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RECLINING CHAIR WITH LEG-REST MOUNTING LINKAGE

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FIG. 1.

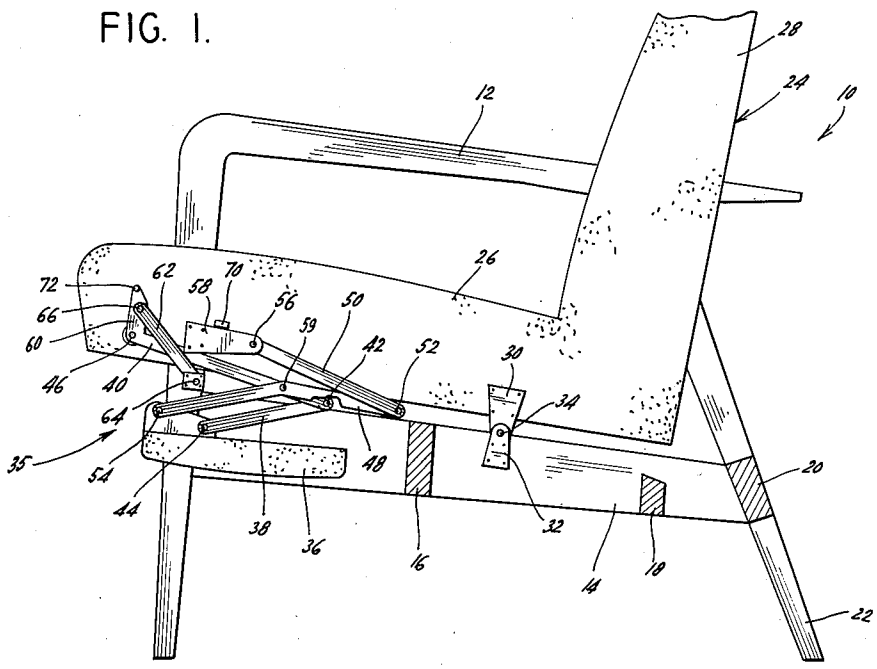
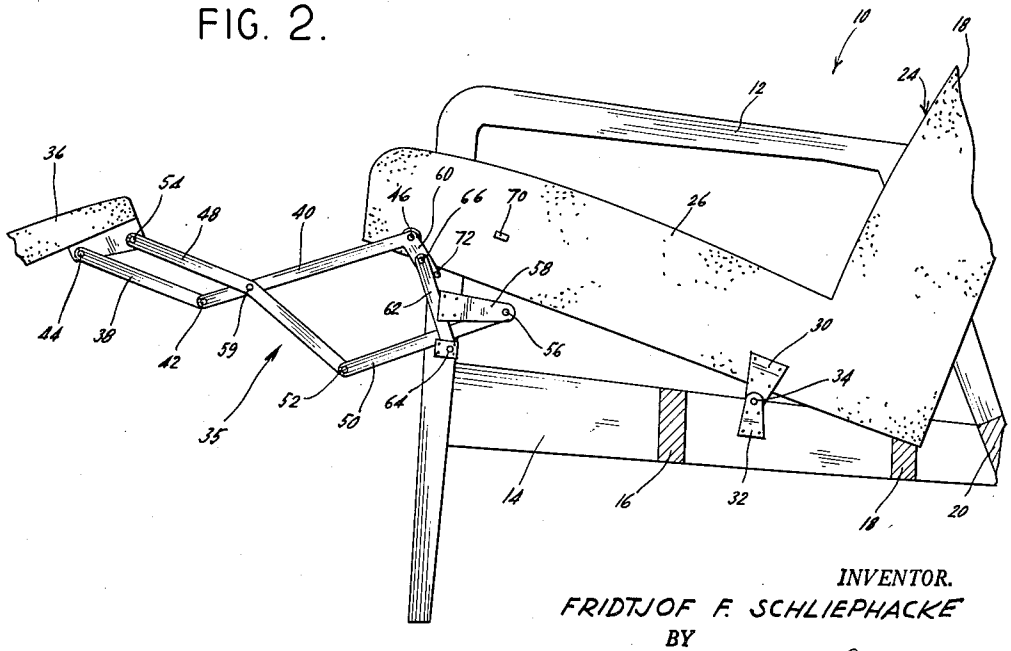


FIG. 2.



