

Sept. 11, 1951

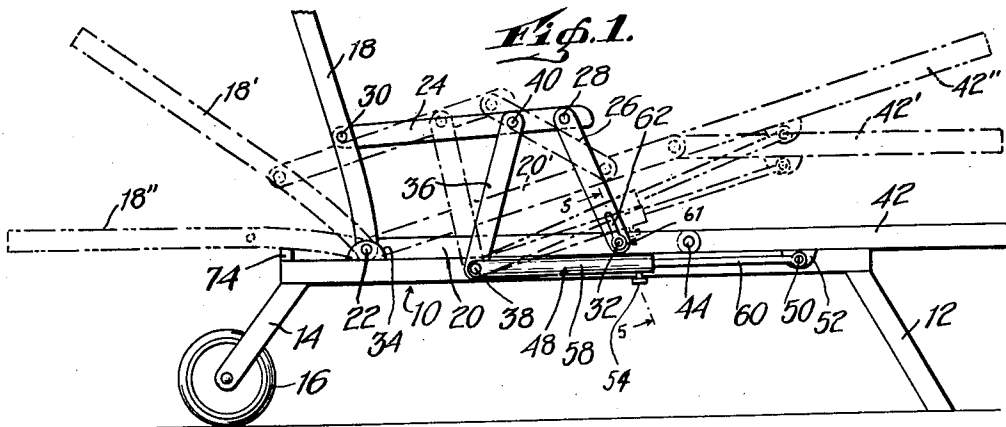
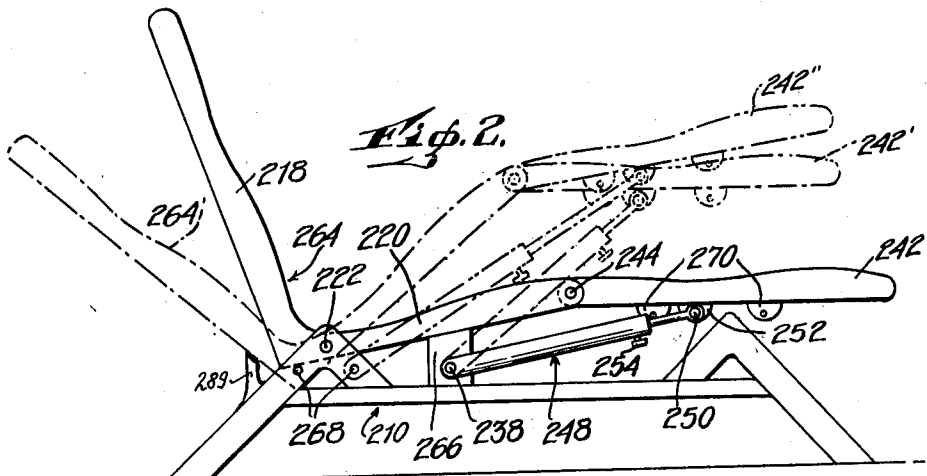
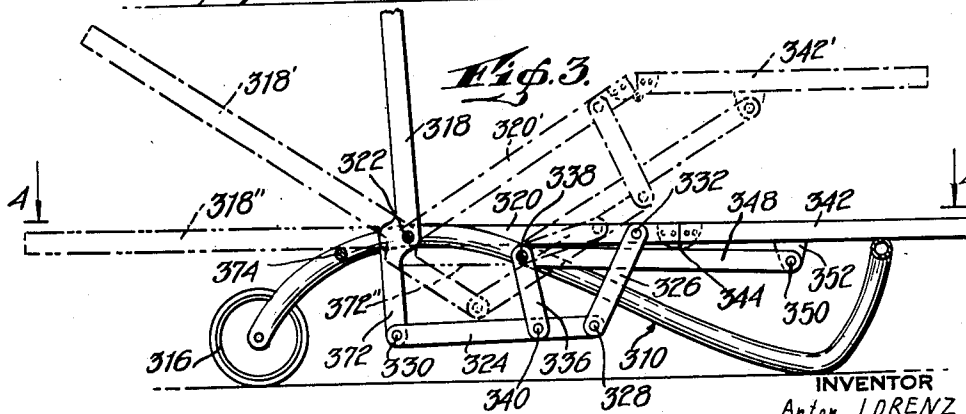
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2,567,222

