Sept. 18, 1962 F. F. SCHLIEPHACKE 3,054,639

LEG REST CONTROL LINKAGE FOR RECLINING CHAIRS

Filed March 31, 1959 6 Sheets-Sheet 1

FIG. 1.

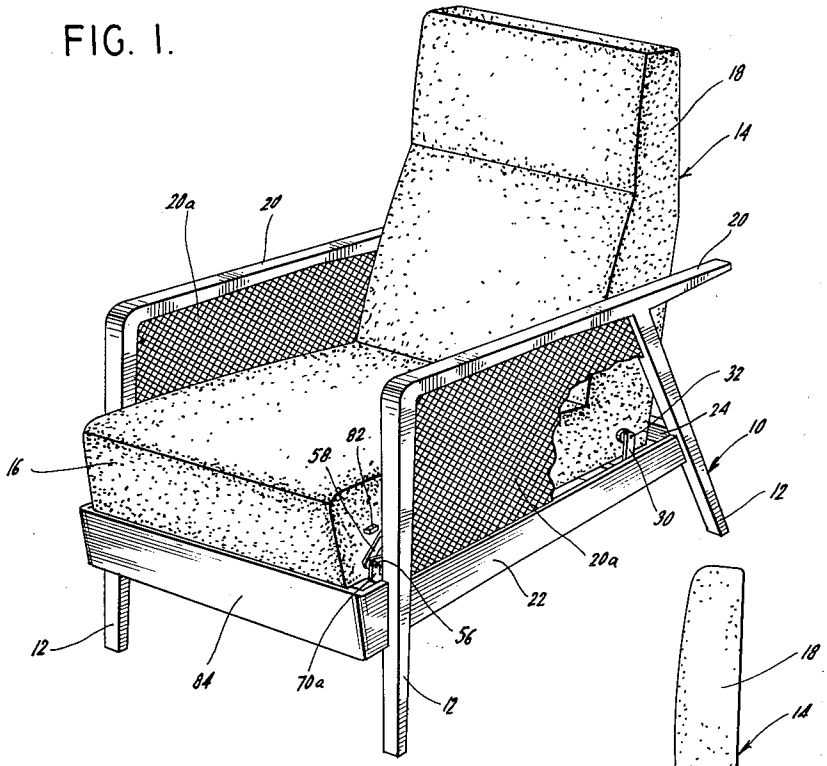
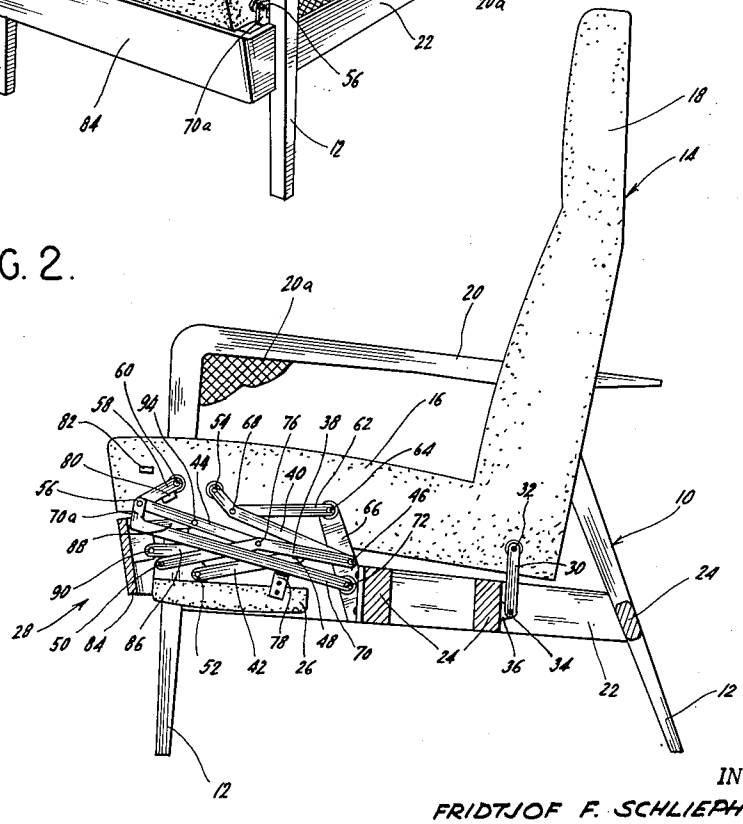


FIG. 2.



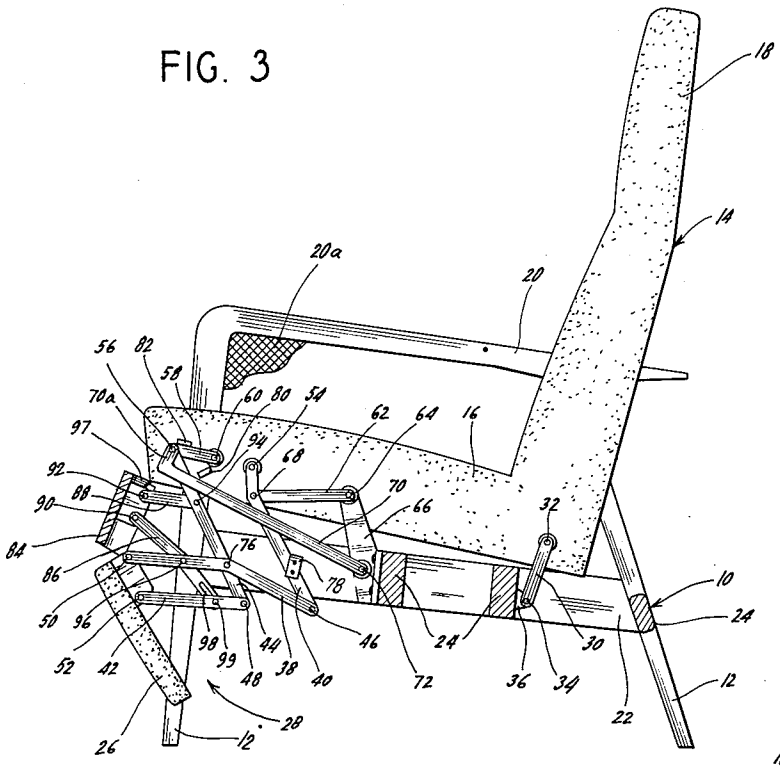
INVENTOR.
FRIDTJOF F. SCHLIEPHACKE
BY Amster & Levy
ATTORNEYS

Sept. 18, 1962 F. F. SCHLIEPHACKE 3,054,639

LEG REST CONTROL LINKAGE FOR RECLINING CHAIRS

Filed March 31, .1959 6 Sheets-Sheet 2

FIG. 3



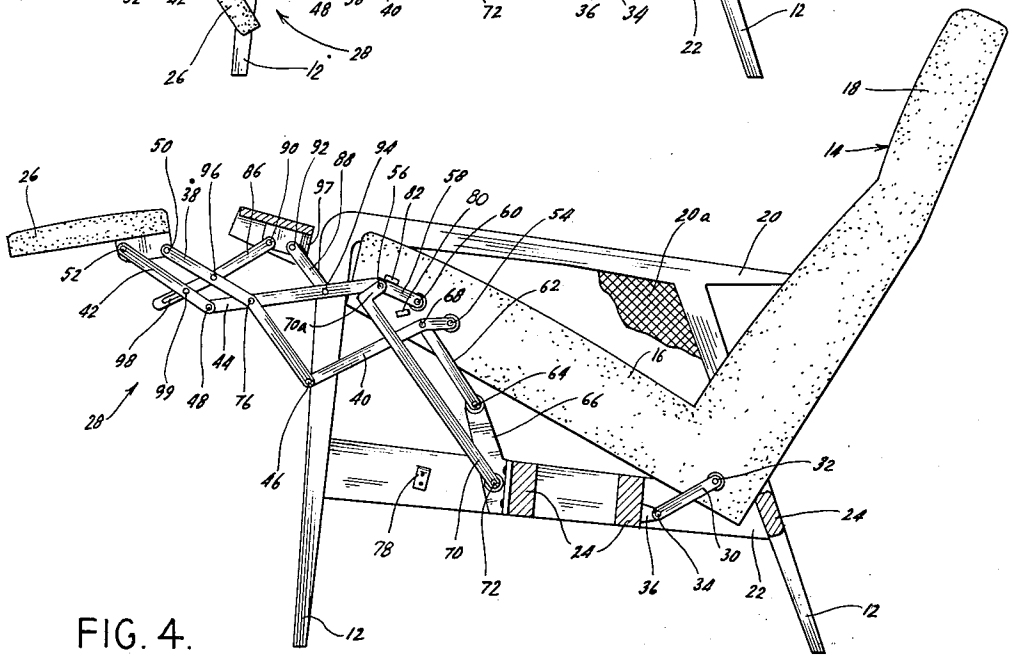


FIG. 4.