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RECLINING CHAIR WITH LEG-REST MOUNTING LINKAGE

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7 Claims. (Cl. 297—89)

The present invention relates to improvements in reclining chairs of the type incorporating an underslung leg-rest, and in particular relates to a new and improved leg-rest linkage which normally maintains the leg-rest in an underslung retracted position, parallel to and close to the lower surface of the seat and is operable to move the leg-rest to an extended position spaced well forwardly of the front of the seat.

Leg-rest arrangements of the underslung type are customarily employed in reclining chairs of the type in which the seat and back-rest structure is movably mounted on a support frame having high legs which maintain the seat raised well above the floor surface and present an open and unencumbered space beneath the seat. In accordance with the dictates of modern styling, such types of chairs are customarily provided with open framework sides mounted on long legs of narrow diameter. and for esthetic reasons it is therefore necessary to conceal the leg-rest and its actuating linkage in the retracted position thereof. Thus, in the normal upright sitting position of the chair, the latter has the appearance of a normal well-styled chair, and its contours remain unbroken by projecting links. An underslung type of leg-rest is therefore employed and is so mounted that in its retracted position it is closely spaced from the bottom surface of the seat and is maintained substantially parallel thereto, being normally concealed by the side rails of the open work chair frame. 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.

The concealment of the leg-rest and its actuating linkage in the upright sitting position of the chair presents a difficult problem when it is considered that as the seat and back-rest are moved rearwardly or tilted into a reclining position, the linkage must be capable of swinging the leg-rest through an angle of approximately 180° from the inverted horizontal position beneath the seat to an upright horizontal position forwardly of the seat. Such a movement involves a relatively long path of travel of the leg-rest in response to a short path of travel of the seat and back-rest structure. The leg-rest linkage must therefore be made in a compact form and at the same time must contain means for accelerating the movements of the leg-rest in response to a relatively short movement of a body supporting structure. This requirement is complicated by the fact that the links of the linkage must be made sufficiently long to permit the leg-rest to be brought to an extended position in which it is spaced well forwardly from the leading edge of the seat and properly positioned to support the legs of the occupant.

A further problem in the construction of a chair of the aforementioned type is encountered when the leg-rest is swung through a vertical position in its travel from the inverted underslung retracted position to the upright extended position. Chair design requires that the seat be located a comfortable distance from the ground surface and the space between the forward end of the seat and the floor surface is therefore limited. The path of travel of the leg-rest must therefore be so regulated that when the leg-rest passes between the seat and the floor surface, it

is not fully in its vertically-disposed position and does not strike or scrape the floor surface.

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

Another object of the invention is the provision of a leg-rest linkage of the character described in which simple and compact means are provided for accelerating the movement of the leg-rest and thereby providing a relatively long path of movement of the leg-rest in response to the short path of movement of the body supporting structure.

A further object of the invention is the provision of a leg-rest linkage of the character described in which novel means are provided for delaying the movement of the leg-rest through its vertically-disposed position until the seat has been raised a sufficient distance to provide clearance above the floor surface for movement of the leg-rest.

In accordance with the present invention, the leg-rest linkage includes a link connecting the leg-rest to the forward end portion of the seat, the link being in the form of a double-arm lever pivotally connected to the seat and controlled by an actuating link pivotally mounted on the support and connected to the short arm of said lever. The double-arm lever, the actuating link, and the seat, form a drag-link mechanism which provides an amplified actuation of the leg-rest linkage and a consequent long path of movement of the leg-rest. At the same time, this drag-link mechanism also provides a lost motion phase of movement which delays the swinging of the leg-rest to its vertical position until the seat has risen a sufficient distance to provide clearance above the floor surface.

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 which show by way of illustrative example the incorporation of the invention into one type of reclining chair, and in which;

FIG. 1 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 sitting position; and

FIG. 2 is a side elevational view similar to FIG. 1, but showing the chair in a rearwardly-tilted position with the leg-rest linkage extended and the leg-rest in its elevated, leg-supporting position.

