June 4, 1963 F. F. SCHLIEPHACKE 3,092,415

UNDERSLUNG LEG-REST CONTROL MEANS FOR RECLINING CHAIRS

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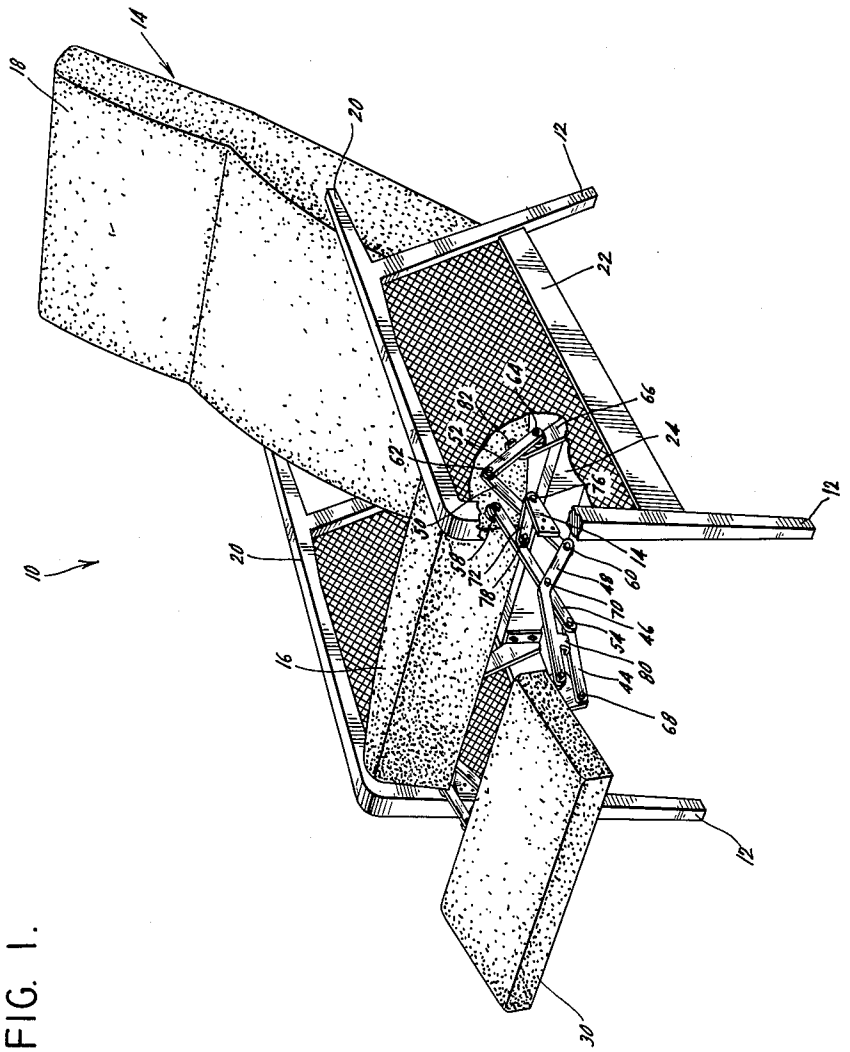


FIG. 1.

INVENTOR.
FRIDTJOF F. SCHLIEPHACKE
BY
Amster & Levy
ATTORNEYS

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FIG. 2.