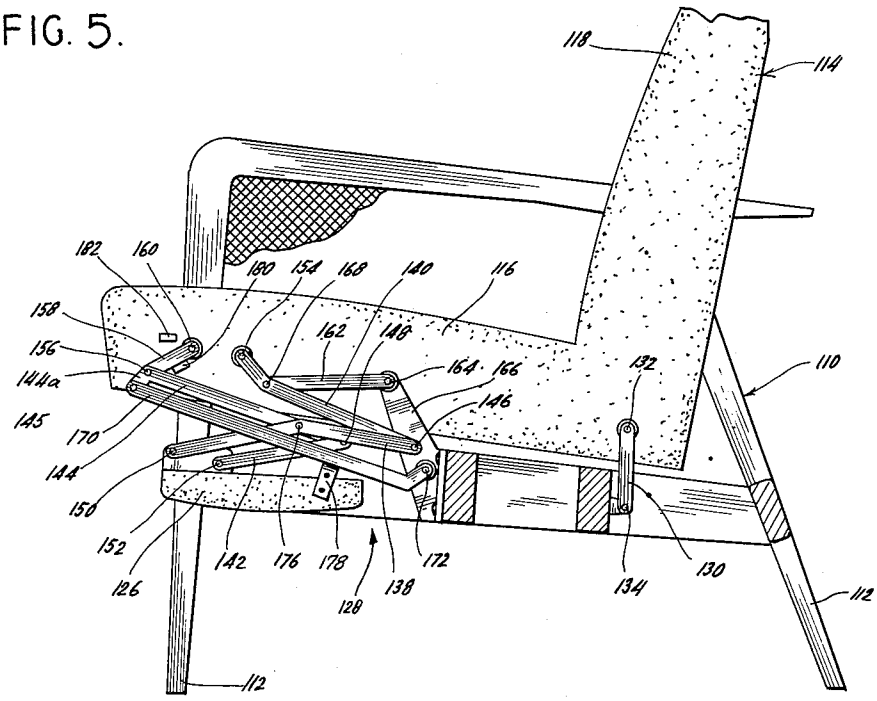
INVENTOR.
FRIDTJOF F. SCHLIEPHACKE
BY
Amster & Levy
ATTORNEYS

Sept. 18, 1962 F. F. SCHLIEPHACKE 3,054,639

LEG REST CONTROL LINKAGE FOR RECLINING CHAIRS

Filed March 31, 1959 6 Sheets-Sheet 3

FIG. 5.



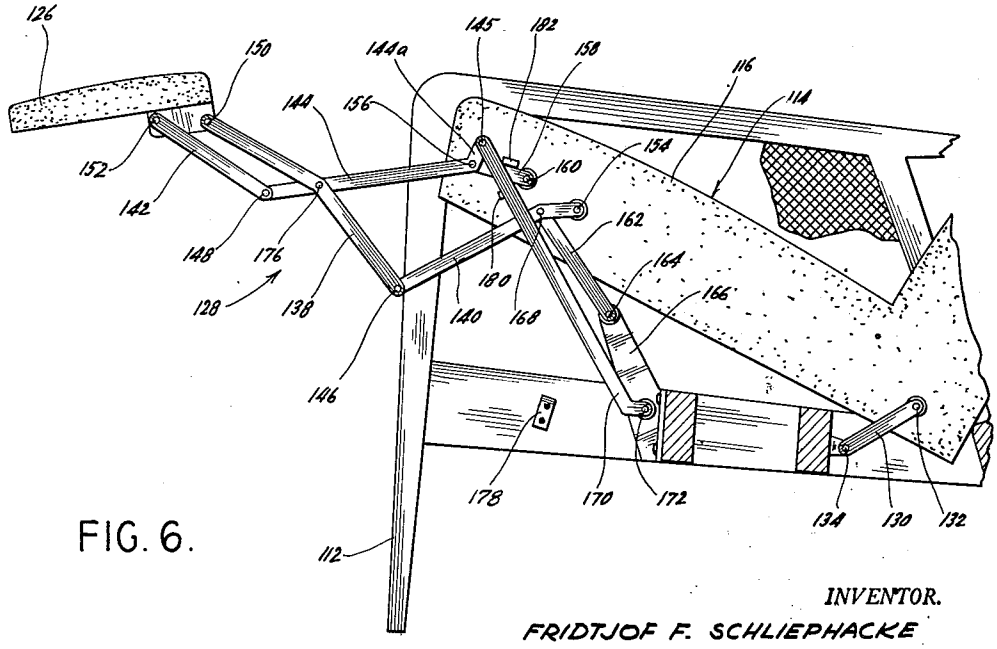


FIG. 6.

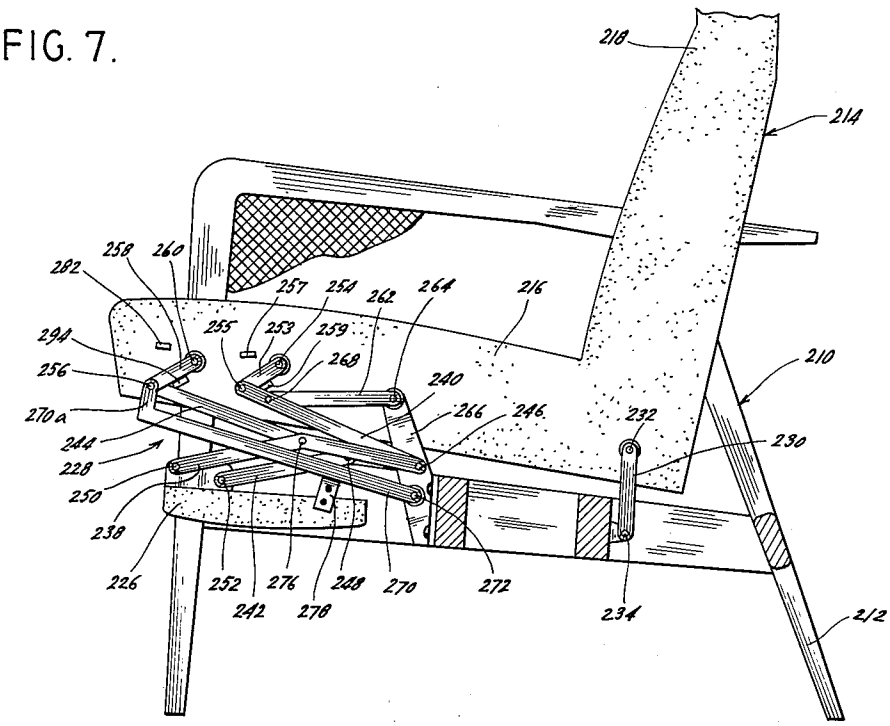
INVENTOR.
FRIDTJOF F. SCHLIEPHACKE
BY
Amster & Levy
ATTORNEYS

Sept. 18, 1962 F. F. SCHLIEPHACKE 3,054,639

LEG REST CONTROL LINKAGE FOR RECLINING CHAIRS

Filed March 31, 1959 6 Sheets-Sheet 4

FIG. 7.