Referring now specifically to the drawings, the chair shown therein has a fixed and immovable support frame or base 10 which is formed by open side frames 12 including side rails 14 connected by cross-bars or braces, such as the members 16, 18, and 20. The side frames 12 include high legs 22 which mount the support frame, and particularly the side rails 14, well above the floor surface. A body supporting structure 24 is mounted on the support frame 10 for rearward tilting movement to a reclining position. In the illustrated embodiment herein, the body-supporting structure 24 includes a seat 26 and a back-rest 28 formed rigidly with each other as an integral unit, although it is to be understood that the invention may be applied to that type of chair in which the seat and back-rest are independently movable. To provide the tilting movement for the body-supporting structure 24, a plate 30, rigidly affixed to the seat 26, is mounted by pivot 34 on a bracket 32 rigidly connected to the support frame 10. The body supporting unit 24 is thus turnable about this fixed pivot 34 from the upright sitting position shown in FIG. 1, to the rearwardly-tilted reclining position shown in FIG. 2. In this reclining position, the lower rear end of the body-supporting unit 24 engages the cross-bar 18 and is restrained thereby from further rear-

ward movement. The chair also includes a leg-rest 36 which is carried by a leg-rest actuating linkage designated generally by the reference numeral 35, the latter being mounted on the support or frame and connected to the seat 26 in a manner which will be presently described. It is to be understood that in actual practice the leg-rest 36 is supported by and controlled by a pair of identical linkages connected to the opposite sides thereof and mounted at the sides of the seat. Since these linkages are identical, only one has been shown in the drawings and only one will be described herein.

The leg-rest linkage 35 includes a first pair of links 38 and 40 which are connected in end-to-end relationship by a pivot 42. The free end of link 38 is connected by pivot 44 to the leg-rest 36, while the free end portion of link 40 is mounted by pivot 46 on the seat 26. The leg-rest linkage also includes a second pair of links 48 and 50 which are connected in end-to-end relationship by a pivot 52. The free end of the link 48 is connected by pivot 54 to a point on the leg-rest 36 which is spaced from the pivotal connection 44. The free end of link 50 is connected by pivot 56 to a bracket 58 rigidly mounted on the support frame 10. The link 48 crosses over an intermediate portion of the link 40 and is connected thereto at the crossing-over point by pivot 59.

The link 40 has an integral extension 60 which extends substantially perpendicularly to the axis of said link 40 beyond the seat pivot 46. The link 40 and its extension 60 therefore take the form of a double arm or bell-crank lever in which the link 40 is the long arm and the extension 60 is the short arm, the lever being pivotally mounted on the seat at the juncture of its two arms. An actuating link 62 is pivotally mounted at one end by pivot 64 on a fixed portion of the support frame 10. The free end of the actuating link 62 is connected by pivot 66 to the free end portion of the link extension or short lever arm 60.

In the retracted position of the leg-rest linkage 35 shown in FIG. 1, the links 40 and 50 are rearwardly disposed and are almost in a horizontal position, forming acute angles with their respective connected links 38 and 48, so that the leg-rest linkage is folded in an extremely compact form in which it is substantially concealed by the seat 26 and the side frames of the support 10. The leg-rest 36 is supported in its retracted, underslung, and substantially horizontal position, being closely spaced beneath the lower surface of the seat 26 and being in alignment with, and concealed by, the side rails 14. The extension 60 of link 40 extends vertically upward and the actuating link 62 extends forwardly and upwardly from its pivotal mount 64. The body supporting structure 24 is in its upright sitting position, and a stop member 70, carried by the seat 26, engages and rests upon the fixed bracket 58 to support the forward end of said seat and prevent it from tilting downwardly from this upright sitting position.

When the occupant of the chair exerts a rearward pressure upon the back-rest 28, the body-supporting unit 24 will turn rearwardly upon the fixed pivotal mount 34 until it reaches its reclining position of FIG. 2. This turning movement of the body supporting unit 24 raises the forward end of the seat 26 and causes the actuating link 62 to exert a restraining influence on the link extension 60, causing the bell crank lever 40, 60 to turn about the seat pivot 46. This rapidly advances the link 40 in a forward and upward direction, in a manner which will be presently described in greater detail, to bring the leg-rest 36 to its extended position of FIG. 2, in which it is substantially at the level of the forward end of the seat 26 and spaced a substantial distance forwardly thereof. The link 40, in turning to its extended position, also raises the link 48 through the pivotal connection 59, causing the link pair 48 and 50 to unfold and increase the angle therebetween. The link 48 controls the angular attitude of the leg-rest 36 and turns it about the pivot 44 through an angle of approximately 180° from the inverted position of FIG. 1 to the upright position of FIG. 2.