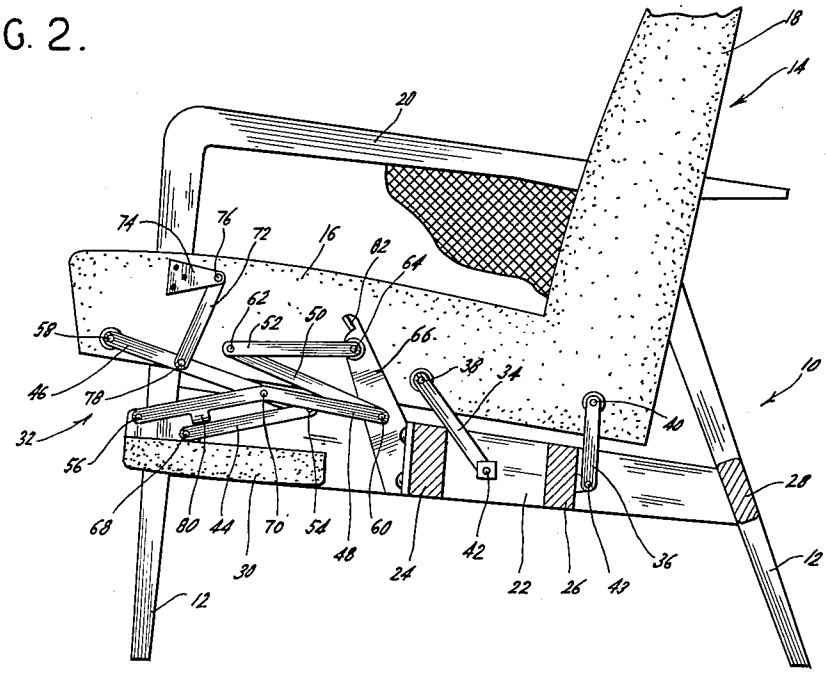
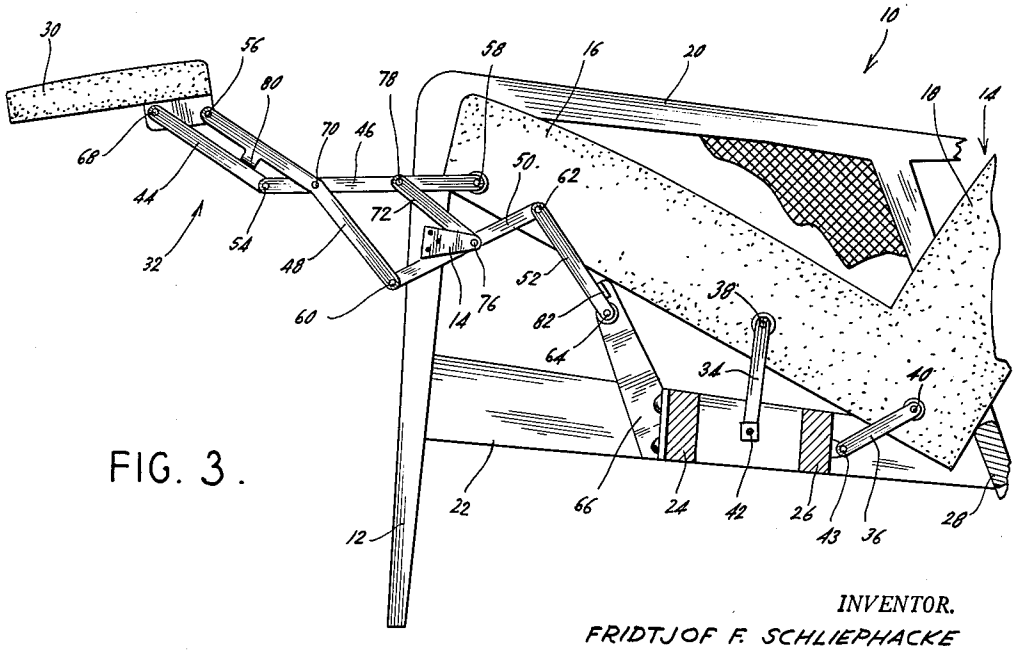


FIG. 3.



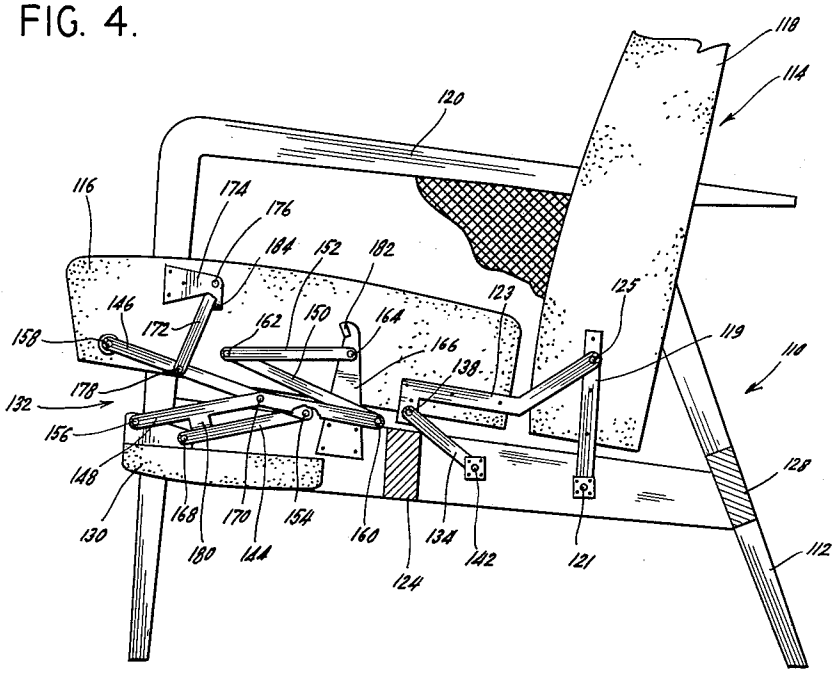
INVENTOR.
FRIDTJOF F. SCHLIEPHACKE
BY
Amster & Levy
ATTORNEYS

June 4, 1963 F. F. SCHLIEPHACKE 3,092,415

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FIG. 4.



