

[54] **RECLINING CHAIR WITH MOVABLE HEADREST**

[76] Inventor: **Peter S. Fletcher**, 200 N.W. 15th St., Delray Beach, Fla. 33444

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[51] Int. Cl. **A47c 1/02**

[58] Field of Search 297/61, 83, 84, 112, 114, 297/410

[56] **References Cited**
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2,947,352	8/1960	Schliephacke	297/61
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3,140,117 7/1964 Fletcher..... 297/61

Primary Examiner—Paul R. Gilliam
Assistant Examiner—William E. Lyddane
Attorney, Agent, or Firm—Amster & Rothstein

[57] **ABSTRACT**

A reclining chair with a headrest actuation mechanism in which movement of the backrest of the chair causes extension of the headrest from a retracted position to a head-supporting position. Geometric perimeters are set for the location of the driver lever and actuating link in the headrest actuating mechanism which enable that mechanism to function with improved operation, while, at the same time allowing the chair designer to construct a chair of reduced bulk and more pleasing aesthetics.

9 Claims, 9 Drawing Figures

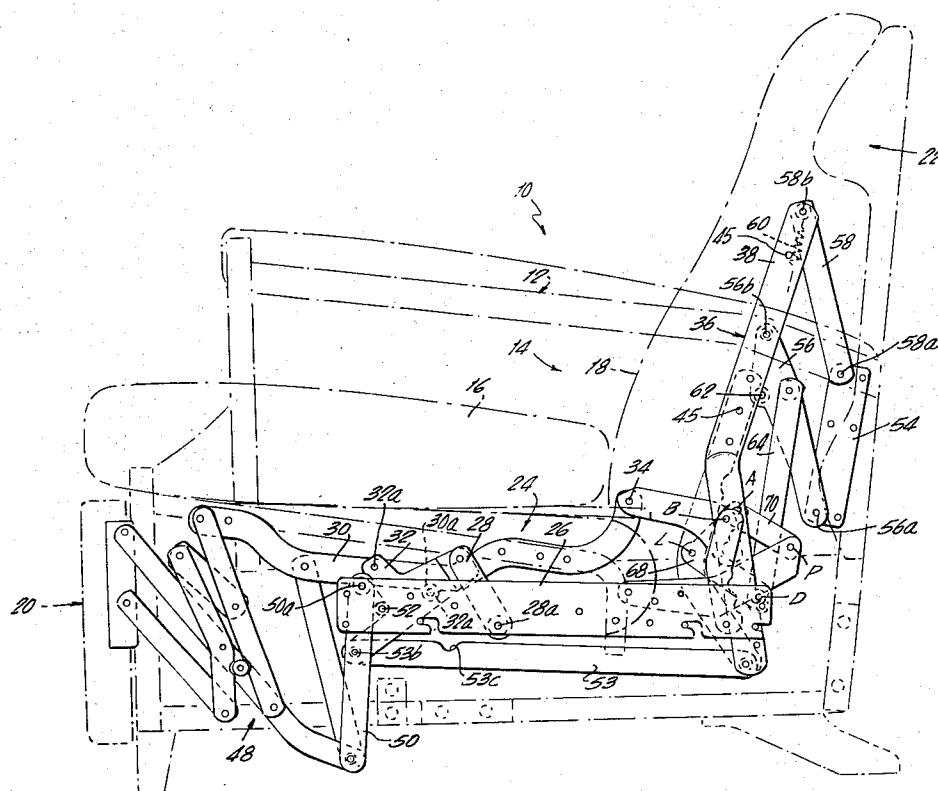


FIG. 1

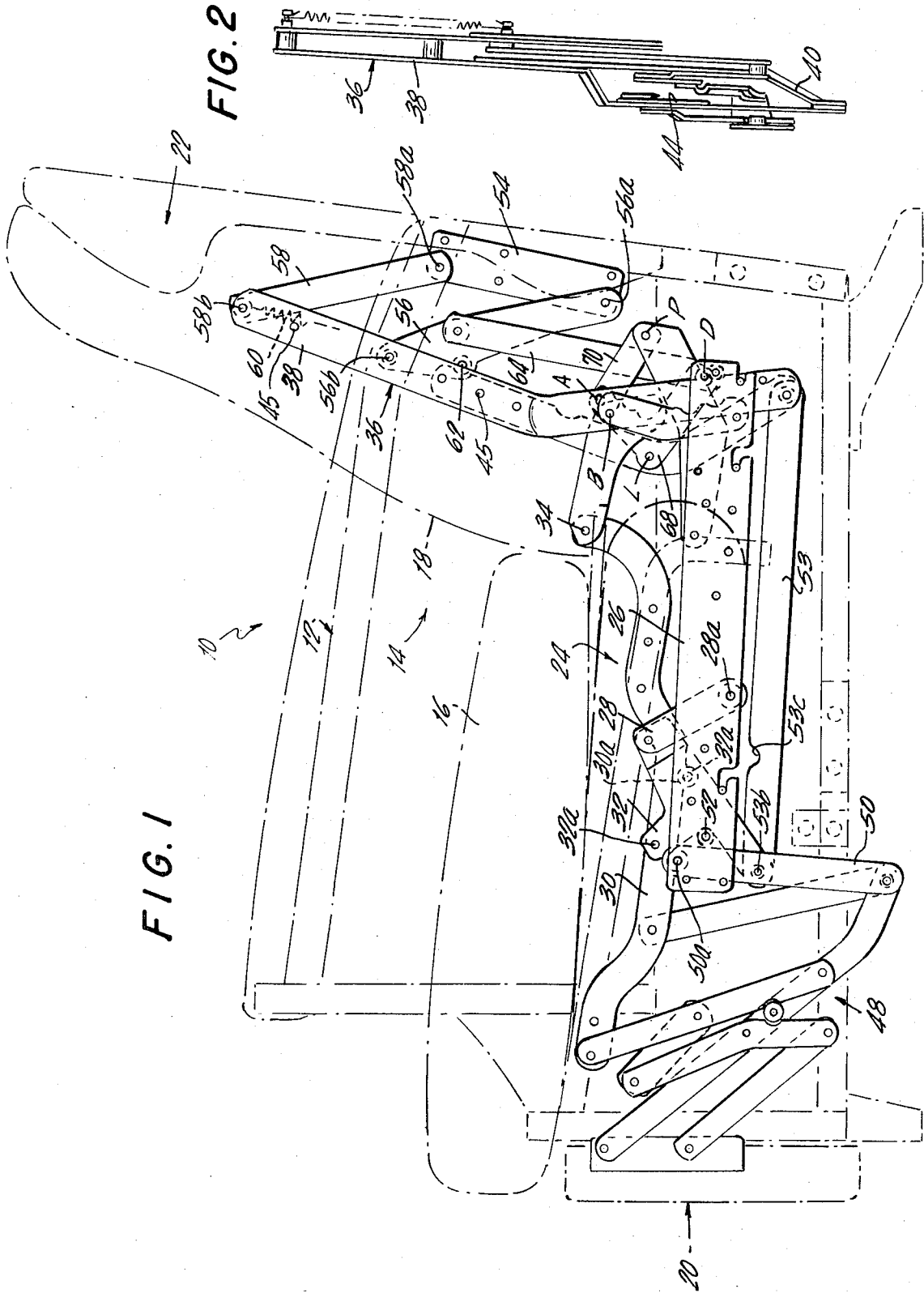


FIG. 2

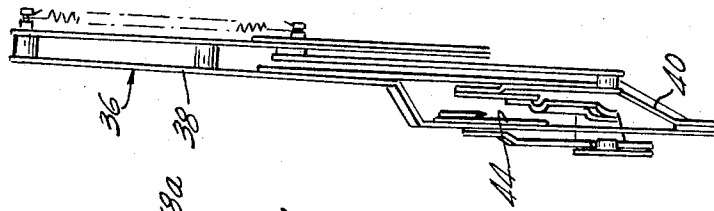


FIG. 3A

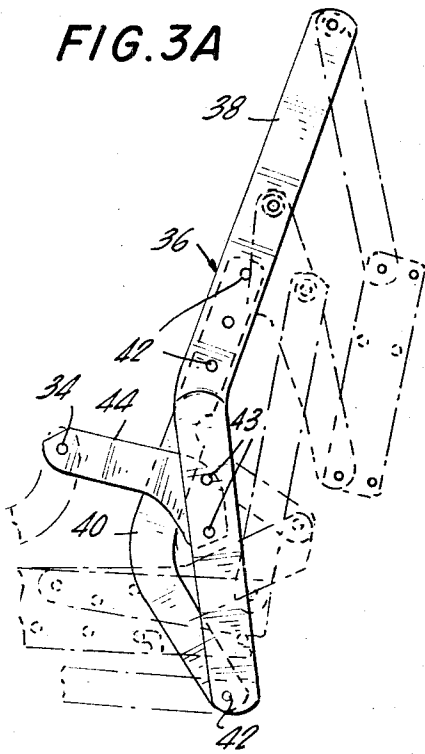


FIG. 3B

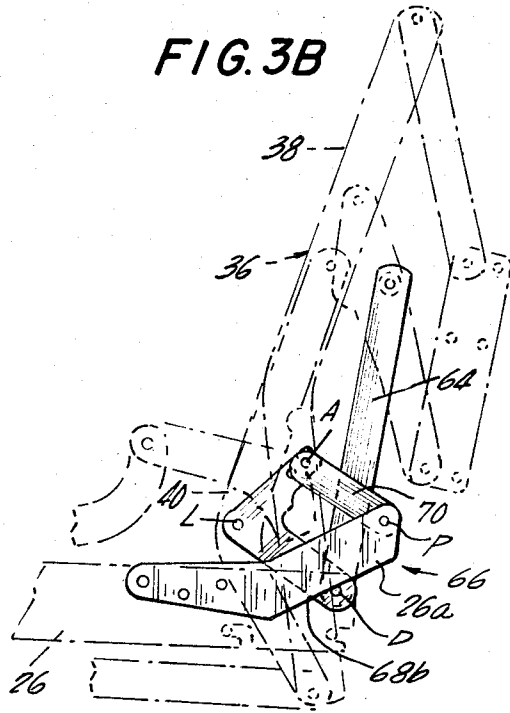
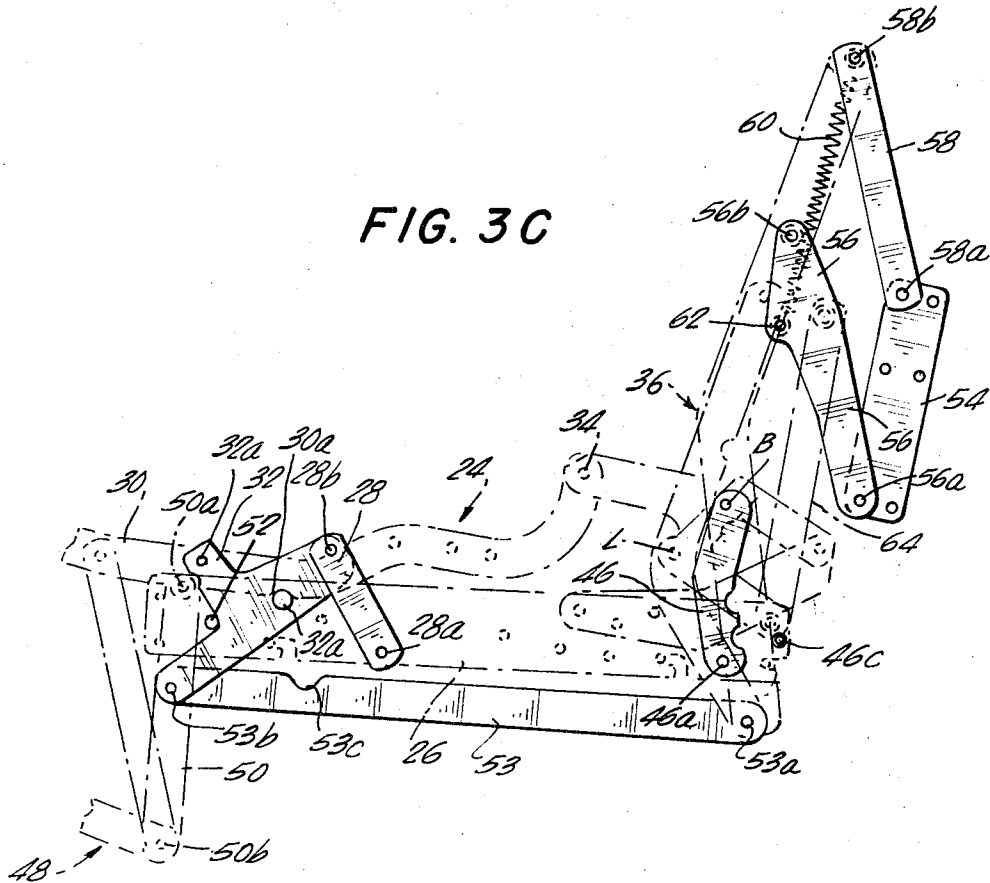
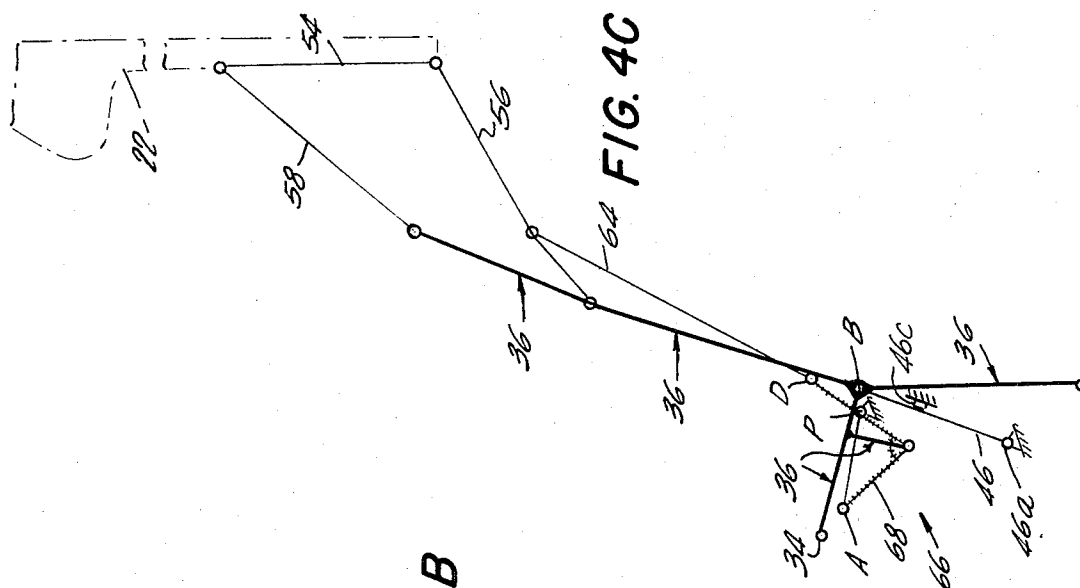
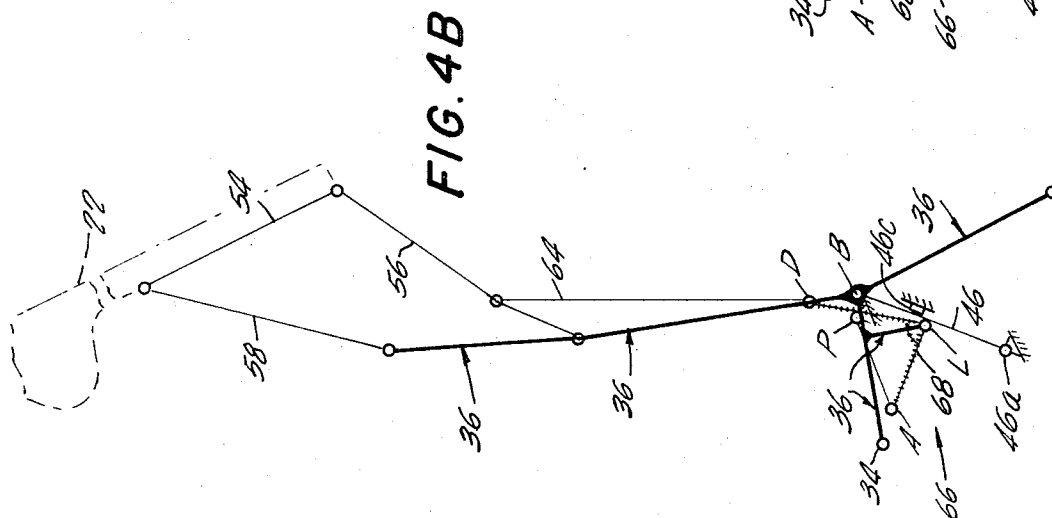
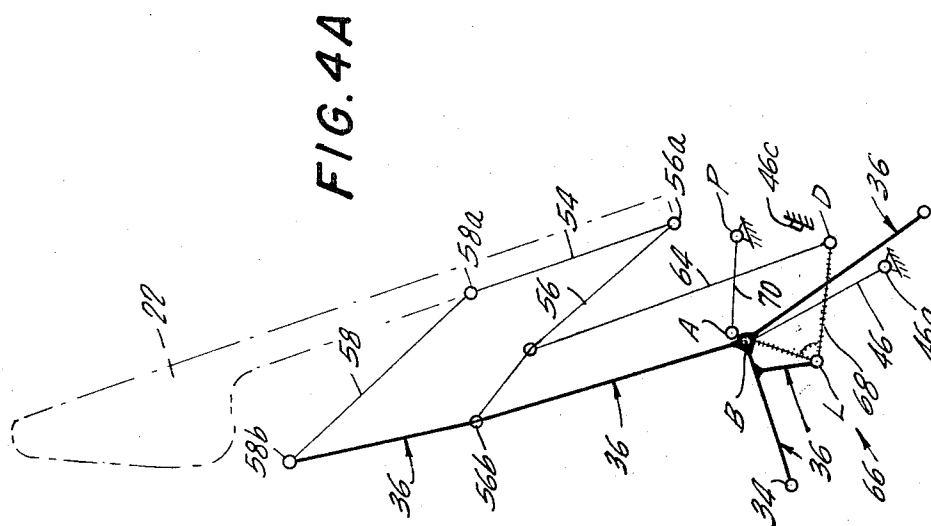


FIG. 3C





RECLINING CHAIR WITH MOVABLE HEADREST

This invention relates generally to automatically operating reclining chairs and specifically to a reclining chair with a headrest which is mounted for movement relative to the backrest in response to movement of the backrest relative to the stationary frame or base of the chair. The headrest is automatically projected from a position behind the backrest to a head-supporting position as the chair is reclined from its upright sitting position.

The chair, in accordance with the present invention, is of the double movement or three position type of chair which has either a rigidly interconnected seat and backrest or a seat and backrest which operate with pivotal and coordinated movement between them. Such chairs have a first movement phase in which there is a rearward, translational movement with a slight tilting of the seat and the backrest during which movement, the legrest of the chair is elevated. This first movement phase moves the chair from its upright sitting position to its intermediate, tilted sitting position which latter position has come to be known as the TV position. Such chairs further have a second movement phase characterized by a pivotal action of the backrest, in which the backrest further inclines. At the end of the second movement phase, the chair has reached its fully reclined position. The present invention relates to an advantageous means by which a headrest may be mounted and actuated in a chair of this type.