RECLINING ARTICLE OF FURNITURE

Filed Dec. 18, 1945

4 Sheets-Sheet 1



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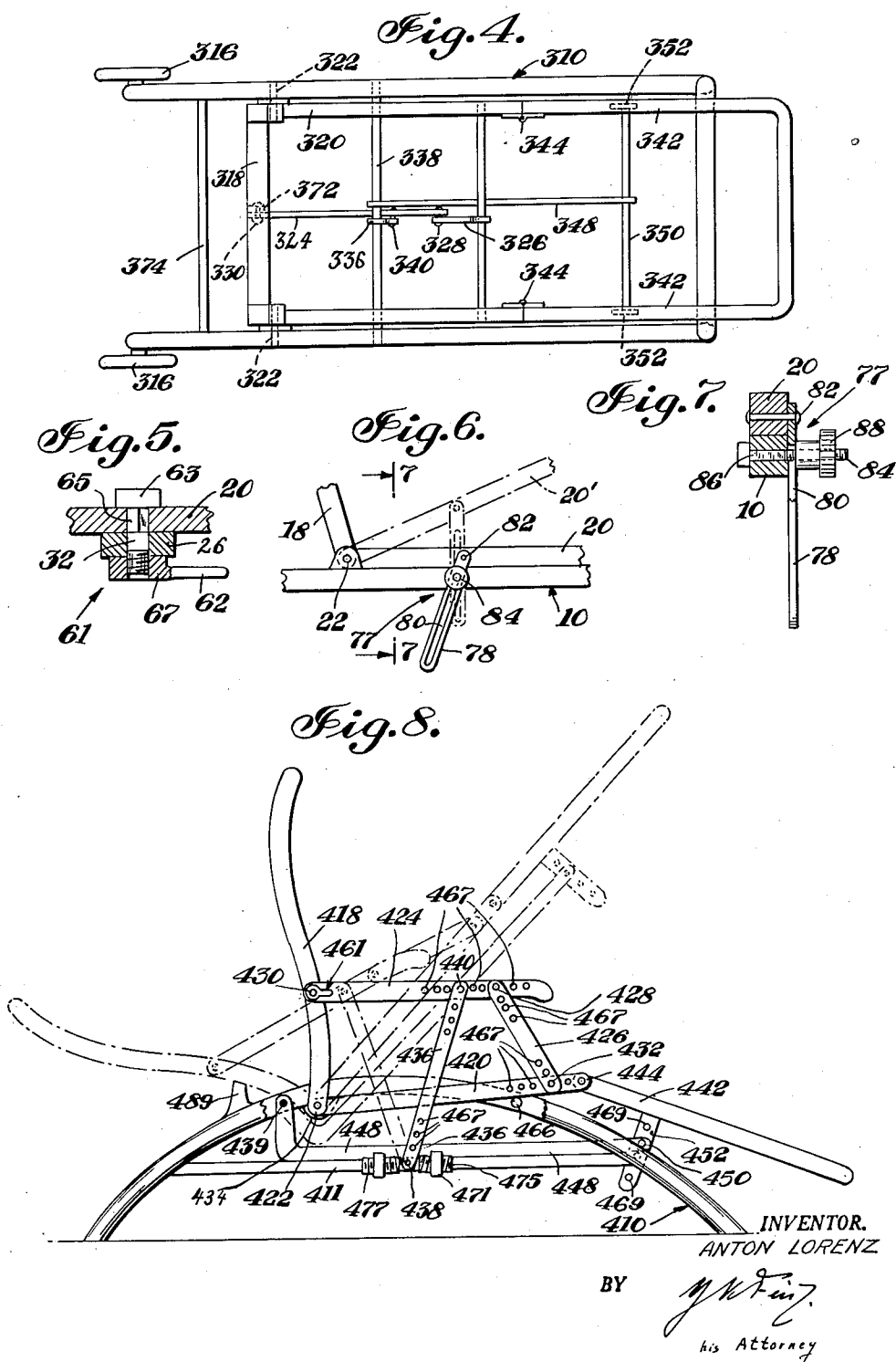
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Fig. 9.

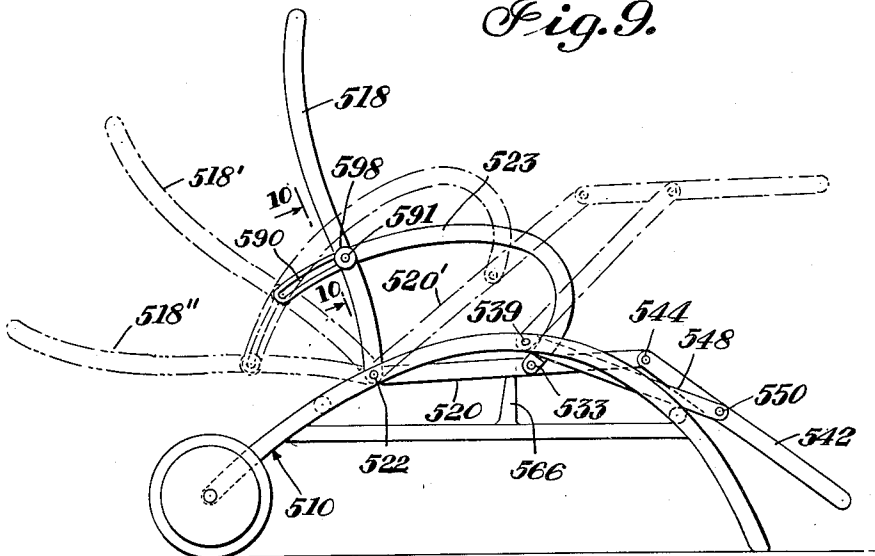


Fig. 11.