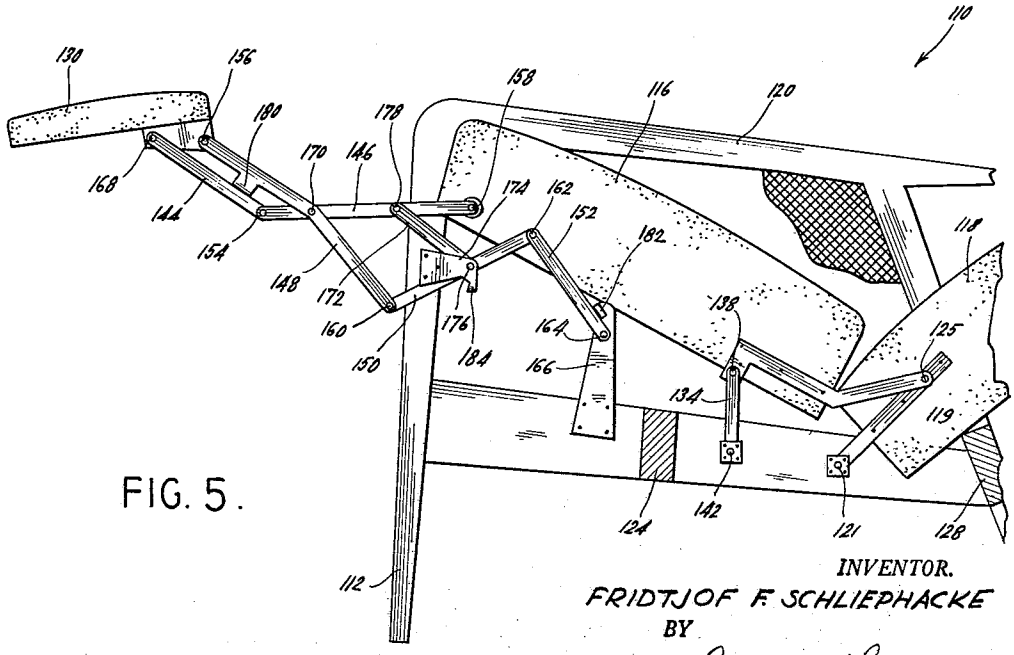


FIG. 5.

INVENTOR.
FRIDTJOF F. SCHLIEPHACKE
BY
Amster & Lewy
ATTORNEYS

June 4, 1963 F. F. SCHLIEPHACKE 3,092,415

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FIG. 6.

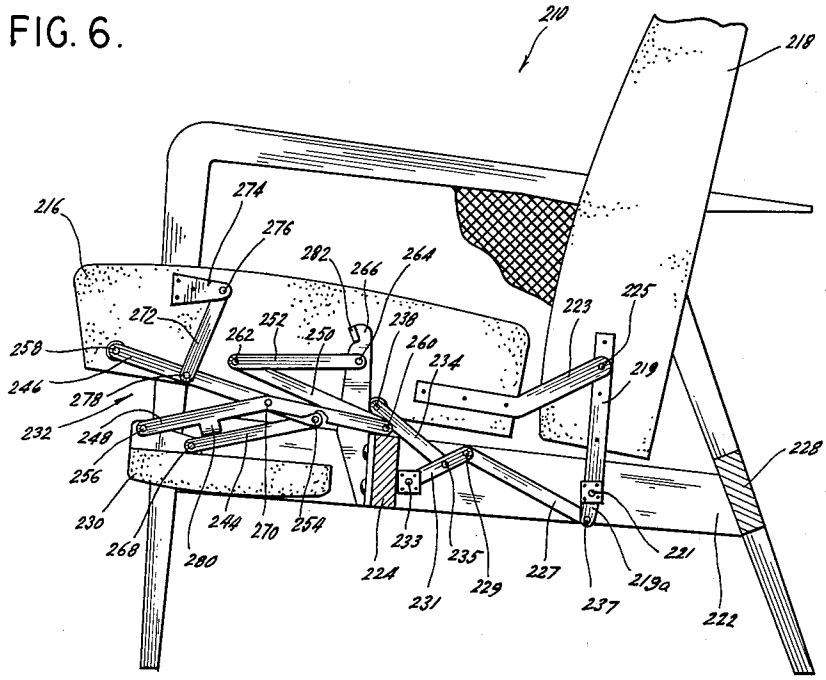
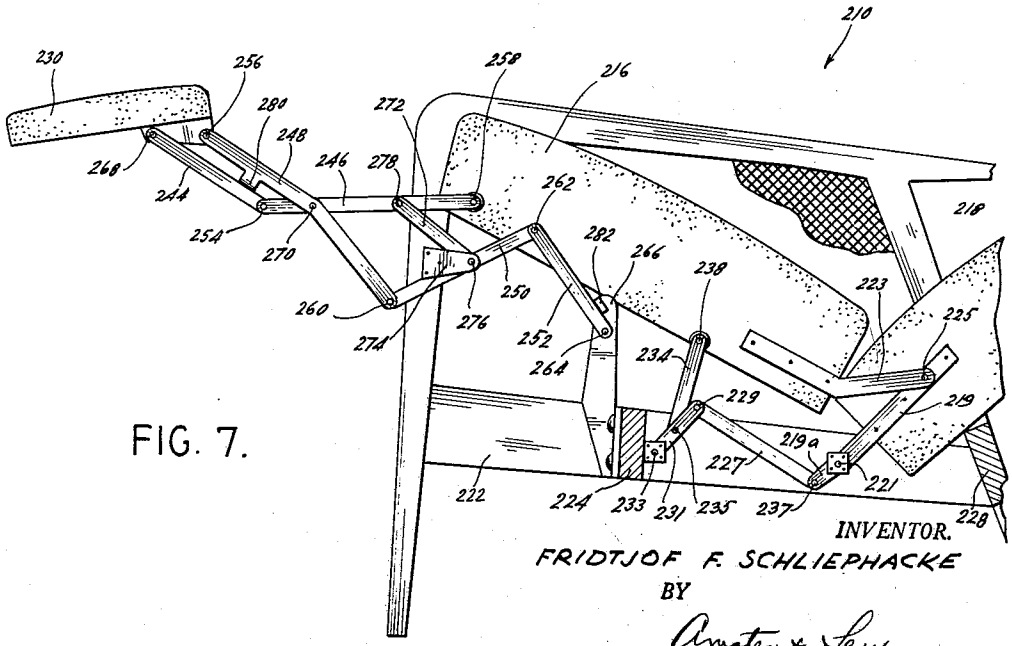


