said second motion phase is about said stationary pivotal mount; the improvement comprising a head-rest, means operatively connected to and mounting said head-rest for movement to an extended head-supporting position relative to said back-rest, and actuating means operatively connected to said head-rest mounting means and having a stationary pivotal connection to said support and operable in response to movement of said back-rest relative to said stationary pivotal connection during the first motion phase for moving said head-rest to said extended head-supporting position, said stationary pivotal connection being positioned in coaxial alignment with said stationary pivotal mount of the back-rest when the latter serves as said back-rest pivot during said second motion phase, whereby said back-rest, said guiding means, said head-rest and said actuating means turn about a common center of rotation during the second motion phase without further actuation of said head-rest.

2. A reclining chair comprising a support, body-supporting means including a seat and a back-rest mounted on said support, a head-rest, means mounting the head-rest on said back-rest for movement between a retracted and extended position, actuating means for said head-rest having a fixed pivotal mount on said support and operatively connected to said head-rest mounting means, first guide means guiding said back-rest and the head-rest and head-rest mounting means carried thereby in a first path of movement relative to the fixed pivotal mount of said head-rest actuating means in a first motion phase, whereby the actuating means moves the head-rest to its extended position, blocking means for halting movement of said back-rest at the end of said first motion phase with the body-supporting means in an intermediate reclining position and the head-rest in extended position, and second guide means providing a stationary pivotal center for said back-rest in a second motion phase, said stationary pivotal center being coaxial with said fixed pivotal mount of the head-rest actuating means, the body-supporting means moving to a fully reclined position in said second motion phase with the back-rest, head-rest, head-rest mounting means and head-rest actuating means all turning in unison about the coaxial stationary pivotal center and fixed pivotal mount, and the head-rest thus remaining in said extended position relative to the back-rest as the latter moves to a further reclining position.

3. A reclining chair comprising a support, a body-supporting unit including a rigidly-formed seat and a back-rest mounted on said support, a head-rest, a linkage mounting the head-rest on said back-rest for movement between retracted and extended positions, an actuating link for said head-rest having a fixed pivotal mount on said support and operatively connected to said head-rest mounting linkage, a support bar having a stationary pivotal mount on the support, means holding said support bar in a stationary position, guiding means mounting the body supporting unit on said support bar for movement in a downward and rearward path toward the fixed pivotal mount of said head-rest actuating link in a first motion phase, whereby the actuating link moves the head-rest to its extended position, blocking means for halting movement of said guide means at the end of said first motion phase with the body-supporting unit in an intermediate, tilted sitting position and the head-rest in extended position, said support bar turning about its stationary pivotal mount in a second motion phase to carry the body-supporting unit and the head-rest and mounting linkage carried thereby in a pivotal movement about said stationary pivotal mount, said fixed pivotal mount of the actuating link being coaxial with said stationary pivotal mount of the support bar, whereby the body-supporting unit moves to a fully reclined position in said second motion phase with the head-rest remaining in said extended position relative to the back-rest.

4. A reclining chair according to claim 3 in which said guiding means comprises a pair of links mounted at spaced points on said support bar and pivotally connected to spaced points on said body-supporting unit.

5. In a reclining chair of the type comprising a support, body-supporting means including a seat and back-rest

adapted to be movably mounted on said support for inclining and reclining movement respectively, and coordinating means operatively connected to said body-supporting means and to said support and mounting said body-supporting means for movement through a first motion phase into an intermediate reclining position and through a second motion phase into a further reclining position, said coordinating means including a movable pivotal connection to said back-rest, means mounting said pivotal connection for movement relative to said support during said first motion phase, and means for blocking movement of said pivotal connection during said second motion phase and providing a stationary back-rest pivot about which said back-rest is reclined during said second motion phase, the improvement comprising a head-rest, guiding means operatively connected to and mounting said head-rest for movement from a retracted position to an extended head-supporting position relative to said back-rest, and actuating means operatively connected to said head-rest and having a fixed pivotal mount on said support and operable in response to movement of said movable pivotal connection relative to said fixed pivotal mount for moving said head-rest to said extended head-supporting position in response to said first motion phase, said movable pivotal connection being positioned to move into coaxial alignment with said fixed pivotal mount when the latter serves as said back-rest pivot during said second motion phase, whereby said back-rest, said guiding means, said head-rest and said actuating means turn about a common center of rotation during the second motion phase without further actuation of said head-rest.