In my U.S. Pat. No. 3,140,117, I show the provision of a headrest in a chair of the double movement type. In that patent, I employed a headrest actuating link which was used to actuate the headrest linkage to push it from its concealed position behind the backrest to its headsupporting position in response to movement of the backrest in the first movement phase. The actuating link in that patent had a center which became coaxial with the pivotal center of the backrest at the end of the first movement phase. During the first movement phase, the translation of the backrest was used to push against the actuating link so that it could push on the headrest mounting means to actuate the headrest. However, during the second movement phase, because of the coaxial position of the pivotal center of the actuating link and the pivotal center for the backrest movement, no further actuation of the headrest occurred during the second movement phase. By this structure, the headrest was maintained in its head-supporting position relative to the backrest during the second movement phase.

The invention described herein is an improvement on the aforementioned patent. I have discovered that the pivotal center of the actuating link does not have to be coincident with the pivotal center of the backrest during the second movement phase and I have developed an alternative structure which provides some special advantages. Whereas my prior patent teaches the use of a coaxial arrangement, the invention disclosed herein shows that if certain limitations are maintained, a non-coaxial arrangement provides unexpected benefits without sacrificing any of the advantages of my prior invention. Specifically, in accordance with the present invention, a structure can be arranged in which there is essentially no headrest movement during the second movement phase or, if desired, a degree of adjustment of the headrest can be designed into the chair.

Some variation may be desired for the relative position of the headrest to the backrest during the second movement phase. For example, a superior product may be produced with adjustments in the headrest position as the backrest progresses towards its fully reclined position. This may be desirable, for example, to accommodate changes in gravitational forces of the chair occupant on the chair upholstery as the attitude of the chair occupant changes.

As will be described below, a construction in accordance with the present invention can be made in a chair with a fixed seat and backrest or one in which there is relative movement between the seat and backrest.

In order to accomplish the goals of the present invention, the actuating pivot of the headrest actuating means must be spaced from the pivotal center of rotation of the backrest during the second movement phase and must be in the general vicinity of a line defined as the P Line. The P Line is a line which passes through the effective center of rotation of the backrest during the second movement phase and bisects the angle of the rotation of the backrest as determined by specific points located on the backrest in the TV position and the fully-reclined position respectively. The headrest actuating link in a structure in accordance with the present invention is connected to a driver lever mounted on the backrest which is placed in a position on the backrest which is significantly more forward than the position of the driver lever disclosed in my U.S. Pat. No. 3,140,117. The center of rotation of this lever on the backrest is determined by another bisect line. This second bisect line is a perpendicular bisector of a line between the actuating pivot point (the point at which the actuating link is pivotally connected to the driver lever), when that point is in the TV position and the location of that point projected onto the backrest in the TV position with the backrest then moved back through the first movement phase to the upright sitting position. By following these geometric perimeters, the designer of a reclining chair is able to achieve the results of essentially no movement or slight adjustable movement as discussed above and, advantageously, is also able to construct a headrest actuating mechanism which is more deeply hidden within the body of the chair. This enables the designer to make a smaller chair of more pleasing aesthetic configuration while, at the same time, offering improved operation.

The above brief description, as well as further objects, advantages and features of the invention, will be best understood by reference to the following detailed description of one illustrative embodiment of the invention when taken in conjunction with the accompanying drawings wherein:

FIG. 1 is a side elevational view of a reclining chair constructed in accordance with the present invention wherein the chair frame and upholstery is shown in phantom lines and the metal linkage or hardware is shown in full line configuration;

FIG. 2 is a rear elevational view looking at the reclining chair linkage of FIG. 1 from the righthand side of FIG. 1;

FIGS. 3A, 3B and 3C are partial elevational views of the linkage shown in FIG. 1 with portions of the linkage in each of the drawings shown in full line with the remaining portions shown in phantom. Specifically, in FIG. 3A the link assembly which is rigidly connected to the backrest is shown in full line; in FIG. 3B, there is

shown in full line, the headrest actuating linkage, the connecting link to the headrest mounting means and the portion of the stationary arm rail to which the actuating linkage is attached; and in FIG. 3C, there is shown in full line configuration, the links which support the seat and backrest during the first movement phase and also the headrest mounting and guiding links;

FIGS. 4A, 4B and 4C are schematic representations of that portion of the chair linkage which coordinates movement of the backrest and headrest. Specifically, FIG. 4A schematically shows the position of the relevant links in the upright sitting position of the chair, FIG. 4B is a schematic representation of the position of the relevant links in the TV position of the chair; and FIG. 4C is a schematic representation of the position of the relevant links in the fully reclined position of the chair; and

FIG. 5 is a geometric diagram which illustrates the geometric criteria which must be substantially met in order to produce a chair in accordance with the present invention.

Now, referring specifically to the drawings, there is shown in FIG. 1 a reclining chair generally designated by the numeral 10 which has a base or arm frame 12 which forms a support for the movable members of the chair. The movable members include a body-supporting unit 14 which is made up of a seat 16 and backrest 18 and further include the legrest 20 and headrest 22. In a generally well understood manner, the body-supporting unit 14 is mounted within the arm frame or base 12 by a mechanism in the form of metal hardware which comprises a chair linkage generally designated by the numeral 24. There are two pairs of linkages 24, one on each side of the chair 10 and the linkages comprise a plurality of links which mount the seat 16 and backrest 18 on the arm frame and which, in turn, mount the legrest 20 on the body-supporting unit 14 and the headrest 22 on the backrest 18.

The details of the functioning of the mechanism mounting the body-supporting unit and the legrest in this illustrative embodiment are known in the art and are more fully described in my prior U.S. Pat. No. 3,393,007. For purposes of the present disclosure, the following is a brief description of that linkage. An arm plate 26 forms a foundation of the linkage 24 and is rigidly secured to the base or arm frame 12. The body-supporting unit is mounted by means of a front guide link 28 on its pivotal mount 28a on the arm plate 26 which is, in turn, pivoted to a seat bracket 30 through a seat lever 32. As will be seen, the seat bracket 30 is pivotally connected to the backrest at a seat-backrest pivot 34. The backrest portion of the linkage hardware 24 is, in this illustrative description, a backrest bracket generally designated by the number 36 in which is made from a plurality of rigidly interconnected pieces of metal. Specifically, and as best seen in FIG. 3A, there is a long generally boomerang shaped strap 38, a second, smaller boomerang-shaped strap 40 which is attached at its upper and lower ends to the first strap 38 by rivets 42, a seat extension rigidly attached to the strap 38 with rivets 43 which extends forwardly to and is pivotally connected to the seat 16 at the seat backrest pivot 34. The straps 38, 40 are shaped to provide space between them as viewed from the front or rear of the chair as may be seen in FIG. 2. The frame of the backrest 18 is rigidly secured to the backrest bracket 36 by conventional means such as the bolts 45.