FIG. 7.



INVENTOR.
FRIDTJOF F. SCHLIEPHACKE
BY
Amster & Levy
ATTORNEYS

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3,092,415

UNDERSLUNG LEG-REST CONTROL MEANS FOR RECLINING CHAIRS

Fridtjof F. Schliephacke, Berlin-Schmargendorf, Germany, assignor to Anton Lorenz

Filed July 28, 1959, Ser. No. 830,012
3 Claims. (Cl. 297—89)

This invention relates to improvements in reclining chairs having a leg-rest of the underslung type which, when retracted, is folded inwardly to a position parallel to and close to the lower surface of the seat, and has particular relation to a new and improved linkage for actuating such underslung type of leg-rest.

Leg-rest arrangements of the underslung type are customarily employed in reclining chairs of the modern type in which the seat is raised well above the floor surface by high legs. Styling requirements for such type of chair presently require open frame-work sides mounted on relatively long legs of narrow diameter with an open space between the bottom of the seat and the floor surface. Because of such open frame-work and the open space beneath the seat, it is desirable to conceal the leg-rest in its retracted position so that the chair will have the appearance of a normal well styled chair in its upright sitting position, and the leg-rest is therefore mounted in an underslung retracted position in which it is closely spaced from the bottom surface of the seat and is maintained parallel thereto. The leg-rest linkage must also be so arranged and must be of such construction that in the upright sitting position of the chair it is collapsed or folded into an extremely compact form with the links thereof closely spaced from each other and hidden by the chair framework.

A problem encountered in the construction of the chair of the aforementioned type is concerned with extending the leg-rest from its retracted position beneath the seat to an extended position forwardly of the seat. During such movement, the leg-rest must be swung through an angle of 180° from an inverted horizontal position beneath the seat to an upright horizontal position forwardly of the seat. Such movement of the leg-rest represents a relatively long path of travel in response to a short path of travel of the seat and back-rest structure. The linkage must therefore be so arranged as to provide an accelerated movement of the leg-rest in response to a slight movement of the body-supporting unit.

In order to effectively and comfortably support the legs of the chair occupant, especially where the occupant is tall, it is required that the leg-rest in its extended position be spaced well forwardly from the forward end of the seat. For this purpose, the links of the leg-rest linkage must be relatively long, and yet the leg-rest linkage must be so constructed that these long links are folded into a sufficiently compact arrangement as to be hidden from view by the chair open framework in the retracted position of the leg-rest. It is also apparent that links of large size raise the problem of constructing the linkage movement in such a manner that the links and the leg-rest do not strike the floor when the leg-rest is moved from its underslung position to its extended position.

It is an object of the present invention to provide a leg-rest linkage for reclining chairs of the type described which meets the aforementioned requirements in an effective and economical matter.

Another object of the invention is the provision of the leg-rest linkage of the character described in which a novel link arrangement is employed for providing a long path of movement of the leg-rest from an underslung position beneath the seat to an extended position spaced well forwardly of the seat, in response to a relatively short path of movement of the body-supporting means.

A further object of the invention is the provision of a leg-rest linkage of the character described in which the links are arranged and constructed to be folded up into a very compact form in the upright sitting position of the body supporting unit when the leg-rest is in its retracted underslung position.

A further object of the invention is the provision of a leg-rest linkage of the character described which is particularly adapted for use in chairs having modern styling features including an open frame, high legs, and the like.