6. A reclining chair of the double movement type comprising a support, body-supporting means including a seat and back-rest adapted to be movably mounted on said support for inclining and reclining movement respectively, coordinating means operatively connected to said body-supporting means and to said support and mounting said body-supporting means for movement through a first motion phase into an intermediate, tilted sitting position during which there is substantially no angular displacement between said seat and back-rest and through a second motion phase into a full reclining position during which the angle between said seat and back-rest increases, said coordinating means including a movable pivotal connection to said back-rest, means mounting said pivotal connection for movement relative to said support during said first motion phase, and means for blocking movement of said pivotal connection during said second motion phase such that said pivotal connection serves as a stationary back-rest pivot about which said back-rest is reclined during said second motion phase, a head-rest, means operatively connected to and mounting said head-rest for movement from a retracted position to an extended head-supporting position relative to said back-rest, and actuating means operatively connected to said head-rest and having a fixed pivotal mount on said support and operable in response to movement of said movable pivotal connection relative to said fixed pivotal mount for moving said head-rest to said extended head-supporting position in response to said first motion phase, said pivotal connection being positioned to be coaxial with said movable pivotal connection when the latter is blocked from movement and serves as said stationary back-rest pivot during said second motion phase, whereby said back-rest, said guiding means, said head-rest and said actuating means turn about a common center of rotation during the second motion phase without further actuation of said head-rest.

7. In a reclining chair of the double movement type, a support, body-supporting means including a seat and back-rest, a main control linkage operatively connected to said body-supporting means for establishing a first motion phase wherein said body-supporting means moves rearwardly with substantially no angular change between said seat and back-rest and a second motion phase wherein said body-supporting means moves rearwardly with an increasing angular change between said seat and back-rest, said main control linkage including at least one pivotal connection to said back-rest movable relative to said support during said first motion phase and substantially stationary during said second motion phase, the improvement comprising a head-rest normally disposed in a stored position within the outline of said back-rest and contiguous to the upper end thereof, and control means operatively connected to said head-rest for moving said head-rest to an extended position relative to the upper end of said back-rest in response to rearward movement of said body-supporting means during said first motion phase, said control means including guiding means operatively connected to said head-rest and mounting said head-rest for movement along a prescribed path relating to said back-rest into said extended position, and actuating means operatively connected to said guiding means and to said support and controlled by said back-rest for moving said head-rest into said extended position in response to said reclining movement, said actuating means including at least one actuating link pivotally mounted on said support at a fixed pivot spaced from said one pivotal connection of said back-rest such that during said first motion phase the relative movement between said one pivotal connection and said fixed pivot is effective to actuate said head-rest, said actuating means including at a further pair of links pivotally connected together and arranged to provide a toggle action during said first motion phase.

8. In a chair having a seat and back-rest mounted on a support for movement to an intermediate position and further movement to a fully-reclined position, a head-rest, and guiding means mounting the head-rest on the back-rest for movement between a retracted position and an extended position; the combination of back-rest mounting means providing a movable pivotal mount for the back-rest on the support and head-rest actuating means connecting the head-rest guiding means to the support at a fixed pivot, said movable pivot moving toward said fixed pivot when the back-rest is moved to the intermediate position, and blocking means engaging said back-rest mounting means at said intermediate position and positioned to retard further movement of said back-rest movable pivotal mount when the latter has moved into coaxial alignment with said fixed fixed pivot, whereby said back-rest and said head-rest actuating means turn about the same fixed center of rotation without further actuation of the head-rest as the back-rest moves from said intermediate position to said fully-reclined position.

9. A chair according to claim 8 in which said head-rest actuating means comprises an actuating link pivotally mounted on said support frame at said fixed pivot and pivotally connected to said head-rest guiding means.

10. A chair according to claim 9 in which said back-rest mounting means comprises a guiding link pivotally mounted on the support frame and connected to the back-rest at said movable pivotal mount, said guiding link moving rearwardly to carry the back-rest to the intermediate position and engaging said blocking means at the intermediate position with the movable pivotal mount located in co-axial alignment with the fixed pivotal mount of the actuating link.

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