Referring to FIG. 3C, a rear guide link 46 is pivotally mounted on the arm plate 26 at a pivotal mount 46A and is pivotally secured to the backrest bracket 36, and specifically to the first boomerang shaped strap 38, at backrest pivot B. During the first movement phase, the body-supporting unit 14 moves rearwardly and tilts somewhat by the combined action of the front guide link 28 rotating about its pivotal mount 28A and the rear guide link 46 rotating about its pivotal mount 46A. At the same time, the headrest 22 is extended from its retracted to its extended head-supporting position in a manner which will be described in detail below. In addition to this, the legrest 20, by its legrest mounting linkage 48, is extended to a leg-supporting position. Specifically, the legrest actuating link 50 is pivotally connected to the arm plate 26 at pivot 50A and is pivoted to the legrest mounting linkage 48 at the actuating pivot 50B. Since the legrest mounting linkage 48 is of the lazy tong type and is mounted on the seat plate 30, as the seat plate 30 moves rearwardly in the first movement phase, the actuating link 50 acts to propel the legrest mounting linkage 48 forwardly and open it up such that the legrest 20 is moved into its elevated leg-supporting position. This arrangement is well known in the art and is shown and described in my prior U.S. Pat. No. 3,092,416.

It will be appreciated that the seat lever 32 has a sequencing function in combination with a sequencing pin 52 which is rigidly mounted on the arm plate 26. Specifically, the forward end of the seat lever 32 is engaged under the sequencing pin 52 until the first movement phase has been substantially completed thereby precluding the seat 16 from moving upwardly until the first movement phase has been completed. When the first movement phase has been completed, the front end of the seat lever 32 is rearwardly of the sequencing pin 52 and thus the chair may be moved in its second movement phase.

Upon the completion of the first movement phase the rear guide link 46 engages the stop 46c and further movement of the backrest 18 constitutes pivotal movement around the backrest pivot B. The backrest pivot B constitutes a backrest center of rotation for the backrest 18 during the second movement phase; in this embodiment, that point is fixed in space, however, in other embodiments, there could be some movement of pivot B, as for example where the stop defining the end of the second movement phase is located at some point in the linkage other than at the backrest line 46, e.g., where the second movement stop is located in the leg rest linkage. The lower end of the backrest bracket 36 is pivotally connected to a connecting link 53 at pivot 53a which, in turn, is connected to the seat lever 32 at pivot 53b. Since the seat lever 32 has moved rearwardly relative to the sequencing pin 52 during the first movement phase, the force transmitted from the backrest 18 through the connecting link 53 causes the seat lever 52 to rotate in a clockwise direction about the pivot 28b thereby elevating the front of the seat 16. The stop 32a on the seat lever 32 and the locating notch 30a on the seat bracket 30 move away from each other during the second movement phase until the stop 32a meets the locating notch 53c on the connecting link 53 when the chair reaches its fully-reclined position. During the second movement phase, but the position of the legrest 20 remains substantially the same in that actuating link 50 while swinging upwardly, does not impart any signifi-

cant movement to the legrest mounting linkage 48 during that movement phase. Similarly, as will be described below, the headrest mounting and actuating linkage is so arranged and designed that the headrest 22 undergoes either no movement relative to the backrest during the second movement phase or only that degree of movement desired for adjusting the relationship between the headrest and the backrest as the combined headrest and backrest is tilted into the fully-reclined position.

Referring now to FIGS. 1, 3B and 3C, description will be made of the headrest mounting and actuating mechanisms incorporated in a chair in accordance with the present invention. The headrest 22 is mounted on a headrest bracket 54 which in turn is mounted on the first boomerang-shaped strap 38 of the backrest bracket 36 by means of two headrest guide links 56, 58. Specifically, link 56 is pivoted at the lower end of the headrest bracket 54 at pivot 56a and is pivoted to the strap 38 at pivot 56b. Link 58 is pivoted at the upper end of the headrest bracket 54 at pivot 58a and is pivoted to the upper end of the strap 38 at pivot 58b. It will be readily appreciated that links 54, 56 and 58 constitute the three movable links of a 4-bar linkage in which the backrest 18 and, in particular, the strap 38 is the stationary member. The linkage as shown in FIGS. 1, 3B and 3C is in the stored position of the headrest 22; when the links 56, 58 rotate upwardly about pivots 56b and 58b, the headrest 22 moves rearwardly out of a recess formed in the back of the backrest 18 and then upwardly into an extended head-supporting position. This will be best appreciated by comparing FIGS. 4A and 4B. A spring 60 is engaged between the pivot 58b and a pin 62 on the lower arm 56 to counter balance the forces from the weight of the headrest 22 which are at a maximum when the headrest 22 is in the middle of its movement from its collapsed to its extended position. As will be described in greater detail below, the 4-bar linkage mounting the headrest 22 is actuated through a headrest actuation connecting link 64.

Reference should now be made to FIGS. 1 and 3B for a description of a presently preferred embodiment of a headrest actuation mechanism as incorporated within a chair in accordance with the present invention. In the description below of FIG. 5, there will be set forth the theoretical criteria which determine the specific construction and limits of design for such a mechanism. The specific linkage shown in the other figures can be considered as illustrative of the concept of the present invention; that linkage is a successful, commercially exploited embodiment of the invention which has been tested by actual full scale commercial manufacture and sale by the furniture industry and use by the public.

The headrest actuating mechanism is generally designated by the numeral 66 and is interconnected between the arm plate 26 at its rigidly-extending bracket 26a and the backrest bracket 36 such that it can be activated by relative movement between the backrest 18 and the stationary base or arm frame 12 during the first movement phase of the chair. Specifically, a headrest driver lever 68 is pivotally connected at a lever pivot L which is carried by the lower boomerang strap 40 of the backrest bracket 36. The driver lever 68 is pivotally interconnected with a headrest actuating link 70 at an actuating pivot A at one end of the link 70, the other end of actuating link 70 being pivoted to the seat plate extension 26a at a base pivot P. The remaining pivot on

the driver lever 68 is designated in the drawings as the driver pivot D and is pivotally connected to the headrest actuation connecting link 64. It will be readily appreciated by studying FIG. 3B and by comparing FIGS. 4A and 4B, that during the first movement phase of the chair, the relative movement of the backrest bracket 36 with regard to the stationary arm frame 12 and, therefore, the arm plate 26 causes rotation of the driver lever 68 and transmits force and motion to the headrest 22 through the connecting link 64. As described above, the connecting link 64 moves upwardly, forcing the lower and upper headrest-mounting links 56 and 58 to rotate in a counterclockwise direction, as shown in the drawings, to raise the headrest 22 from the retracted position shown in FIGS. 1 and 4A to the extended position shown in FIG. 4B.