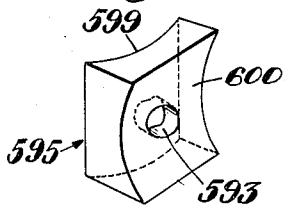


Fig. 12.

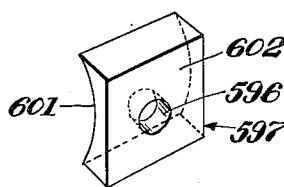


Fig. 10.

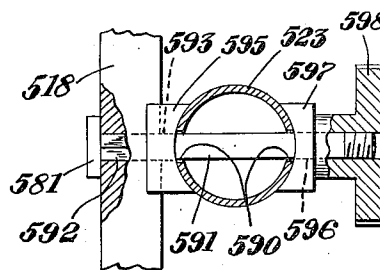
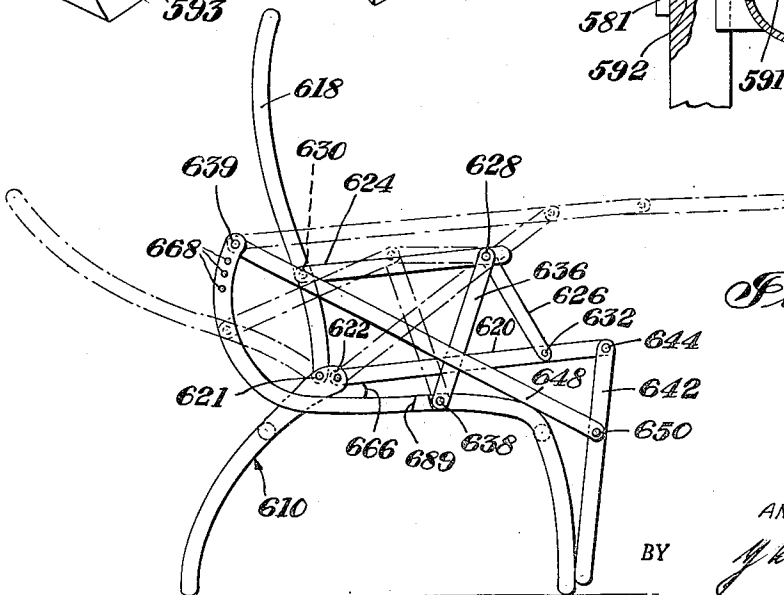


Fig. 13.