It will be observed that in the retracted position of the leg-rest linkage 35 shown in FIG. 1, the angle between the extension 60 of link 40 with the actuating link 62 is very small, and that in the extended position of FIG. 2, the extension 60 is substantially aligned with the actuating link 62 so that it forms an angle of approximately 180° therewith.

The link extension 60 is therefore formed through a very wide angle from its upright position of FIG. 1 to its downwardly-extending position of FIG. 2 and thus moves the link 40, representing the long arm of the double-arm lever, through a long path of movement for extending the leg-rest. The free end of the extension 60 is made sufficiently long to overlap the actuating link 62, and is provided with a rigid stop member 72 which engages the edge of the actuating link 62 in the extended position of FIG. 2, to prevent the extension 60 and the actuating link 62 from passing through the dead center, aligned position.

It will be appreciated that the actuating link 62, the link extension 60, the seat 26, and a portion of the support frame, form a drag-link mechanism comprising of a four-bar linkage in which the portion of the support frame 10 between the fixed pivots 34 and 64 is a stationary link, and three movable links are constituted by the seat 26 between the pivots 34 and 46, the actuating link 62, and the link extension 60. The seat 26 constitutes the driving crank of the drag-link mechanism, while the actuating link 62 constitutes the driven crank and the link extension 60 constitutes the connecting rod. Only a small portion of the rotational movement of this drag-link mechanism is utilized in the linkage herein for the purpose of obtaining the greatest possible angular movement for the link extension or connecting rod 60, producing the important result of rapidly increasing the angle between the extension 60 and the actuating link 62 and thereby moving the leg-rest rapidly through a long path from its retracted to its extended position in response to a relatively small upward movement of the seat 26.

An important feature of the invention is the unexpected function of the actuating link 62 in delaying the turning of the leg-rest 36 about the pivot 44. When the forward end of the seat is initially raised from its sitting position of FIG. 1, the seat pivot 46 is moved in an upward and rearward direction with it about the pivotal mount 34, raising the link 40 and its extension 60. The actuating link 62 during this initial phase of the movement pivots rearwardly, that is to say in a clockwise direction as viewed in FIG. 1, about its fixed pivot 64, so that the angle between said actuating link 62 and the link extension 60 is not appreciably increased. When the seat pivot 46 reaches the height of the pivot 66 at the end of the actuating link 62, said actuating link then commences its action as the driven crank of the drag-link mechanism, restraining the free end portion of the rising link extension 60 and causing the same to turn rapidly about the seat pivot 46. During this phase of movement, the actuating link 62 pivots forwardly or in a counterclockwise direction about its pivotal mount 64 until, in the extended position of FIG. 2, it is in substantial alignment with the link extension 60. The effect of this is to produce a delay in the movement of the leg-rest 36 which permits the forward end of the seat 26 to move upwardly and to raise the entire leg-rest linkage 35 sufficiently to provide clearance for movement of the leg-rest 36. When the leg-rest reaches its vertically-disposed position, it is therefore spaced above the floor surface and will not strike or rub against the latter.

It is to be understood that the free end of the link 50, instead of being pivoted at 56 to a portion of the support frame, could also be connected to the seat 26 to produce the same action without affecting the movement of the leg-rest linkage. It will also be understood that

the seat 26 instead of having a fixed pivotal mount 34, could also be mounted on the support frame by a link or a pair of guide links, as is well known in the art.