Contrary to the teachings in my U.S. Pat. No. 3,140,117, the base pivot P of the headrest actuating mechanism 66 in the chair 10 is not coincident with the center of rotation of the backrest during the second movement phase of the chair. In the aforementioned patent, it was taught that the headrest actuating mechanism could be used effectively if the actuating pivot were arranged to be coincident with the center of rotation of the backrest during the second movement phase, thereby producing relative actuation movement only during the first movement phase and no movement at all during the second movement phase because of the coincidence of the actuation pivot with the pivotal center of the backrest. In accordance with the present invention, however, and as will be more fully described below, it has been determined that there are other positions in which the actuation pivot can be located during the second phase, producing little or no headrest actuation movement or, alternatively and beneficially, producing slight movements which may be desired for increased comfort. Specifically, the backrest 18 of the chair 10 pivots during its second movement phase about the backrest pivot B at the upper end of the rear guide link 46. As will be appreciated, the rear guide link 46 engages a stop 46c on the arm plate 26 at the end of the first movement phase effectively making the rear guide link 46 stationary during the second movement phase. Thus, the backrest 18 and, of course, the backrest bracket 36 pivots about the then stationary backrest pivot point B during the second movement phase. As can be seen by comparing FIGS. 4A, 4B and 4C, however, the backrest pivot B and the base pivot P for the headrest actuating mechanism 66, are not coincident in the TV position of FIG. 4B or the fully reclined position of 4C and therefore are not in coincident arrangement during the second movement phase. In fact, those pivotal points are intentionally selected to be spaced from each other during the second movement phase. However, as can be appreciated by inspecting FIGS. 4B and 4C, there is little or no movement of the headrest relative to the backrest during the second movement phase. Incidentally, the linkage shown in FIGS. 4A, 4B and 4C are tilted somewhat in a counterclockwise direction (forwardly) as compared to the true horizontal as shown in FIG. 1; this is done only for convenience in fitting the drawing within the standard size while maintaining the same scale throughout all the drawings.

There follows a discussion of the specific geometric criteria which must be met in accordance with the present invention in order that the headrest actuating

mechanism will operate in the desired manner. Specifically, the criteria to be described below permits the headrest actuating mechanism 66 to advance the headrest from its retracted to its extended head-supporting position during the first movement phase and then to maintain the headrest in its extended position during the second movement phase with or without minor adjustments of the relative position of the headrest to the backrest during that second phase. In this discussion, reference must be made to FIG. 5 which should be considered in conjunction with the drawings previously described.

In FIG. 5 there is a schematic representation of the geometry of the headrest actuating mechanism 66 utilized in the reclining chair 10. For orientation purposes, it is seen that there is a rear guide link 46 which is mounted at a mounting pivot 46a on the base of the chair and rotates from its position in the upright sitting position of the chair, which is shown in solid line, to its TV position, which is shown by a dotted line and which is defined by stop 46c. At the upper end of the rear guide link 46 is the backrest pivot B which is labeled B_s for the setting position and B₂ which is the position of the backrest pivot throughout the second movement phase of the chair from the upright sitting position to the fully-reclined position. The phantom lines extending generally upwardly from the points B_s and B₂ to the points X_s, X_{TV} and X_R represent a single arbitrary line drawn on the backrest 18 from the pivot B to an arbitrary point X with the position of that line in the sitting position of the chair, the TV position and the fully-reclined position. The subscripts indicated for the various locations of the point X indicated the respective positions, as do the subscripts used throughout FIG. 5. For example, D_s indicates the location of the driver pivot D in the sitting position of the chair and D_{TV} indicates the location of that pivot point when the chair is in the TV position. One variation in this code must be pointed out and it relates to the notations relative to the position of the actuating pivot A. Actuating pivot A is indicated as A_s in the drawings in its location in the sitting position and is indicated by the notation A_{TV} in the TV position; a third location for A is shown and it is designated as A'_{TV-S} and this designation has special meaning. It indicates the location of the actuating pivot A when projected onto the backrest when the chair is in its TV position and with the backrest then moved backwardly through the first movement phase to the upright sitting position. In other words, the designation A'_{TV-S} is a true point in space which is defined by locating a point on the backrest when the backrest is in its TV position and then moving the backrest and that point into the upright sitting position of the backrest.

It will be appreciated that the backrest (and, therefore, the line B_X defined by the points B and X on the backrest) rotates around an effectively fixed center of rotation B through an angle θ during the second movement phase. Any point X on the backrest can follow one and only one arcuate path during such movement. This arc is illustrated as the arc between the points X_{TV} and X_R in FIG. 5. If the actuating pivot A is to produce no movement of the headrest actuating mechanism 66 during the second movement phase, then the actuating pivot must move with the backrest during this phase, describing an arc around the backrest pivot B and moving through the angle θ . Therefore, if a point is chosen

suitable for the actuating pivot, and its position is determined relative to the backrest in the TV position, its location is also known for the fully reclined position, i.e., an arc around backrest pivot B is traced through an angle θ and the location of the point is determined. This angle can also be described as the angle A_{TV}B₂A_R or the angle between the lines A_{TV}B₂ and B₂A_R. The bisector of this angle is defined for purposes of this disclosure as the P Line and it is a line on the fixed base along which the base pivot P must be located if there is to be no relative movement of the headrest vis-a-vis the backrest as compared in the TV position and the fully-reclined position. The pivot P can be located anywhere along the P Line with some practical limits as described below. The greater the spacing between the base pivot point P and the backrest pivot B, the greater will be the difference between the path followed by the actuating pivot A during the second movement phase where there is theoretically absolutely no movement (an arc around the backrest pivot B) and the actual path (an arc around the base pivot P). In accordance with the present invention, this slight spacing between the two arcs between the points A_R and A_{TV} will, in most cases, produce little or no movement of the headrest during the second movement phase. What is of most significance, however, is not the slight movement which may result from the minor spacing between the two arcs, but the fact that the base pivot P in an actual reclining chair can be located forwardly of the position of the backrest pivot B during the second movement phase and thus forwardly of the position shown in my U.S. Pat. No. 3,140,117. The consequence of this is, from a practical point of view, that a reclining chair can be made with a significantly shorter fixed base dimension because I have found that it is not necessary to provide a base pivot as far rearwardly as had been specified in the above patent. In this regard, those skilled in the art will realize that the backrest pivot B during the second movement phase could be at a point rearwardly of the actual confines of the chair when the chair is in its upright sitting position since the rear guide link could be arranged, in some instances, to pivot rearwardly of the rearward extend of the arm frame.