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

FIG. 1 is a perspective view of a reclining chair incorporating the leg-rest linkage of the present invention, the chair being shown in its reclining position and portions thereof being broken away to reveal internal construction;

FIG. 2 is a side elevational view, with parts broken away and shown in section, of the improved reclining chair of FIG. 1, the chair being shown in its upright or sitting position;

FIG. 3 is a side elevational view similar to FIG. 2, showing the chair in its rearwardly-tilted reclining position with the leg-rest linkage extended and the leg-rest in its elevated, leg-supporting position;

FIG. 4 is a side elevational view with parts broken away and shown in section, of a reclining chair having an independently-movable seat and back-rest, and incorporating the improved leg-rest linkage of the present invention, the chair in this view being shown in its upright or sitting position;

FIG. 5 is a side elevational view of the forward portion of the chair of FIG. 4, showing the chair in its rearwardly-tilted or reclined position and the leg-rest linkage in its fully extended leg-supporting position;

FIG. 6 is a side elevational view, with parts broken away and shown in section, of a reclining chair having a modified type of control means for the seat and back-rest structure, and incorporating the leg-rest linkage of the present invention, the chair being shown in its upright sitting position;

FIG. 7 is a side elevation of the forward portion of the chair shown in FIG. 6, with the chair in its rearwardly-tilted tended leg-supporting position;

Referring now specifically to the drawings, FIGS. 1–3 illustrate the type of chair in which the leg-rest linkage of the present invention is particularly adapted and intended to be incorporated. The chair has a fixed and immovable support frame or base **10** which includes legs **12**. A body supporting structure **14**, comprising a seat **16** and a back-rest **18** formed rigidly with each other, is mounted for rearward tilting movement upon the support frame **10**.

The support frame **10** is formed by open side frames **20** which include side rails **22** connected by cross bars or braces such as the members **24**, **26** and **28**. The chair also includes a leg-rest **30** which is carried by a leg-rest actuating linkage designated generally by the reference numeral **32**, the latter being mounted on the support frame **10** and seat **16** in a manner which will be presently described.

The chair legs **12** are made in accordance with modern styling and are relatively high and narrow so as to present a large unemcumbered space beneath the seat **16**. Such styling requires in a chair of this type that the leg-rest be retracted to an underslung position, as indicated in FIG. 2 in which it is normally spaced a short distance

beneath the lower surface of the seat and is parallel thereto, so as to be substantially hidden from view by the side rails **22**. It will also be observed that the leg-rest linkage **32** in this retracted position of the leg-rest is collapsed to a very compact condition in which the links constituting said linkage are closely folded together and are located close beneath the seat **16** where they are hidden from view by the side rails **22**.

The body-supporting unit is mounted upon the support frame **10** for rearward movement to a reclining position by a front guiding link **34** and a rear guiding link **36**. The upper ends of the guiding links **34** and **36** are connected to spaced points on the seat **16** by respective pivots **38** and **40**. The lower ends of the guiding links **34** and **36** are pivotally mounted at spaced points on the support frame **10** by respective pivots **42** and **43**. In the upright sitting position of FIG. 2, the front guiding link extends upwardly and forwardly from its pivotal mount **42** on the support frame while the rear guiding link **36** extends vertically upright from its pivotal mount **43** on the support frame. When the body-supporting unit **14** is moved rearwardly, the upper end of the front guiding link **34** will move in an upward arc while the upper end of the rear guiding link **36** will move in a downward arc, thereby raising the front end of the seat **16** and bringing the seat to the tilted position of FIG. 2. In this position, the rear edge of the back-rest **18** engages the rearmost cross bar **28** to limit further rearward movement.

Referring now specifically to the leg-rest linkage **32**, the leg-rest **30** is supported by a pair of links **44**, **46** and a chain of three links **48**, **50** and **52**.

The pair of links **44** and **46** are interconnected in end-to-end relationship by a pivot **54**. The free end of the link **44** is connected to the structure of the leg-rest **30** by a pivot **68**, while the free end of the link **46** is mounted on the forward end portion of the seat **16** by a pivot **58**.

The ends of links **48** and **50** of the chain of links are interconnected by pivot **60**, while the other end of link **50** is connected to one end of the link **52** by a pivot **62**. The other end of the link **52** is pivotally mounted at **64** on a bracket **66** which is in turn rigidly mounted on the cross bar **24** of the support frame **10**. The free end of the link **48** is connected by pivot **56** to a point on the leg-rest **30** which is spaced from the pivot **68**. The links **46** and **48** cross each other and are pivotally connected at their crossing over point by pivot **70**.

The movements of the leg-rest linkage **32** is effected by and controlled by an actuating link **72** which is mounted at one end by pivot **76** on a bracket **74** formed as a fixed part of the support frame **10**. The free end of the actuating link **72** is connected by pivot **78** to an intermediate point on the link **46** between the pivots **58** and **70**. The pivotal mount **76** of the actuating link **72** is located above and to the rear of the pivotal connection **58** of the link **46** to the seat **16** in the upright sitting position thereof, as shown in FIG. 2, and the actuating link **72** extends downwardly and forwardly from its pivotal mount **76** to its point of connection **78** with said link **46**.