While a preferred embodiment of the invention has been shown and described herein by way of illustrative example, it will be appreciated that numerous additions, changes and omissions may be made in such embodiment 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 a back-rest mounted on the support frame for rearward tilting movement from an upright sitting position to a reclining position, a leg-rest, and a leg-rest linkage supporting the leg-rest and adapted to move the latter from an underslung position beneath the seat to an extended position forwardly of the seat, said leg-rest linkage including a pair of interconnected links, the first link of said pair being pivotally connected to the leg-rest and the second link of said pair being pivotally mounted on the forward end of said seat, said second link having an integral extension extending beyond the pivotal mount on the seat and forming with said second link a double-arm lever, and an actuating link pivotally mounted on said support frame and pivotally connected to said extension, said actuating link extending upwardly and forwardly from its pivotal mount to its pivotal connection with said extension in the upright sitting position, and the latter pivotal connection being located above the pivotal mount of the second link on the seat, whereby the actuating link turns upwardly and rearwardly with the seat during the initial rearward tilting movement of the body-supporting structure to delay actuation of the second link until the pivotal mount of the second link reaches the level of the pivotal connection of the actuating link with said extension, the actuating link then restraining upward movement of said extension with the seat and causing the extension to turn about said pivotal mount on the seat in response to tilting movement of the seat, whereby to move the second link forwardly and raise the leg-rest toward its extended position.

2. A reclining chair comprising a support structure, a body supporting structure including a seat and a back-rest mounted on the support structure for rearward tilting movement from an upright sitting position to a reclining position, a leg-rest, and a leg-rest linkage supporting the leg-rest and adapted to move the latter from an inverted underslung position closely spaced beneath the seat to an upright extended position substantially at the level of the seat and spaced forwardly thereof, said leg-rest linkage including a first pair of links formed by a first and second link connected end-to-end, and a second pair of links formed by a third and fourth link connected end-to-end, the first link and third links being pivotally connected to spaced points on the leg-rest, the second link being pivotally mounted on the forward end of said seat, the fourth link being pivotally mounted on one of said structures, means coupling the second and third links for coordinated movement thereof, said second link having an integral extension extending beyond the pivotal mount on the seat and forming with said second link a double-arm lever, and an actuating link pivotally mounted on said support structure and pivotally connected to said extension said actuating link extending upwardly and forwardly from its pivotal mount to its pivotal connection with said extension in the upright sitting position and the latter pivotal connection being located above the pivotal mount of the second link on the seat, whereby the actuating link turns upwardly and rearwardly with the seat during the initial rearward tilting movement of the body-supporting structure to delay actuation of the second link until the pivotal mount of the second link reaches the level of the pivotal connection of the actuating link with said extension, the actuating link then restraining upward movement of said extension with said seat and causing the extension to turn about said pivotal mount on the seat when the latter is tilted rearwardly, whereby to move the second link forwardly and raise the leg-rest toward its extended position.

3. A reclining chair comprising a support frame, a body supporting structure including a seat and a back-rest mounted on the support frame for rearward tilting movement from an upright sitting position to a reclining position, a leg-rest, and a leg-rest linkage supporting the leg-rest and adapted to move the latter from an underslung position beneath the seat to an extended position forwardly of the seat, said leg-rest linkage including a pair of interconnected links, the first link of said pair being pivotally connected to the leg-rest and the second link of said pair being pivotally mounted on the forward end of said seat, said second link having a substantially perpendicular integral extension extending beyond the pivotal mount on the seat and forming with said second link a bell-crank lever, the second link extending rearwardly with said extension disposed upwardly therefrom in the underslung position of the leg-rest, and an actuating link pivotally mounted on said support and pivotally connected to the free end portion of said extension, said actuating link extending upwardly and forwardly from its pivotal mount to its pivotal connection with said extension in the upright sitting position, and the latter pivotal connection being located above the pivotal mount of the second link on the seat, whereby the actuating link turns upwardly and rearwardly with the seat during the initial rearward tilting movement of the body-supporting structure to delay actuation of the second link until the pivotal mount of the second link reaches the level of the pivotal connection of the actuating link with said extension, the actuating link then restraining upward movement of said extension with the seat and causing the extension to turn about said pivotal mount on the seat in response to tilting movement of the seat, whereby to move the second link forwardly and raise the leg-rest toward its extended position.