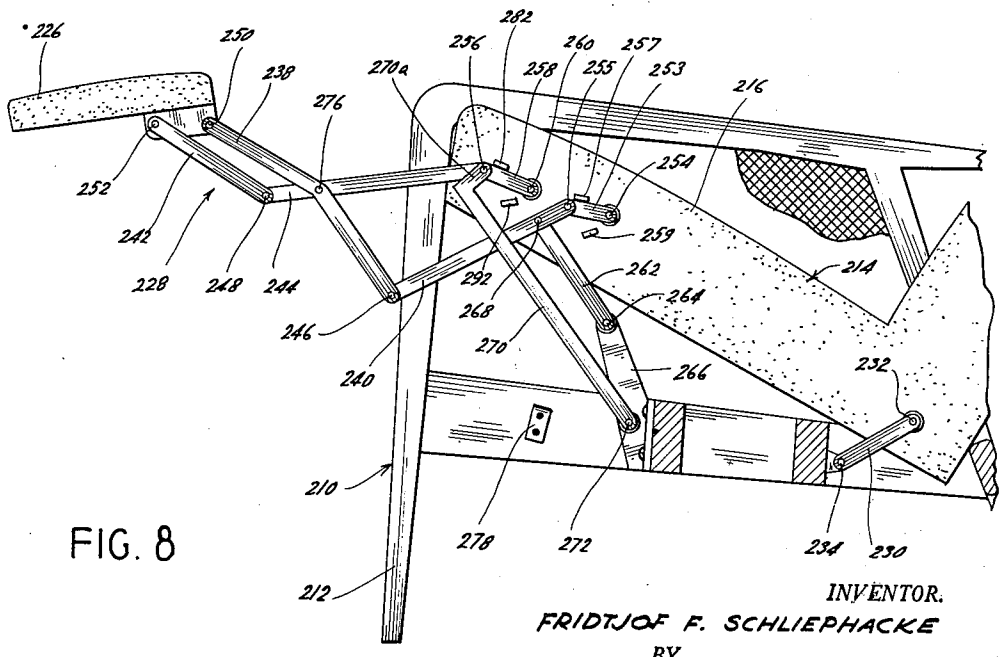


FIG. 8

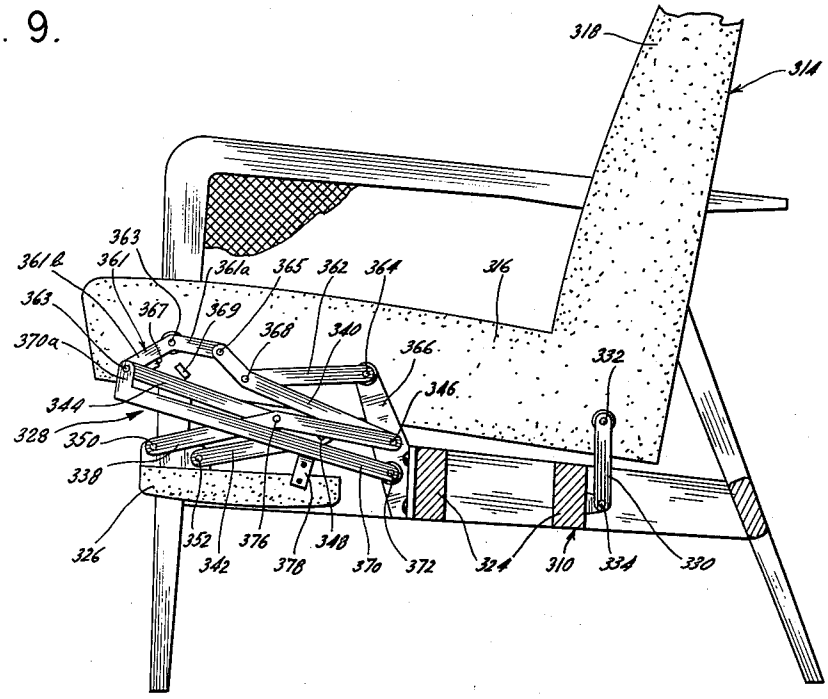
INVENTOR.
FRIDTJOF F. SCHLIEPHACKE
BY
Amster + Levy.
ATTORNEYS

Sept. 18, 1962 F. F. SCHLIEPHACKE 3,054,639

LEG REST CONTROL LINKAGE FOR RECLINING CHAIRS

Filed March 31, 1959 6 Sheets-Sheet 5

FIG. 9.



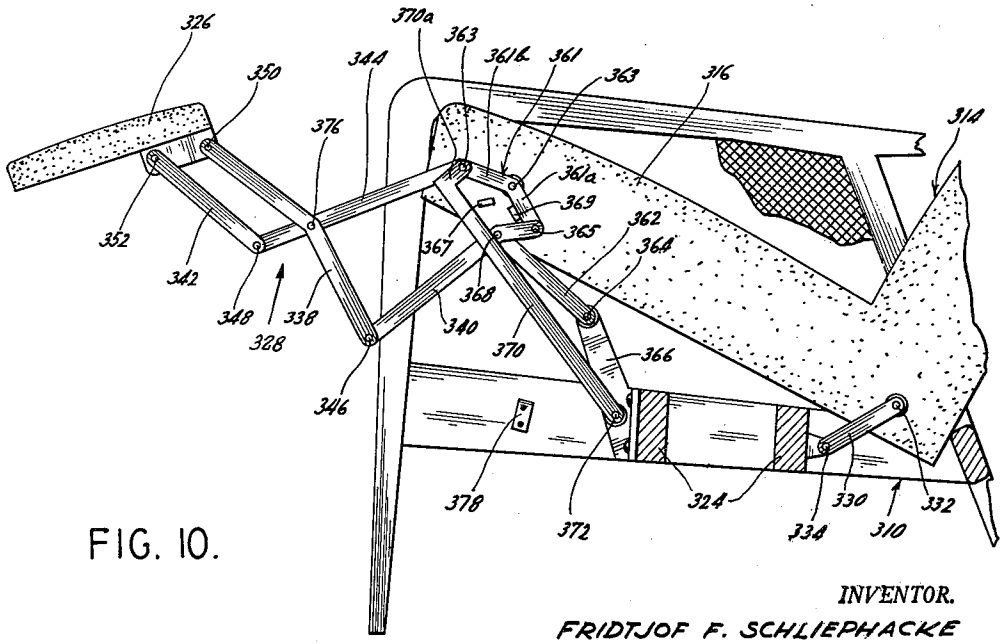


FIG. 10.

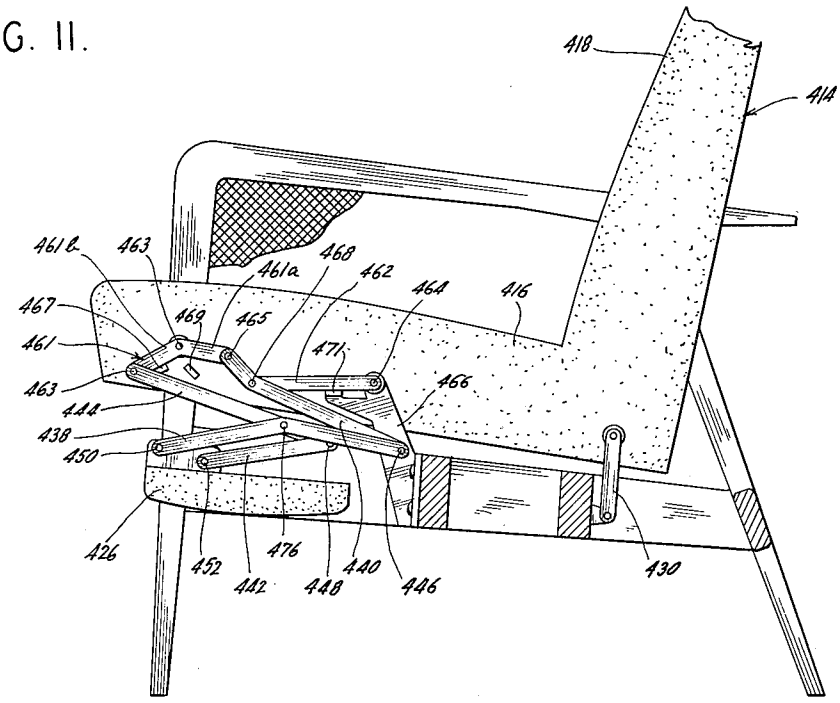
INVENTOR.
FRIDTJOF F. SCHLIEPHACKE
BY
Armstrong + Levy
ATTORNEYS

Sept. 18, 1962 F. F. SCHLIEPHACKE 3,054,639

LEG REST CONTROL LINKAGE FOR RECLINING CHAIRS

Filed March 31, 1959 6 Sheets-Sheet 6

FIG. 11.