When the body-supporting structure **14** is moved from its sitting position of FIG. 1 to the rearwardly-tilted position of FIG. 2, the actuating link **72** operates to drive the leg-rest linkage in such a manner as to bring the leg-rest **30** from its retracted position to its extended position. This is accomplished by the arrangement of the actuating link **72** with the link **46** and the seat **16** to form a drag-link mechanism in which the seat **16** serves as a movable link in the nature of a driving crank, the actuating link **72** serves as a driven crank, and the link **46** serves as a connecting rod which is rotated through an angle of nearly 180°. The seat **16** as the driving crank has a pivotal mount on the support frame **10** and the actuating link **72** is also mounted on the support frame. The connecting rod **46**, however, has no fixed pivot on the support and therefore is free to rotate through a large angular path.

When the occupant of the chair in the sitting position of FIG. 1 exerts a rearward pressure against the back-rest **18**, the body-supporting unit **14** will be carried rearwardly by the guiding links **34** and **36** which turn about their respective pivots **42** and **43** to move the seat **16** rearwardly and tilt it to its reclining position. During this rearward tilting movement, the front portion of the seat **16** is raised and moved rearwardly, carrying with it the pivot **58** of link **46** in an upward and rearward path toward the fixed pivot **76** of the actuating link **72**. The actuating link **72** therefore exerts a relative pushing force against the link **46**, which urges the latter in a forward direction causing it to pivot forwardly about its seat pivot **58**. At the same time, as the upper portion of link **46** is moved rearwardly with the seat **16**, said link **46** is turned about the pivot **78** on the actuating link **72**. The lower portion of the link **46** is thus moved rapidly through a long path of travel from its position of FIG. 2 to the position of FIG. 3, carrying the leg-rest link **44** forwardly and upwardly with it in such a manner as to raise the leg-rest **30** toward its extended position.

At the same time, the link **48** is also raised and moved forwardly because of its pivotal connection **70** with the link **46**, causing the chain of links **48**, **50** and **52** to open up to the extended position shown in FIG. 3, in which the angles between the links are substantially increased. The provision of the chain of three links **48**, **50** and **52**, working in cooperation with the drag link mechanism of links **46** and **72**, provides a means for effecting a long movement of the leg-rest **30** to a position in which it is spaced a large distance forwardly of the seat **16**, while at the same time permitting the leg-rest linkage **32** to be folded up to a very compact condition in the retracted and underslung position of the leg-rest. It will be observed that in the sitting position of FIG. 2, the links **48**, **50** and **52** are folded up in a stacked relationship, one above the other and substantially parallel to each other so that they are in an extremely compact form and are concealed by the seat **16** and the side frames **20**. In addition, the chain of links **48**, **50**, and **52** provide a delay in pivoting the leg-rest **30** about the pivot **68**, so that the leg-rest is not turned through a vertical position until after it has moved past the forward end of the seat, and is thus prevented from striking the floor surface.

In arriving at the extended position of FIG. 3, the actuating link **72** pivots upwardly from its depending position of FIG. 2 to the upwardly and forwardly-inclined position shown in FIG. 3, in which it supports the link **46** in a substantially horizontal position. It will be noted that in this extended position, the leg-rest is spaced a considerable distance forwardly of the front end of the seat **16**.

At its forward end, the link **48** is provided with a stop element **80** which extends in the direction of the link **44**. As shown in FIGS. 2 and 3, when the leg-rest linkage is in its extended and retracted positions, the stop element **80** engages the link **44** and limits movement of the leg-rest linkage past said extended and retracted positions.

The bracket **66** also carries a fixed stop member **82** which is positioned to engage the link **52** when the body-supporting unit **14** reaches its reclining position of FIG. 3, and the leg-rest linkage **32** reaches its fully-extended position. This stop member **82** also serves to limit movement of the leg-rest linkage past its fully-extended position.

Referring now specificaly to FIGS. 4 and 5 of the drawings, there is shown a modified type of reclining chair which incorporates the improved leg-rest linkage of the present invention. In these views reference numerals similar to those of FIGS. 2 and 3 are employed for like parts, except that these numerals are in the "100" series.

The chair shown in FIGS. 4 and 5 again includes a support frame **110** mounted on legs **112**, the support frame

comprising side frames 120 including side rails 122 connected to each other by cross bars 124 and 128.

Mounted on the support frame 110 is a body-supporting structure 114, which in this instance comprises a seat 116 and a back-rest 118 which are separate from each other and mounted for individual movement instead of being rigidly connected as in the previous embodiment. The back-rest 118 carries a rigidly-secured, depending bar 119 which is mounted by pivot 121 on the support frame 110. The seat 116 also has a bar 123 rigidly affixed thereto and projecting rearwardly therefrom. The rear end of the bar 123 is connected by pivot 125 to the bar 119 so that the seat 116 is pivotally connected to the back-rest 118 at a point above the back-rest pivot 121. When the back-rest 118 is pivoted rearwardly to its reclining position of FIG. 5, the seat 116 is drawn rearwardly with it through the bar 123. The forward end of the seat 116 is raised by a front guiding link 134 which is mounted on the support frame 110 by a pivot 142 and is connected by pivot 138 to the bar 123 fixed to the seat. As the seat 116 is drawn rearwardly with the back-rest 118, the front guide link 134 pivots rearwardly and upwardly to raise the seat front end portion and cause the seat to assume the tilted reclining position shown in FIG. 5.