4. A reclining chair comprising a support frame, a body supporting structure including a seat and a back-rest mounted on the support frame for rearward tilting movement from an upright sitting position to a reclining position, a leg-rest, and an interconnected double four-bar linkage supporting the leg-rest and adapted to move the latter from an underslung position beneath the seat to an extended position forwardly of the seat, one of the links of said double four-bar linkage being pivotally mounted on the forward end of the seat and having an integral extension extending beyond the pivotal mount on the seat and forming with said link a double-arm lever, and an actuating link pivotally mounted on said support and pivotally connected to said extension for restraining upward movement of said extension with the forward end of said seat when the latter is tilted rearwardly, the extension defining an acute angle with the actuating link in the retracted position of the leg-rest, said actuating link extending upwardly and forwardly from its pivotal mount to its pivotal connection with said extension in the upright sitting position and the latter pivotal connection being located above the pivotal mount of the second link on the seat, whereby the actuating link turns upwardly and rearwardly with the seat during the initial rearward tilting movement of the body-supporting structure to delay actuation of the second link until the pivotal mount of the second link reaches the level of the pivotal connection of the actuating link with said extension, the actuating link then causing the extension to turn about said pivotal mount on the seat in response to tilting movement of the seat whereby to move the second link forwardly and raise the leg-rest toward its extended position.

5. A reclining chair according to claim 4, in which said one link is longer than its extension, said one link

forming the long arm of the double-arm lever and the extension forming the short arm of the double-arm lever.

6. A reclining chair comprising a support frame, a body supporting structure including a seat and a backrest mounted on the support frame for rearward tilting movement to a reclining position, a leg-rest, and an interconnected double four-bar linkage supporting the leg-rest and adapted to move the latter from an underslung position beneath the seat to an extended position forwardly of the seat, one of the links of said leg-rest linkage being pivotally mounted on the forward end of the seat and having an integral, substantially perpendicular extension extending beyond the pivotal mount on the seat and forming with said link a bell-crank lever, and an actuating link pivotally mounted on said support and pivotally connected to said extension for restraining upward movement of said extension with the forward end of said seat when the latter is tilted upwardly, said one link extending rearwardly and the extension being substantially vertically-disposed in the retracted position of the leg-rest, with the actuating link extending upwardly and forwardly toward said extension and forming an acute angle therewith, the actuating link, the extension, and the seat forming a drag link mechanism in which the portion of the seat between the pivotal mount thereof on the support frame and the pivotal connection of said one link thereto is the driving crank, the actuating link is the driven crank, and the extension is the connecting rod, said drag-link mechanism being operative to turn the extension and said one link through an angle of approximately 180° to move the leg-rest to its extended position in response to a relatively short movement of the seat, the pivotal mount of said one link and said extension on the seat being located below the pivotal connection of the actuating link with the extension in the retracted position of the leg-rest, the actuating link being positioned to move rearwardly and thereby delay its restraining action on said extension during the initial movement of the seat and until said pivotal mount has reached the level of said pivotal connection.

7. In a reclining chair comprising a support structure, a body-supporting structure including a seat and backrest mounted on the support structure for rearward tilting movement to a reclining position in which the forward end of the seat is raised relative to the support structure, and a leg-rest; a leg-rest linkage supporting the leg-rest and coupled to the seat and support structure for actuation by the body-supporting structure to move the leg-rest from an underslung position beneath the seat to an extended position forwardly of the seat, the leg-rest being inverted and closely spaced beneath the seat in its retracted position and being upright and spaced forwardly of the seat substantially at the level thereof in its extended position, said leg-rest linkage comprising a first pair of links constituting a first and second link connected end-to-end, a second pair of links constituting a third and a fourth link connected end-to-end, the first and third links being connected to spaced points on the leg-rest, the second link being pivotally mounted on the forward end of the seat, the fourth link being pivotally mounted on one of said structures, the second link having a substantially perpendicular integral extension extending beyond the pivotal mount on the seat, the extension being shorter than the second link and defining therewith a bellcrank lever pivotally mounted on the seat with the extension as the short arm and the second link as the long arm, and an actuating link pivotally mounted on the support and connected to the free end of said extension, the extension being disposed in a vertically-upright position from its pivotal mount on the seat in the retracted position of the leg-rest with the second link extending rearwardly and the actuating link extending upwardly and forwardly toward said extension, the second link and its extension being raised with the forward end of the seat when the body-supporting structure is brought to its extended position and the free end of the extension being restrained by the actuating link to cause the second link to turn about the pivotal mount on the seat through a wide angle to a position in which it is downwardly directed, whereby to move the leg-rest through a relatively long path of movement from its underslung retracted position to its extended position in response to relatively short tilting movement of the body-supporting structure.

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