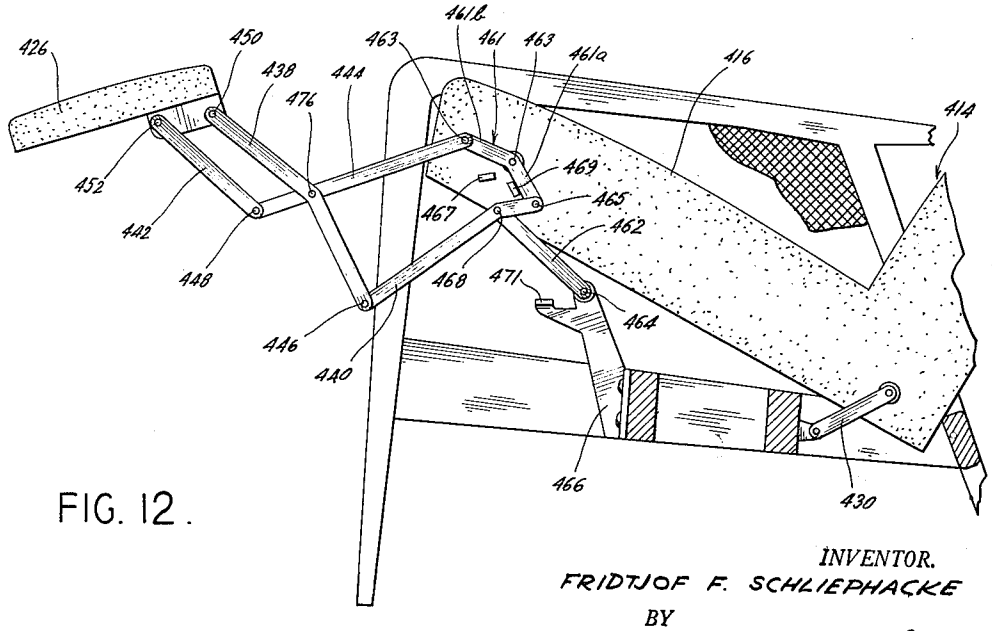


FIG. 12.

INVENTOR.
FRIDTJOF F. SCHLIEPHACKE
BY
Armstrong + Levy
ATTORNEYS

United States Patent Office 3,054,639 Patented Sept. 18, 1962

3,054,639

LEG REST CONTROL LINKAGE FOR RECLINING CHAIRS

Fridtjof F. Schliephacke, Berlin-Schmargendorf, Germany, assignor to Anton Lorenz, Ocean Ridge, Boynton Beach, Fla.

Filed Mar. 31, 1959, Ser. No. 803,195
9 Claims. (Cl. 297—89)

The present invention relates to improvements in reclining chairs and in particular to a novel and improved leg-rest linkage for reclining chairs having an underslung type of leg rest which when retracted folds inwardly to a position parallel to and close to the lower surface of the seat.

The leg rest linkage of the present invention is particularly adapted for use in a reclining chair of the type having a rigid seat and backrests and in which the seat is raised well above the floor surface by high legs. Recent styling developments in reclining chairs of this type have imposed particular problems, particularly with regard to extension of the leg rest to an extended position in response to rearward tilting movements of the body supporting structure. For esthetic purposes, the chair frame is mounted on relatively long legs of narrow diameter so that an open space is provided between the bottom of the seat and the floor surface. In chairs having this modern styling, it is necessary 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 for this purpose the leg rest must be mounted so that in its retracted position it is closely spaced from the bottom surface of the seat and is maintained parallel to the seat. The leg rest linkage must also be so arranged and constructed that in its folding or collapsed position it is in very compact form with the links thereof closely spaced from each other and preferably substantially parallel to each other. In this condition, neither the leg rest nor the leg rest linkage is visible from outside the chair, when the body supporting structure is in the sitting position.

A serious problem presented by the structure of a chair of the above-mentioned type is concerned with the movements of the leg rest from its underslung, inverted, retracted position to an extended position forwardly of and substantially at the level of the seat, when the body supporting structure is moved from its upright sitting position to a rearwardly-tilted position. In order to bring the leg rest from its retracted position to its extended position, the leg rest must first be swung downwardly and forwardly from its substantially horizontal position beneath the seat to a vertical position beneath the forward end of the seat, and then swung upwardly and outwardly so that it is spaced forwardly of the front end of the seat. The requirements of chair design are such that the height of the seat above the floor surface must be standard to insure a comfortable sitting position. The spacing of the seat from the floor therefore provides very limited space through which the leg rest can travel in its path of movement. The leg rest must of course pass through this limited space in such a manner that it will not strike or scrape the floor. A structural requirement of the chair, therefore, is that the lowest portion of the leg-rest must have a clearance of at least one inch above the floor during its path of movement from its horizontal underslung position in order to insure that the leg rest does not strike the floor or even a rug upon which the chair may be resting. This problem is accentuated by the fact that the leg rest must be mounted on relatively long links in order to enable it to be positioned well forwardly of the seat in its extended position.

It is an object of the present invention to provide a leg rest linkage for a reclining chair of the type described, which linkage is made up of links of relatively small size which are effective to move the leg rest to an extended position well forwardly of the front of the seat, and at the same time is so constructed and arranged as to provide sufficient clearance between the leg-rest and the floor when the leg rest is initially moved downward from its underslung position beneath the seat.

Another object of the invention is the provision of a leg-rest linkage of the character described which incorporates lost motion means for delaying the opening of said linkage until the front of the seat has been raised a sufficient distance from the floor to permit the leg-rest to pass freely therebeneath without striking or scraping the floor surface.

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 side frame, high legs, etc.

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

FIG. 1 is a perspective view of a reclining chair incorporating the leg rest linkage of the present invention;

FIG. 2 is a side elevational view, with parts broken away and shown in section, of an improved reclining chair embodying the leg-rest linkage of the present invention, the chair being shown in its upright or its sitting position;

FIG. 3 is a side elevational view similar to FIG. 1, showing the chair in a partially tilted or intermediate position with the leg-rest linkage slightly extended, but with the leg-rest in a position in which it has not yet reached the lowest point in its path of movement;

FIG. 4 is a side elevational view similar to FIG. 3, but showing the chair tilted rearwardly to its fullest extent and the leg-rest in its elevated leg-supporting position;

FIG. 5 is a side elevational view, with parts broken away and shown in section, of a reclining chair having a modified leg-rest linkage made in accordance with the invention herein, the chair being shown in its upright or sitting position.

FIG. 6 is a side elevational view of the forward position of the chair of FIG. 5, showing the chair in its rearwardly-tilted position and the leg rest linkage in its full-extended leg-supporting position;

FIG. 7 is a side elevational view, with parts broken away and shown in section, of a reclining chair having another modified type of leg-rest linkage made in accordance with the invention, the chair being shown in its upright sitting position;

FIG. 8 is a side elevation of the forward portion of the chair shown in FIG. 7, with the chair shown in its rearwardly-tilted position and the leg-rest linkage thereof in its extended leg-supporting position;

FIG. 9 is a side elevational view of a reclining chair incorporating still another type of leg-rest linkage made in accordance with the present invention, the chair being shown in its upright sitting position;

FIG. 10 is a partial side elevational view of the chair shown in FIG. 9, but showing the chair in its rearwardly-tilted position with the leg-rest in its fully-extended, leg-supporting position;

FIG. 11 is a side elevational view of a reclining chair incorporating a further modified type of leg-rest linkage made in accordance with the present invention; the chair being shown in an upright sitting position; and

FIG. 12 is a side elevational view similar to FIG. 11 but showing the chair thereof in its rearwardly-tilted position with the leg-rest linkage extended and in a position for supporting the legs of the occupant of the seat.