The leg-rest 130 is actuated by a leg-rest linkage 132 which is substantially identical to that shown in the previous embodiment of FIGS. 1–3. Again, the linkage 132 includes a pair of links 144 and 146 interconnected by pivot 154, and a chain of three links 148, 150 and 152 interconnected by respective pivots 160 and 162. The links 146 and 148 are connected at their crossing-over point by pivot 170.

The links 144 and 148 are connected at spaced points on the leg-rest 130 by respective pivots 168 and 156. The link 146 is mounted by pivot 158 on the forward portion of the seat, while the link 152 is mounted by pivot 164 on a bracket 166 rigidly connected to the support frame 110.

An actuating link 172 is mounted by pivot 176 on a bracket 174 formed as a fixed part of the support frame 110. The other end of the actuating link 172 is connected by pivot 178 to the link 146. The actuating link 172, link 146 and the seat 116 function as a drag link mechanism to extend the pair of links 144, 146 rapidly and thus to bring the leg-rest 130 to its extended position of FIG. 5, which movement has been previously explained in detail. Similarly, the chain of links 148, 150 and 152 operate to delay the turning movement of the leg-rest 130 about the pivot 168, as was also previously described, and thus delay the leg-rest 130 from reaching a vertically-disposed position until it has been moved through the space between the seat and the floor surface.

In addition to the stop members 180 and 182, the purpost of which has been previously explained, the bracket 174 is provided with an integral stop member 184 which engages the actuating link 172 in the sitting position of the chair shown in FIG. 4, and prevents the front end of the seat 116 from moving downwardly past its sitting position.

FIGS. 6 and 7 illustrate another modified type of reclining chair incorporating the leg-rest linkage similar to to that previously described. In this embodiment, like reference numerals are again used for identical parts, except in this instance they are part of a "200" series.

In the chair disclosed in FIGS. 6 and 7, the seat 216 and back-rest 218 are again made separate, and are mounted for independent movement. A bar 219 is affixed to the back-rest 218 and depends therefrom, the projecting end of said bar 219 being mounted by pivot 221 on the side frame 222 of the support 210. The seat 216 also has a bar 223 affixed thereto and projecting rearwardly therefrom. The rear end of the bar 223 is connected by pivot 225 to the back-rest bar 219.

The bar 219 has a lower extension 219*a* which depends below the pivotal mount 221. This extension 219*a* is connected by a pivot 237 to one end of a link 227, the other end of which is connected by pivot 229 to the end of a link 231. The other end of link 231 is mounted on the support frame 210 by pivot 233. The front guide link 234 is mounted by pivot 235 to an intermediate point on the link 231, and at its other end is connected by pivot 238 to the seat 216. In the sitting position shown in FIG. 6, the front guide link 234 rests upon the cross bar 224 to support the seat 216.

When the occupant of the chair leans rearwardly on the back-rest 218, the latter and its fixed bar 219 turn about the pivot 221, drawing the seat 216 rearwardly through the bar 223. As the seat moves rearwardly, it carries with it the top end of front guide link 234, the latter pivoting to the upstanding position of FIG. 7 to raise the forward end of the seat 216. At the same time, the lower extension 219*a* of the bar 219 turns forwardly and upwardly, moving the link 227 in the same direction and causing the link 231 to pivot forwardly and upwardly about its fixed pivot 233 to the position of FIG. 7. This turning movement of link 231 raises the guiding link 234 and brings the seat 216 to its tilted or reclining position. In this construction, the upward movement of the seat is a positive action afforded directly by the rearward tilting of the back-rest 218, and does not depend wholly upon the rearward movement of the seat as in the preceding embodiments.

The leg-rest 230 is again carried by a leg-rest linkage 232 which is similar to that previously described. The linkage 232 includes a pair of links 244 and 246 interconnected by pivot 254 and a chain of three links 248, 250 and 252 connected by respective pivots 260 and 262. The links 244 and 248 are connected to spaced points on the leg-rest by respective pivots 268 and 256. The link 246 is mounted on the forward end of the seat 216 by pivot 258, while the link 252 is mounted by pivot 264 on a bracket 266 which is rigidly mounted on the cross bar 224 of the support frame 210. The link 246 crosses over the link 248 and is connected thereto by pivot 270.

Movement of the leg-rest linkage 232 is controlled by an actuating link 272 which is mounted at one end by pivot 276 on a bracket 274 rigidly connected to the support frame 210. The other end of said actuating link 272 is connected by pivot 278 to an intermediate point on the link 246.

In the sitting position of the chair shown in FIG. 6, the leg-rest 230 is in its underslung position beneath the seat 216 and the leg-rest linkage 232 is disposed in a closely-folded and compact position. The pair of links 244 and 246 are rearwardly disposed and form an acute angle therebetween. The chain of links 248, 250 and 252 are also in compact form, forming acute angles with each other.