The location of the driver lever pivot L depends basically upon the action desired from the driver lever 68 during the first motion phase. If, for example, fast initial action is desired, the positions of the arms of the driver lever relative to the rest of the linkage will be adjusted by selection of the location of pivot L. If a large movement of the driver pivot D is required, the relative lengths of the driver lever arms are adjusted. There is a wide latitude in selecting the location of the driver lever pivot L but the geometry can be defined exactly by locating a bisect line which, in this description, is referred to as the L Line.

The L Line is defined as follows

The actuating pivot A moves in an arc relative to the backrest around the driver lever pivot L with the arc passing through the point A_{TV} (i.e., the location of pivot A in the TV position). It will be seen in FIG. 5 that if the point A_{TV} relative to the backrest is projected onto the backrest and the backrest is then moved back through the first motion phase to its location in the upright sitting position of the chair, that position in space would be at the point defined in FIG. 5 as A'_{TV-S}. Obviously, the portion of the driver lever 68 between the point A and L must always satisfy the condition that the

actuating pivot A can pass through point A'_{TV-S} on the backrest (the driver lever 68 is of fixed length and the distance between points A and L must be the same, no matter what the location of the driver lever 68). Furthermore, the actuating pivot A in the upright sitting position must be on the arc described by the headrest actuating link 70, i.e., it must be able to intersect the arc $A_R A_{TV}$ (the arc labeled "Arc" in FIG. 5) about the base pivot P. Therefore, the position of the driver lever pivot L must satisfy the A'_{TV-S} point as well as a selected point on the arc $A_R A_{TV}$ (this selected point being the position of the actuating pivot at the sitting position of the chair, i.e., A_S). The result of this is that the driver lever pivot L must lie on the perpendicular bisector of the line drawn between A_S and A'_{TV-S} . This perpendicular bisector is defined as the L Line and the lever pivot must be located on this line.

For any selected position of the point A_S along the arc $A_R A_{TV}$, the lever arm AL of the driver lever 68 can be varied by moving the lever pivot L on the L Line for greater or lesser leverage. Similarly, the position of A_S may be selected along the arc $A_R A_{TV}$ at the desired location to produce the proper desired acceleration during the first movement phase. Thus, a wide range of headrest actuation control is possible within the design criteria discussed above.

Of course, there are certain design limitations which must be respected. The base pivot P cannot be moved so far forwardly along the P Line that the angle $P A_{TV} L_S$ is 180° since in that condition there would be no moment lever at all tending to turn the driver lever 68. Obviously, that angle should be considerably less than 180° . Furthermore, the base pivot P cannot be moved so far forward that it will pull the driver lever 68 in the opposite direction from that intended. It is also obvious that any designs in which there is a dead center or inline positions for moving parts should be avoided. Situations in which there are large differences in the curvature between two arcs joining the points A_{TV} and A_R , i.e., the arc labeled "Arc" and "Barc" in FIG. 5, should be avoided in order to minimize movement of the headrest during the second movement phase, except, of course, in those design situations in which such movement is desired.

Those skilled in the art will understand that in addition to the wide design latitude and special advantages noted above, this arrangement provides still further advantages involved with the possibility of adjustment of position of the headrest during the second movement phase. The base pivot P can be located somewhat off the P Line but in the vicinity of it in an amount which will provide that degree of adjustment as is required. Such adjustment may be desirable because of the relative difference of the attitude of the body in the TV position as compared with the fully-reclined position. For example, in the TV position, the body remains relatively upright whereas in the fully-reclined position, the body is much closer to horizontal and therefore the gravitational effect on the head pressing against the headrest is much more extreme. This might well cause a compression of the headrest upholstery so that the head actually is lower than desired. To correct for this, the designer may, with certain upholstery materials, desire that the headrest be raised slightly relative to the backrest when the seat is moved to its fully-reclined position. In other instances the effect might be the opposite and the increased force might be felt on the back-

rest rather than on the headrest. The present system allows for the appropriate adjustment.

In general, the invention provides an overall geometry of great flexibility for the design of headrest actuation control, making it extremely desirable for the purposes of compact size and ease and dependability of operation while, at the same time, providing a wide degree of design flexibility for an automatic headrest movement control in a double movement type of reclining chair.

The above description shows only one illustrative embodiment of the present invention and presents a single illustrative geometric description of the design criteria of a chair in accordance with the present invention. Obviously, a wide variety of other embodiments incorporating the teachings of the invention can be utilized by those skilled in the art.

What is claimed is:

1. A reclining chair of the multiple movement type having a base, and a body supporting means including a seat and a backrest, body-supporting mounting mechanisms mounting said backrest on said base for movement in a first movement phase from an upright sitting position to an intermediate, tilted sitting position and for further movement in a second movement phase from said intermediate tilting seated position to a fully-reclined position with said backrest moving rearwardly during said first movement phase and turning about a backrest center of rotation during said second movement phase, a legrest, and a legrest guiding mechanism mounting said legrest on said body-supporting means for movement from a retracted position to an extended, leg-supporting position in response to movement of said body-supporting means during said first movement phase;
 - a headrest mounted on said backrest for movement between a lowered position and a raised head-supporting position in response to movement of said body-supporting means during the said first movement phase;
 - headrest mounting and guiding means mounting said headrest on said backrest and headrest; and
 - headrest actuating means effectively interconnected between said backrest, said support and said headrest mounting and guiding means for actuating and control movement of said headrest, said actuating means comprising:
 - a. a driver lever pivotally mounted on said backrest at a driver lever pivot;
 - b. an actuating link pivotally connected at one of its ends to said base at a base pivot and at its other end to said driver lever at an actuating pivot;
 - c. a connecting link pivotally connected at its lower end to said driver lever at a driver pivot and operatively connected at its upper end to said headrest mounting and guiding means;
 - d. said base pivot of said actuating link being spaced from said backrest center of rotation and located on a line which bisects the angle included between a first line between the location of the actuating pivot when the chair is in the intermediate tilted sitting position and the backrest pivot and a second line between the backrest pivot and the location of the actuating pivot when the chair is in the fully-reclined position; said bisected angle being equal to the angle of rotation of said

backrest about said backrest pivot during said second movement phase;

- e. the location of the driver lever pivot of the driver lever being along a line which is the perpendicular bisector of a line drawn between the location of the actuating pivot in the upright sitting position and the location of the actuating pivot projected onto the backrest when said actuating pivot is in the intermediate tilted sitting position and with said backrest thereafter translated into its position when in the upright sitting position.