Referring now specifically to the drawings, FIG. 1 illustrates 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**.

FIG. 2 shows the inner constructional detail of the chair illustrated in FIG. 1. It will be observed that the support frame **10** includes open side frames **20** which have side rails **22** connected by cross bars or braces **24**. The chair also includes a leg-rest **26** which is carried by a leg-rest actuating linkage designated generally by the reference numeral **28**, the latter being mounted on the support frame **10** and connected to the seat **16** in a manner which will be presently described.

As can be readily seen in FIG. 2, the legs **12** are made in accordance with modern styling and are relatively high and narrow so as to present a large unencumbered space beneath the seat **16**. In conformance with this modern styling, it is required 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**. For this purpose it will also be observed that the leg-rest linkage **28** in this retracted position of the leg-rest is collapsed to a very compact condition in which the links of said linkage are closely folded adjacent the seat **16** and the side rails **22** are also hidden from view. The leg-rest **26** in its retracted position is inverted as shown in FIG. 2, and in order to be brought to its extended position illustrated in FIG. 4 it is necessary to move the leg rest downwardly and outwardly through a designated path of movement, during which movement the leg-rest is brought to a vertical position and approaches the surface of the floor. As was previously indicated, this invention is concerned with the problem of providing sufficient clearance of the leg rest in order to prevent the latter from striking or scraping along the floor surface when the leg rest is moved through said path of movement.

The body supporting unit **14** is mounted for rearward tilting movement upon support frame **10** by a link **30** which is connected at its upper end by pivot **32** to said unit **14** at the juncture between the seat **16** and back-rest **18**. The other end of the link **30** is connected by pivot **34** to a bracket **36** which is formed as a fixed part of the support frame **10**. When the occupant of the chair in the sitting position leans rearwardly upon the backrest **18**, the body supporting unit **14** will tilt rearwardly about the pivot **32**, and at the same time the link **30** will swing rearwardly about the pivot **34** to carry the body supporting unit in a rearward direction relative to the support frame **10** until the fully tilted position of said body supporting unit (shown in FIG. 4) is reached. In this fully tilted position of FIG. 4, the rear surface of the back-rest **18** engages the rearmost cross bar **24**, the latter serving as stop means to limit further rearward tilting movement of said body supporting unit.

Referring now specifically to the leg-rest linkage **28** which incorporates the invention herein, the leg-rest **26** is supported and guided by a first pair of links **38**, **40** and a second pair of links **42**, **44**. The first pair of links **38** and **40** are interconnected in end-to-end relationship by a pivot **46**, while the second pair of links **42** and **44** are likewise connected end-to-end by a pivot **48**. The free end of the link **38** is connected to the structure of the leg-rest **26** by a pivot **50**. The free end of the link **42** of the second pair of links is also connected to the leg-rest structure by pivot **52** at a point spaced from the pivotal connection **50** of the link **38** to said leg rest **26**.

The free end of the link **40** is pivotally mounted at **54** on the seat **16** at a point near the forward end thereof.

The free end of the link **44** of the second pair of links is connected by pivot **56** to one end of an auxiliary link **58** the other end of which is pivotally mounted at **60** on the seat **16** at a point spaced forwardly of the pivotal mount **54**. The auxiliary link **58** forms a part of the leg-rest control linkage during the initial rearward tilting movement of the body supporting structure **14**, and serves as lost motion means for delaying the extension of the leg-rest linkage, in a manner which will be presently described.

Movement of the first link pair **38**, **40** is effected by a first actuating link **62** which is pivotally mounted at **64** on an elongated bracket **66** which is fixed to the support frame **10** and forms a rigid portion thereof. The first actuating link **62** is connected by pivot **68** to the upper end portion of the link **40** of the first pair of links and serve as a pusher link to cause the first pair of links **38**, **40** to move to their extended position when the body supporting unit **14** is tilted and moved rearwardly.

A second actuating link **70** is associated with the second pair of links **42** and **44**. This second actuating link **70** is pivotally mounted at **72** on the fixed elongated bracket **66**, and has a bent free end portion **70***a* which is pivotally connected by pivot **56** to the link **44** and auxiliary link **58** coaxially with the point of connection between said two latter links. The second actuating link **70** serves as a pusher link to cause the auxiliary link **58** to pivot upwardly during the initial movement of the body supporting structure **14** from its upright sitting position of FIG. 2 to its rearwardly tilted position of FIG. 4.

The link **38** of the first pair of links crosses over the link **44** of the second pair of links and is pivotally connected thereto at its crossing-over point by pivot **76**.

In the sitting position of the body supporting unit **14** shown in FIG. 2, the leg-rest linkage **28** is folded up into compact form and the leg-rest **26** is held in an inverted position substantially parallel to and closely spaced from the bottom surface of the seat **16**. The side rails **22** are made sufficiently wide, or the open side frames **20** are provided with sufficient filler material **20***a*, to cover the leg-rest **26** and the leg-rest linkage **28** so that these parts are not visible from the exterior of the chair. In this sitting position, the second actuating link **70** is resting upon a stop member **78** which is fixed to the side rails **22** of the chair support frame **10**, so that the forward portion of the seat **16** is restrained against downward pivoting movement and the leg-rest **26** is maintained in its underslung retracted position. The auxiliary link **58** is resting upon a stop **80** which is also affixed to the seat **16**, this stop **80** serving to lock the leg rest linkage in its folded position and prevent its downward collapse. The links of the leg rest linkage **28** can therefore not move until the body supporting unit **14** is moved rearwardly from its sitting position of FIG. 2.

When the occupant of the chair in the sitting position of FIG. 2 exerts a slight pressure against the back rest **12**, the body supporting unit **14** will move rearwardly guided by the guide link **30** in a downward arc about the fixed pivot **34** and the front portion of the seat **16** will move upwardly and rearwardly, carrying with it the seat pivots **54** and **60**.

FIG. 3 shows the condition of the chair in the initial stages of the rearward tilting movement of the body supporting unit **14**. As the seat moves rearwardly, the seat pivot **54** is brought closer to the fixed pivot **64**, thereby causing the first actuating link **62** to push against the rearwardly-moving link **40** of the first pair of links and causing said link **40** to begin to pivot about said seat pivot **54**. This pivoting movement of the link **40** increases the angle between the first pair of links **38** and **40**, causing the link **38** to carry the leg rest **26** downwardly and forwardly from its original retracted position of FIG. 1. The second pair of links **42** and **44** determine the attitude of the leg rest **26**, and the action of these links causes the leg rest to turn about the pivot **50** through an angle of

substantially 180° from the substantially horizontal, inverted position of FIG. 1 to the reversed, upright extended position of FIG. 4. In traversing this path of movement, the leg rest 26 passes through a point in which it is vertically disposed and in which its edge is closest to the floor surface. Since the links of the leg-rest linkage 28 are so arranged as to provide an accelerated movement of the leg rest 26 so that the leg rest travels an appreciably greater distance than the body supporting unit 14, ordinarily this vertical position of the leg-rest would be reached at a time before the front portion of the seat 16 has risen sufficiently to allow the leg-rest to clear the floor surface. In accordance with the persent invention however, the auxiliary link 58 acts to delay the action of the second pair of links 42 and 44 until the seat front portion has risen a sufficient distance to provide clearance for the leg-rest. In this connection it will be noted that when the body supporting unit 14 is initially moved rearwardly, the seat pivot 60 is moved toward the fixed pivot 72 causing the second actuating link 70 to urge the auxiliary link 68 in a forward and upward direction. The auxiliary link 58 therefore pivots upwardly about the pivot 60 until it engages a blocking member or stop 82 which is affixed to the seat 16, this position being shown in FIG. 3.