When the occupant leans rearwardly on the back-rest, the seat 216 is drawn rearwardly, and its forward portion is raised by the guiding link 234 and the links 231 and 227 as was previously described. The seat 216 moving upwardly and rearwardly, acts as the driving crank of a drag link mechanism, causing the actuating link 272, as the driven crank, to pivot forwardly and upwardly, and causing the link 246, as the connecting rod to turn through an angle of approximately 180° to bring the leg-rest 230 to its extended position of FIG. 7 in which it is spaced well forwardly of the seat 216. While the leg-rest 230 is being moved rapidly from the underslung position to the extended position, the chain of links 248, 250 and 252 are unfolding relatively slowly, so that they delay the turning movement of the leg-rest from its inverted underslung position to its upright extended position, delaying the turning of the leg-rest through the vertical position until after the leg-rest has passed through the space between the seat and the floor surface.

The link 248 carries a stop element 280 which extends in the direction of link 244 and engages said link 244 in the extended and retracted positions of the leg-rest linkage 232, thus limiting the movement of said leg-rest linkage

beyond said extended and retracted positions. The bracket **266** also carries a fixed stop member **282** which is positioned to engage the link **252** in the extended position of the leg-rest linkage shown in FIG. 7, thereby also serving to limit movement of the linkage past its extended position.

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

What I claim is:

1. A reclining chair comprising a support frame, a body-supporting structure including a seat and back rest, means mounting said body-supporting structure on the support frame for tilting movement to a reclining position in which the forward portion of the seat is raised and moved rearwardly relative to the support frame, a leg-rest, and a leg-rest linkage carrying the leg-rest and adapted to move the latter from a retracted underslung position beneath the seat to an extended position spaced forwardly of the seat, said leg-rest linkage including a pair of interconnected links connecting said leg-rest to the forward end portion of the seat, an actuating link pivotally mounted on the support frame and pivotally connected to one of the links of said pair of links and forming therewith a drag link mechanism to provide a rapid movement of the leg-rest through a long path of travel from its retracted position to its extended position in response to relatively short movement of the body-supporting structure, a chain of three links pivotally connected end-to-end, and pivotally interconnected with said pair of links for coordinated movement therewith, means pivotally connecting one end link of the chain to the leg rest, and means pivotally mounting the other end link of the chain, the chain of three links being free of direct connection with the body-supporting structure, and forming an unconstrained linkage as the leg-rest is moved to its extended position with said other end link of the chain providing a movable mount for the pivotal connection of the center link with said other end link and stop means engaging and immovably holding said other end link at the extended position of the leg-rest, whereby said pivotal connection of the center link is fixed at the reclining position to provide a constrained linkage supporting said leg-rest.

2. A reclining chair comprising a support frame, a body-supporting structure including a seat and back-rest, means mounting said body-supporting structure on the support frame for tilting movement to a reclining position, a leg-rest, and a leg-rest linkage carrying the leg-rest and adapted to move the latter from a retracted position beneath the seat to an extended position spaced forwardly of the seat, said leg-rest linkage including a pair of links connected end-to-end, one of the links of said pair being connected to said leg-rest and the other link being mounted on the seat at the forward end thereof, an actuating link pivotally mounted on the support frame and pivotally connected to an intermediate point on said other link, the forward end portion of the seat carrying the pivotal mount of said other link upwardly and rearwardly relative to the pivotal mount of the actuating link when the body-supporting structure is moved to its reclining position, the actuating link pivoting forwardly and upwardly to raise said other link, and the seat drawing the upper end of the other link rearwardly and causing the latter to turn about the actuating link to bring the leg-rest to its extended position, a chain of three links pivotally connected end-to-end, means pivotally connecting one end link of the chain to the leg-rest, and means pivotally mounting the other end link of the chain on the support, the chain of three links being independent of the body-supporting structure, and forming an unconstrained linkage as the leg-rest is moved to its extended position with said other end link of the chain providing a movable mount for the pivotal connection of the center link with said other end link, and stop means engaging and immovably holding said other end link at the extended position of the leg-rest, whereby said pivotal connection of the center link is fixed at the reclining position to provide a constrained linkage supporting said leg-rest.

3. A reclining chair comprising a support frame, a body-supporting structure including a seat and back rest, means mounting said body-supporting structure on the support frame for tilting movement to a reclining position, a leg-rest, and a leg-rest linkage carrying the leg-rest and adapted to move the latter from a retracted position beneath the seat to an extended position spaced forwardly of the seat, said leg-rest linkage including a first pair of links connected end-to-end, one of the links of said first pair being mounted on the seat at the forward end thereof and the other being connected to the leg-rest, an actuating link pivotally mounted on the support frame and pivotally connected to an intermediate point on said one link, a second pair of links connected end-to-end, means pivotally connecting one link of said second pair to the leg-rest, a pivotal mount at the end of the other link of the second pair, and a flexible coupling connecting said pivotal mount to said support frame for upward movement of said pivotal mount as the leg-rest is moved to its extended position, said flexible coupling comprising a third link connected to the pivotal mount of the other link of the second pair and pivotally mounted on the support frame, and stop means engaging and immovably retaining said third link at the extended position of the leg-rest.

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