2. A reclining chair of the multiple movement type having a support, a body-supporting means including a seat and backrest and a guiding mechanism mounting said seat and backrest within said support for motion in a first movement phase from an upright sitting position to an intermediate, tilted sitting position and for further motion in a second movement phase from said intermediate, tilted sitting position to a fully reclined position, said backrest turning about a backrest center of rotation during said second movement phase; a headrest mounted on said backrest for movement between an inactive position and an active, head-supporting position in response to movement of said seat and backrest relative to said support; mounting and guiding means mounting said headrest on said backrest and guiding same for said movement; actuating means effectively interconnected between said support, said body-supporting means and said headrest mounting and guiding means for actuating said headrest movement; said headrest actuating means comprising:

- a. a driver lever pivotally mounted on said body-supporting means at a driver lever pivot, an actuating link pivotally interconnected between said driver lever at an actuating pivot and said support at a base pivot, and a connecting link operatively interconnected between said driver lever at a driver pivot and said headrest mounting and guiding means;
- b. the axis of said base pivot being located at a point spaced from the axis of said backrest center of rotation and which is positioned to effectively maintain said headrest relative to said backrest in an effective position to support the head of a chair occupant during said second movement phase and in said fully reclined position.

3. In a reclining chair in accordance with claim 2, the location of said base pivot being spaced toward the front of the chair relative to the center of rotation of said backrest and being selected to produce relatively minor movement of said headrest with respect to said backrest during said second movement phase for adjusting the relative position of said headrest to said backrest to accommodate the changes of position of the chair occupant during said second movement phase.

4. In a reclining chair in accordance with claim 3, the location of said base pivot being adjacent but spaced from a line defined as the P Line which bisects the angle between a first line between the location of the actuating pivot when the chair is in the intermediate tilted sitting position and the center of rotation of the backrest and a second line between the center of rotation of the backrest and the location of the actuating pivot when the chair is in the fully reclined position.

5. In a reclining chair having a seat and backrest mounted within an arm frame by a mounting and guiding linkage for movement from an upright position to a tilted position, a headrest mounting means mounting said headrest on said backrest for movement from a retracted position to an extended position and a headrest actuating mechanism operable in response to said movement of said seat and backrest to actuate said movement of said headrest, said headrest actuating mechanism including an actuating link pivoted to said arm frame at a base pivot and extending generally in line with the direction of said movement of said seat and backrest, a driver lever being pivotally mounted on said backrest and having two arms, a first arm being generally perpendicular to the direction of said actuating link, a connecting link pivotally connected at its lower end to the second arm of said driver lever and pivotally connected at its upper end to said headrest mounting means, said second arm of said driver lever and said connecting link being generally perpendicular to each other.

6. A reclining chair in accordance with claim 5 wherein said driver lever is located forwardly of said actuating link.

7. A reclining chair in accordance with claim 6 wherein the two arms of said driver lever are generally perpendicular and the pivotal mount of said driver lever on said backrest is at the intersection of said two arms.

8. A reclining chair of the multiple movement type having a base, and a body-supporting means including a seat and a backrest, body-supporting mounting mechanisms mounting said backrest on said base for movement in a first movement phase from an upright sitting position to an intermediate, tilted sitting position and for further movement in a second movement phase from said intermediate tilting seated position to a fully-reclined position with said backrest moving rearwardly during said first movement phase and turning about a backrest center of rotation during said second movement phase, a legrest, and a legrest guiding mechanism mounting said legrest on said body-supporting means for movement from a retracted position to an extended, legsupporting position in response to movement of said body-supporting means during said first movement phase;

a headrest mounted on said backrest for movement between a lowered position and a raised head-supporting position in response to movement of said body-supporting means during said first movement phase;

headrest mounting and guiding means mounting said headrest on said backrest and headrest; and headrest actuating means effectively interconnected between said backrest, said base and said headrest mounting and guiding means for actuating and control movement of said headrest, said actuating means comprising:

- a. a driver lever pivotally mounted on said backrest at a driver lever pivot;
- b. an actuating link pivotally connected at one of its ends to said base at a base pivot and at its other end to said driver lever at an actuating pivot;
- c. a connecting link pivotally connected at its lower end to said driver lever at a driver pivot and oper-

actively connected at its upper end to said headrest mounting and guiding means;

- d. said base pivot of said actuating link being spaced from said backrest center of rotation and located adjacent a line which bisects the angle included between a first line between the location of the actuating pivot when the chair is in the intermediate tilted sitting position and the backrest pivot and a second line between the backrest pivot and the location of the actuating pivot when the chair is in the fully-reclined position; said bisected angle being equal to the angle of rotation of said backrest about said backrest pivot during said second movement phase;

- e. the location of the driver lever pivot of the driver lever being substantially along a line which is the perpendicular bisector of a line drawn between the location of the actuating pivot in the upright sitting position and the location of the actuating pivot projected onto the backrest when said actuating pivot is in the intermediate tilted sitting position and with said backrest thereafter translated into its position when in the upright sitting position.

9. A reclining chair having body supporting means including a backrest movable in a first motion phase from an upright position to a first tilted position and in a second motion phase from said tilted position to a fully reclined position, the motion from said upright position to the tilted position being different from the motion from said tilted position to said fully reclined position, a headrest mounted on said backrest for move-

ment between a lowered position and a raised head supporting position in response to movement of said back from said upright position to said tilting position, headrest mounting and guiding means mounting said headrest on said backrest, headrest actuating means effectively interconnected between said backrest and said support and said mounting and guiding means for actuating and controlling the movement of said headrest in coordination with the movement of said backrest, said actuating means comprising a driver lever pivotally mounted on said backrest at a driver lever pivot, an actuating link pivotally connected at one of its ends to said base at a base pivot and at its other end to said driver lever at an actuating pivot, a connecting link pivotally connected at its lower end to said driver lever at a driver pivot and operatively connected at its upper end to said headrest mounting and guiding means, the base pivot of said actuating link being spaced from the pivotal center of rotation of said backrest during the second motion phase of said backrest and located substantially on the line which bisects the angle of rotation of said backrest as it moves from said tilted position to said fully reclined position, said angle being defined by the positions of said actuating pivot in said tilted position and in said fully reclined position respectively and the pivotal center of rotation of said backrest during said second movement phase, said actuating means actuating the headrest during the first movement phase and holding the headrest substantially in the operative head supporting position during said second movement phase.

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