The pushing force of the second actuating link 70 is therefore primarily taken up by the auxiliary link 58, and the second pair of links 42 and 44 are afforded only a small amount of relative movement so that the turning movement of the leg-rest 26 about the pivot 50 is held to a minimum. As shown in FIG. 3, therefore, at the time that the auxiliary link 58 engages the blocking member 82, the leg rest 26 has been moved forwardly past the front portion of the seat, and the leg-rest 26 has not yet been pivoted to its vertical position and is spaced well above the level of the floor surface.

Once the auxiliary link 58 engages the blocking member 82, said auxiliary link 58 becomes a fixed portion of the seat 16 and thereafter becomes inactive. The pivot 56 therefore becomes a seat pivot and the second actuating link 70 is connected thereby to the seat and becomes a guiding link for raising the forward portion of said seat 16. As the body supporting unit continues to pivot and tilt rearwardly, the first actuating link 62 continues to exert a pushing force upon the link 40 of the first pair of links, and the second pair of links through their pivotal connection 76 with the first pair of links serves its normal function in causing the leg-rest 26 to turn about pivot 50 until it assumes the substantially horizontal extended position of FIG. 4. In this extended position of FIG. 4, it will be observed that the leg rest 26 is spaced well forwardly of the front edge of the seat 16 and is substantially at the level thereof.

When the occupant of the chair in the rearwardly-tilted position of FIG. 4 wishes to return to the sitting position of FIG. 1, he need only exert a slight downward pressure with the legs upon the extended leg-rest 26. A reverse action of the leg-rest linkage 28 then occurs to bring the leg-rest 26 back to its underslung retracted position of FIG. 2. The link 40 will move downwardly about its seat pivot 54 and the link 44 will move downwardly about the pivot 56 which still serves as a seat pivot during this first phase of movement because the auxiliary link 58 is still held immovably relative to the seat by its engagement with the blocking member 82. After the leg-rest 26 has passed through that phase of its downward movement in which it is vertically disposed, the auxiliary link 58 leaves the blocking member 82 and begins to pivot downwardly about the seat pivot 60 until it engages the stop 80 to terminate the retracting movement of the leg-rest linkage. In this position the leg rest linkage 28 is completely folded and the leg-rest 26 is securely held in its underslung retracted position of FIG. 2.

The chair may also include a filler board 84 which is operatively connected to the leg-rest linkage 28. As can best be seen in FIGS. 3 and 4 the filler board 84 is supported by a pair of links 86 and 88 which are respectively connected thereto at spaced points by pivots 90 and 92. The free end of the link 88 is connected by pivot 94 to an intermediate point on the seat link 44 of the second pair of links, and the link 86 is connected at an intermediate point by pivot 96 to a forward portion of the leg-rest link 38 of the first pair of links. At its lower end, the link 86 has an elongated slot 98 through which extends a pivot pin 99 affixed to the leg-rest link 42 of the first pair of links.

In the upright sitting position of the chair shown in FIG. 2, the filler board 84 is substantially vertically disposed beneath the front end of the seat 16 and extends downwardly so as to conceal the leg-rest 26 when the chair is viewed from the front. In the rearwardly tilted position of the body supporting unit 14 shown in FIG. 4, the filler board links 86 and 88 are raised by the leg-rest links 38 and 44, and the filler board 84 is brought to the extended position shown in FIG. 4 in which it bridges the gap between the front edge of the seat 16 and the leg rest 26. The filler board 84 in this position serves as an auxiliary support upon which the upper portion of the legs of the occupant may rest. The two pivotal connections 96 and 99 of the filler board link 86 with the respective leg rest links 38 and 42 prevent the filler board linkage from collapsing in the retracted position of FIG. 2. On the other hand, the elongated slot 98 provides a sliding connection between the filler board link 86 and the leg rest link 42 which permits the filler board 84 to be brought to its extended position of FIG. 4. The filler board 84 carries a fixed stop member 97 which engages the link 88 in the position of FIG. 4, to hold the filler board immovably in its extended position.

In the succeeding embodiments now to be described, the filler board and its linkage will be omitted for the sake of clarity, it being understood however, that it is contemplated that a filler board of the type described in connection with FIGS. 1 through 4 can be incorporated in any one of the linkages of such succeeding embodiments.

Referring now specifically to FIGS. 5 and 6 of the drawings, there is shown a reclining chair which incorporates another embodiment of leg rest linkage demonstrating further features of the present invention. In these views similar reference numerals are used for like parts, except that these numerals are in the "100" series.

Again the chair includes a support frame 110 having relatively long legs 112 and mounting a body supporting unit 114 which includes a seat 116 and backrest 118 formed rigidly with each other. The body supporting unit 114 is mounted for rearward tilting movement upon the support frame 110 by a link 130 which is connected at its upper end by a pivot 132 to the rear end portion of said body supporting unit, and at its lower end by pivot 134 to the support frame 110. The leg-rest 126 is supported and guided by a leg-rest linkage 128 which is similar in construction to the leg-rest linkage of FIGS. 2 through 4, except as will be presently explained.

As in the previously-described embodiment, the leg rest linkage 128 includes a first pair of links 138 and 140 connected in end-to-end relationship by pivot 146. The free end of link 138 is connected by pivot 150 to the leg-rest 126, while the free end of link 140 is connected by pivot 154 to the seat 116. A second pair of links 142 and 144 are also connected in end-to-end relationship by a pivot 148. The free end of the link 142 is connected by pivot 152 to a point on the leg rest 126 which is spaced on the pivot 150 while the free end of the link 144 is connected by a pivot 156 to the lower end of an auxiliary link 158. The auxiliary link 158 is connected at its opposite end by pivot 160 to the seat 116. The links 138 and 144 cross each other and are connected at their crossing over point by a pivot 176. Movement of the first pair of links 138 and 140 is effected by a first actuating link 162 which is mounted at 164 on a bracket 166 formed

as a fixed part of the support frame **110**, the other end of the first actuating link **162** being connected by pivot **168** to the upper portion of link **140**.

Movement of the auxiliary link **158** is effected by a second actuating link **170** which is connected at one end by pivot **172** to the fixed bracket **166**. This second actuating link **170** is coupled to the auxiliary link **158** in a different manner from that of the previous embodiment of FIGS. 2 to 4, that is to say the actuating link **170** is not connected concentrically with the point of connection between the auxiliary link **158** and the link **144** of the second pair of links. Rather, said link **144** has an angular terminal extension **144***a*, to the free end of which the free end of the second actuating link **170** is connected by pivot **145**.

The operation of this leg rest linkage of FIGS. 5 and 6 is essentially the same as that described for the embodiment of FIGS. 2 to 4. In the sitting position of the chair shown in FIG. 5, the leg-rest linkage **128** is in the collapsed position shown, and the leg-rest **126** is in its underslung retracted position in which it is substantially horizontally disposed and closely spaced from the bottom surface of the seat **116**. The second actuating link **170** is resting upon a stop **178** which is affixed to the support frame **110**, and the auxiliary link **158** is resting upon a stop **180** which is also formed as a fixed part of the seat **116**.

When the occupant of the seat in the upright sitting position of FIG. 5 leans rearwardly upon the backrest **118**, the link **130** will pivot rearwardly to move the body supporting unit **114** in a rearward direction, and the body supporting unit will also begin to tilt about the pivot **134**. During the initial phase of this movement, the second actuating link **170** will exert a pushing action upon the auxiliary link **158** thorugh the link extension **144***a*, and the auxiliary link **158** will pivot upwardly until it abuts the blocking member **182**, thereby absorbing some of the movement of the leg-rest linkage **128** and preventing the said linkage from extending until the forward end of the seat has risen a sufficient distance to provide clearance for the movement of the leg rest **126**. After the seat has risen a sufficient distance to provide such clearance, the auxiliary link **158** engages the blocking member **182** and becomes a rigid portion of the seat, the second actuating link **170** now pushing directly upon the seat link **144** of the second pair of links through its pivotal connection **145**, and the link **144** having a lever action to bring the leg rest **126** to the substantially horizontal extended position shown in FIG. 6.

FIGS. 7 and 8 illustrate still another modified type of leg-rest linkage made in accordance with the invention and incorporated in a chair of identical structure to that previously described. The leg-rest linkage differs from that shown in FIGS. 2 through 4 in that a second auxiliary link is provided for the first pair of links.

The leg-rest linkage **228** again comprises a first pair of links **238** and **240** connected in end-to-end relationship by a pivot **246** and a second pair of links **242** and **244** connected end to end by pivot **248**. The free ends of the links **238** and **242** are connected at spaced points on the leg-rest **226** by respective pivots **250** and **252**. The free end of the link **244** is pivotally connected at **256** to an auxiliary link **258**, the other end of which is pivotally mounted at **260** on a forward portion of the seat **216**. The free end of the link **240** of the first pair of links is connected by pivot **255** to a second auxiliary link **253**, the free end of which is pivoted at **254** to a point on the seat which is spaced rearwardly from the pivotal connection **260**.

The leg-rest linkage **228** again includes a first actuating link **262** which is pivotally mounted at **264** on a bracket **266** formed as a rigid part of the support frame **210**. The forward end of the first actuating link **262** is connected by pivot **268** to an upper portion of the link **240** of the first pair of links. A second actuating link **270** is pivotally mounted at one end by pivot **272** to said bracket **266**, the other end of said link **270** having a vent extension portion **270***a* which is connected by pivot **256** to the pivotal connection between link **244** and the first auxiliary link **258**. The links **238** and **244** cross each other and are connected at the crossing-over point by a pivot **276**.

The operation of this leg rest linkage **228** is essentially the same as that described in connection with the embodiment of FIGS. 2, 3 and 4. In the sitting position of the body supporting unit **214**, shown in FIG. 7, the second actuating link **270** rests upon a stop **278** affixed to the support frame **210** while the auxiliary links **258** and **253** rest upon respective stops **294** and **259** which are fixed to the seat, thereby supporting the front end of the seat **216** and maintaining the leg rest linkage **228** in its compact folded position with the leg rest **226** in its underslung retracted position. When the occupant of the chair leans rearwardly upon the backrest **218**, the body supporting unit **214** begins to turn about the pivot **232**, and the link **230** swings rearwardly about its fixed pivot **234** to move the body supporting unit in a rearward direction. The two actuating links **262** and **270**, however, instead of having a direct effect upon the link pairs **38**, **40**, **42** and **44**, cause both auxiliary links **253** and **258** to pivot upwardly until they engage the respectively blocking members **257** and **282** which are affixed to the seat. Thus a double lost motion means is provided for delaying the opening action of the leg-rest linkage **228** until the seat **216** has been raised a sufficient distance to permit the leg rest **226** to be swung outwardly and brought through its vertical position, while at the same time clearing the floor surface. This delay period during the first phase of motion is longer than in the previous embodiments, so that the leg rest in this instance may be made larger and still have an opportunity to clear the floor surface.

A modified type of leg-rest linkage **328** is shown in FIGS. 9 and 10. In this structure, neither of the pairs of leg-rest links are pivotally mounted directly on the seat, but rather each is pivotally mounted on an end of a lever which is in turn mounted on the seat.

In this construction, a double-arm lever **361** is mounted intermediate its ends on the front end of the seat **316** by a pivot **363**. The first pair of links **338** and **340** are connected end-to-end by pivot **346**. The free end of link **340** is connected by pivot **365** to one arm **361***a* of the double-arm lever **361**, while the free end of the other link **338** is connected by pivot **350** to the leg-rest **326**. The second pair of links **342** and **344** are connected end-to-end by a pivot **348**. The free end of link **342** is connected by pivot **352** to the leg-rest **326**, while the free end of link **344** is connected by pivot **363** to the arm **361***b* of the double-arm lever **361**. The links **338** and **344** cross each other and are connected by pivot **376** at their crossing-over point.

A first actuating link **362** is pivotally mounted at **364** on a bracket **366** connected to cross bar **324** and forming a fixed part of the chair support frame **310**. The other end of the first actuating link **362** is connected by pivot **368** to an intermediate point on the link **340** of the first link pair.

A second actuating link **370** is also pivotally mounted on the bracket **366**, this connection being effected by pivot **372**. The other end of the second actuating link **370** has an inclined offset terminal portion **370***a* which is connected by pivot **363** to the point of connection between the link **344** of the second link pair to the arm **361***b* of the double-arm lever **361**.

In the upright sitting position of the chair shown in FIG. 9, the double arm lever arm **361***b* rests upon a stop **367** which is rigidly and immovably mounted on the forward end of the seat **316**. This stop **367** prevents any expanding movement of the leg-rest linkage **328** while the body-supporting unit **314** is in said upright sitting

position, so that the leg-rest linkage 328 is maintained in its collapsed position with the leg-rest 326 retracted and underslung, as shown in FIG. 9. The second actuating link 370 also rests upon a stop 378 which is rigidly mounted on the support frame 310, this stop 378 serving to support the forward end of the seat 316 in the upright sitting position of the body-supporting unit 314. The rear end of the seat is supported by the link 330 which is connected to the body-supporting unit 314 and the support frame 310 by respective pivots 332 and 334.

When the occupant of the chair exerts rearward pressure against the back-rest 318, the rear portion of the body-supporting unit 314 will tilt rearwardly about the pivot 332 on link 330, and the link 330 will also turn rearwardly about the fixed pivot 334 to move the body-supporting unit 314 in a rearward direction relative to the support frame 310. As the seat 316 moves rearwardly the pivot 365 is brought closer to the fixed pivot 364, causing the first actuating link 362 to push upon the rearwardly-moving link 340 of the first pair of links and causing the link 340 to being to pivot about said pivot 365. In the same manner, the second actuating link 370 exerts a pushing force upon the arm 361*b* of the double-arm lever 361, causing the latter to pivot in a clockwise direction about the seat pivot 363. The double-arm lever 361 therefore serves in this instance as the auxiliary link which takes up the pushing force of the second actuating link 370 during the first movement phase, so that the second pair of links 342 and 344 are afforded very little relative movement. The pivoting movement of the leg-rest 326 about the pivot 350 is therefore held to a minimum, and the linkage 328 is retarded in its expansion until the forward end of the seat 316 has risen sufficiently to prevent the leg-rest from engaging the floor surface in its movement to the extended position.

The double-arm lever 361 also serves an additional function in delaying movement of the first pair of links 338 and 340. As the second actuating link 370 pushes upon the arm 361*b* and turns the double-arm lever 361, the other arm 361*a* moves in a direction to maintain the links 340 in its collapsed position. Thus, during this first phase of movement, the pushing action of the first actuating link 362 is also substantially absorbed by the pivoting movement of the double-arm lever 361.

The first movement phase is ended by the engagement of the double-arm lever arm 361*a* with a blocking member 369 which is rigidly affixed to the seat 369. Thereafter, the double-arm lever 361 becomes a rigid portion of the seat 316 and the full pushing force of the first actuating link 362 is directed to the link 340 of the first link pair. The linkage 328 is thus fully actuated to bring the leg-rest 326 to the extended position shown in FIG. 10.

A further modification of the leg-rest linkage is shown in FIGS. 11 and 12. This linkage is similar to that illustrated in FIGS. 9 and 10 and just described, except that the second actuating link is eliminated.

In this embodiment of FIGS. 9 and 10, the first pair of links 438 and 440, connected by pivot 446, are connected at one end to the leg-rest 426 at 450, and at the other end by pivot 465 to the arm 461*a* of double-arm lever 461. The second pair of links 442 and 444, connected by pivot 448, are connected at one end to the leg-rest 426 at 452, and at the other end by pivot 463 to the arm 461*b* of double-arm lever 461. At their crossing-over point the links 438 and 444 are connected by pivot 476. The double-arm lever 461 is mounted intermediate its ends on the seat 416 by pivot 463.

The first actuating link 462 is pivotally mounted at 464 on bracket 466 which is rigidly monuted on the support frame 410. The free end of the first actuating link 462 is connected by pivot 468 to the link 440. As can be seen in FIGS. 11 and 12, there is no second actuating link in this instance.

In the upright sitting position of the body-supporting unit 414, shown in FIG. 11, the first actuating link 462 rests upon a stop member 471, formed as a rigid part of the fixed bracket 466, to support the front end of the seat 416. The lever arm 461*b* also rests upon stop 467, formed as a rigid part of the seat 416, thereby preventing any opening movement of the leg-rest linkage 428 while the chair is in its upright sitting position.

When the occupant of the chair, in the sitting position of FIG. 11, exerts rearward pressure on the back-rest 418, the body-supporting unit 414 tilts rearwardly and is moved in a rearward direction by the rear link 430. The first actuating link 462 exerts a pushing force against link 440, but this is transmitted to the lever arm 461*a*, causing double-arm lever 461 to turn in a clockwise direction about its seat pivot 463. In this first phase of movement, such pivoting movement of the double-arm lever 461 retards the opening movement of the first pair of links 438 and 440. In addition, the upward movement of lever arm 461*b* also retards the opening movement of the second pair of links 442 and 444.

The first movement phase terminates when the lever arm 461*a* engages the stop 469 which is fixed to the seat. The bell-crank lever 461 thus becomes immovable relative to the seat and thereafter the pivots 463 and 465 become fixed seat pivots. The first actuating link 462 is then effective to actuate the first link pair 438, 440 and also to actuate the second link pair 442, 444 through said first link pair. Thus, the leg-rest linkage 428 is brought to its extended position of FIG. 12 without the necessity for providing a second actuating link.

While preferred embodiments of the invention have been shown and described herein by way of illustrative examples, 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. In a reclining chair having a support frame, a body-supporting structure including a seat and a back-rest mounted on said support frame for rearward movement to a tilted position, and a leg-rest, leg-rest control means for supporting said leg-rest and moving the latter from a retracted position beneath the seat to an extended position forwardly of the seat, said leg-rest control means including a constrained linkage mounted on the seat for movement therewith and carrying said leg-rest, actuating means connecting said constrained linkage to the support frame for actuating said constrained linkage to extend said leg-rest in response to rearward movement of said body-supporting means, and an auxiliary link connecting at least one link of said constrained linkage to said seat, said auxiliary link being pivotally mounted on said seat and associated with said actuating means for lost motion pivotal movement when said body supporting structure is initially moved rearwardly, whereby to delay actuation of said constrained linkage, said constrained linkage including a first pair of links connected end-to-end and a second pair of links connected end-to-end, one link of each link pair being pivotally connected to the leg-rest, the other link of the first pair of links being pivotally mounted on the seat, the other link of said second pair of links being pivotally connected to the auxiliary link, said auxiliary link being pivotally mounted on the seat.

2. Leg-rest control means according to claim 1 in which said actuating means includes an actuating link pivotally mounted on the support frame and pivotally connected to said other link of the first pair of links.

3. Leg-rest control means according to claim 2 in which said actuating means also includes a second actuating link pivotally mounted on the support frame and pivotally connected to said other link of the second pair of links.

4. In a reclining chair having a support frame, a body-supporting unit including a rigidly-formed seat and a back-rest mounted on said support frame for rearward movement from an upright sitting position to a tilted posi-

tion, and a leg-rest, a leg-rest control linkage for supporting the leg-rest and moving the latter from a retracted, underslung position beneath the seat to an extended position forwardly of the seat, said leg-rest control linkage, including a first and second pair of links, each connected in end-to-end relationship, a first link of each pair being pivotally connected to the leg-rest, the second link of each pair being operatively coupled to the seat for movement therewith, an actuating link pivotally mounted on the support frame and connected to the link of one of said link pairs for actuating said link pairs to move the leg-rest toward its extended position in response to rearward tilting movement of the body-supporting unit, and lost motion means operatively connecting the second link of the second pair of links to said seat, said lost motion means being movable during an initial phase of rearward tilting movement of the body-supporting unit and retarding the effect of said actuating link upon said link pairs whereby to delay the movement of said leg-rest to its extended position, the lost motion means comprising an auxiliary link pivotally mounted on the seat and extending downwardly and forwardly to a pivotal connection with the second link of the second pair of links.

5. A leg-rest control linkage according to claim 4 in which the lost motion means also comprises second auxiliary link pivotally mounted at a spaced point on the seat and pivotally connected to the second link of the first pair of links.

6. A leg-rest control linkage according to claim 4 in which the auxiliary link comprises a bell-crank lever pivotally mounted intermediate its ends on the seat and having a first arm pivotally connected to the second link of the second pair of links and a second arm pivotally connected to the second link of the first pair of links.

7. A leg-rest control linkage according to claim 4 in which the structure includes a second actuating link pivotally mounted on the support frame and connected to the second link of the first pair of links.

8. In a reclining chair having a support frame, a body-supporting structure including a seat and back-rest mounted on said support frame for rearward movement from an upright sitting position to a reclining position, and a leg-rest; leg-rest control means for supporting said leg-rest and moving the latter from a retracted substantially horizontal, inverted position beneath the seat through a vertical position to an upright, substantially horizontal position forwardly of the seat, said leg-rest control means including a lazy-tong linkage carrying said leg-rest and expandable to guide the leg-rest to its extended position, means mounting said lazy-tong linkage on said seat, and an actuating link mounted on the support frame and connected to said lazy-tong linkage for expanding the latter to bring the leg-rest to its extended position when the body-supporting structure is moved on the support frame to its reclining position, said mounting means including lost motion means connecting at least one link of the lazy-tong linkage to the seat and providing a pivotal mount therefor, said lost motion means being movable in a lost motion movement during the initial rearward movement of the body-supporting structure from its upright sitting position to its reclining position and said pivotal mount moving relative to the seat in a direction away from said actuating link to absorb the actuating force of said actuating link without substantial expansion of said lazy-tong linkage, whereby to delay turning movement of the leg-rest through its vertical position as the leg-rest is extended forwardly until the forward end of the seat thas risen a sufficient distance to provide clearance for the leg-rest to pass therebeneath, and stop means on said seat positioned to engage and block further movement of said lost motion means at the end of said initial movement of the body-supporting structure and thereby provide a stationary pivotal mount for said one link on said seat, whereby further rearward movement of said body-supporting structure expands said lazy-tong linkage through said actuating link to bring said leg-rest to its extended position.

9. In a reclining chair having a support frame, a body-supporting structure including a seat and back-rest mounted on said support frame for rearward movement from an upright sitting position to a reclining position, and a leg-rest; leg-rest control means for supporting said leg-rest and moving the latter from a retracted substantially horizontal, inverted position beneath the seat through a vertical position to an upright, substantially horizontal position forwardly of the seat, said leg-rest control means including a lazy-tong linkage carrying said leg-rest and expandable to guide the leg-rest to its extended position, means mounting said lazy-tong linkage on said seat, and an actuating link mounted on the support frame and connected to said lazy-tong linkage for expanding the latter to bring the leg-rest to its extended position when the body-supporting structure is moved on the support frame to its reclining position, said mounting means including an auxiliary link connecting at least one link of the lazy-tong linkage to the seat and providing a pivotal mount therefor, said auxiliary link being movable in a lost motion movement during the initial rearward movement of the body-supporting structure from its upright sitting position to its reclining position and said pivotal mount moving relative to the seat in a direction away from said actuating link to absorb the actuating force of said actuating link without substantial expansion of said lazy-tong linkage, whereby to delay turning movement of the leg-rest through its vertical position as the leg-rest is extended forwardly until the forward end of seat has risen a sufficient distance to provide clearance for the leg-rest to pass therebeneath, and stop means on said seat positioned to engage and block further movement of said auxiliary link at the end of said initial movement of the body-supporting structure and thereby provide a stationary pivotal mount for said one link on said seat, whereby further rearward movement of said body-supporting structure expands said lazy-tong linkage through said actuating link to bring said leg-rest to its extended position.

References Cited in the file of this patent

UNITED STATES PATENTS

2,664,942	Spear	Jan. 5, 1954
2,788,058	Luckhardt	Apr. 9, 1957
2,808,827	O'Hara	Oct. 8, 1957
2,888,978	Schliephacke	June 2, 1958
2,892,485	Schliephacke	June 30, 1959
2,918,113	Lorenz	Dec. 22, 1959