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Fig. 14

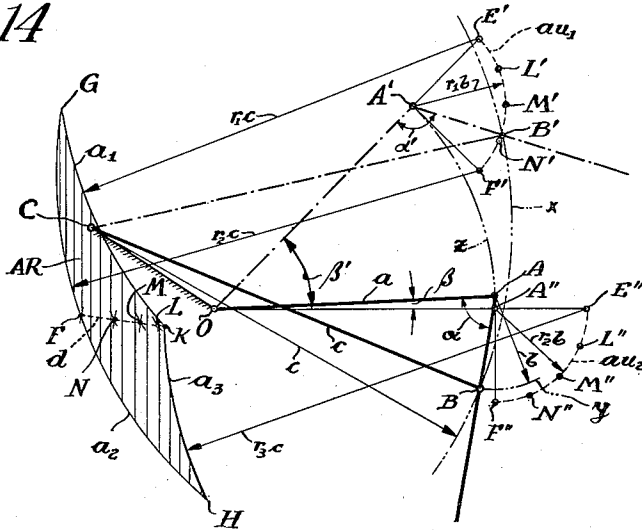


Fig. 15

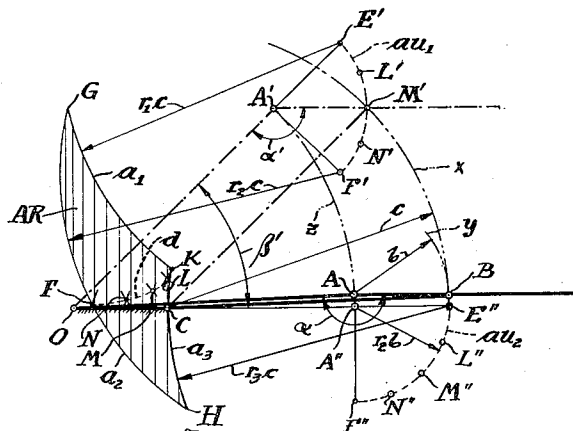
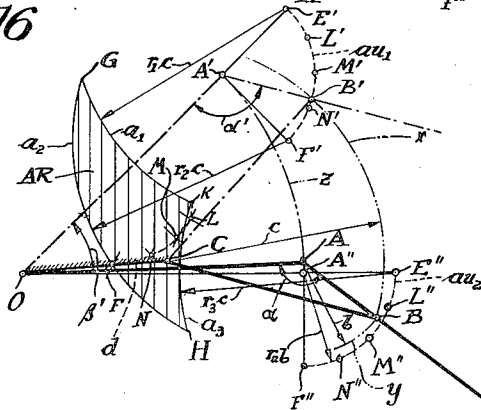


Fig. 16



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RECLINING ARTICLE OF FURNITURE

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Application December 18, 1945, Serial No. 635,623

6 Claims. (Cl. 155—105)

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This is a continuation-in-part of patent application Ser. #558,241 relating to "An Adjustable Resting Furniture," filed October 11, 1944 and of patent application Ser. #560,553 relating to "An Adjustable Reclining Furniture," filed October 27, 1944, which have matured into Patents Nos. 2,468,765 and 2,474,264, respectively, the former having been granted May 3, 1949, and the latter on June 28, 1949.

The present invention relates to an article of furniture, and more particularly to a reclining article of furniture, wherein a swingable seat and back-rest may be moved from a sitting position into a reclined position, and wherein controlling means are arranged for controlling the movements of a leg-rest pivoted to the seat during a swinging movement of the seat from its sitting position into its reclined position and vice versa.

An object of the present invention is to provide a reclining article of furniture of above described type with controlling means for the leg-rest, by means of which a change in the angle between the leg-rest and the seat may be effected during a movement of the seat from its sitting position into its reclined position and vice versa.

Another object of the present invention is to provide a reclining article of furniture of above described type, wherein the angle between the leg-rest and the seat is 180° or less when the seat is in its sitting position, with controlling means for the leg-rest, by means of which such a change in the angle between the leg-rest and the seat may be effected, that said angle is 90° or larger than 90° when the seat is in its extreme reclined position.

A further object of the present invention is to provide a reclining article of furniture of above described type, wherein the angle between the leg-rest and the seat is 180° or less when the seat is in its sitting position, with controlling means for the leg-rest, by means of which such a change in the angle between the leg-rest and the seat may be effected, that said angle is 180° when the seat is in its extreme reclined position.

Still another object of the present invention is to provide a reclining article of furniture of above described type, wherein the angle between the leg-rest and the seat is smaller than 180° when the seat is in its sitting position, with controlling means for the leg-rest, by means of which such a change in the angle between the leg-rest and the seat may be effected, that the angle between the leg-rest and the seat is larger when the seat is in its extreme reclined position than the angle between the leg-rest and the seat when the seat is in its sitting position.

A further object of the present invention is to provide a reclining article of furniture of above described type, wherein the angle between the leg-rest and the seat is 180° or less when the seat

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is in its sitting position, with controlling means for the leg-rest, by means of which such a change in the angle between the leg-rest and the seat may be effected, that the angle between the leg-rest and the seat is smaller when the seat is in its extreme reclined position than the angle between the leg-rest and the seat when the seat is in its sitting position.

Another object of the present invention is to provide a chaise-longue or lounge of the reclining type, wherein the back-rest, seat, and leg-rest are movable relative to each other.

Still another object of the present invention is to provide a chaise-longue or lounge of the reclining type, which may be readily converted into a bed-like or couch-like furniture.

A further object of the present invention is to improve upon the art of reclining articles of furniture as now ordinarily made.

My invention consists in certain novel features of construction of my improvements as will be hereinafter fully described.

It is to be understood that the term "effective length" of a certain member set forth in the specification and claims means the length of such a member between its pivotal connections, i. e. the distance between the axes of the pivots of said pivotal connections.

The above mentioned objects and advantages as well as other objects and advantages will be more fully described in the following specification, reference being had to be the accompanying drawings forming part of this specification, wherein:

Fig. 1 is a side elevational view of a chaise-longue or lounge of the reclining type according to the invention,

Fig. 2 is a side elevational view of another embodiment of a lounge of the reclining type according to the invention,

Fig. 3 is a sectional view of a further embodiment of a lounge according to the invention, said sectional view being taken on line 3—3 of Fig. 4,

Fig. 4 is a sectional view of the lounge shown in Fig. 3, taken on line 4—4 of Fig. 3,

Fig. 5 is a sectional view of the locking device of the lounge shown in Fig. 1, taken on line 5—5 of Fig. 1,

Fig. 6 is a fragmentary side elevational view of a portion of the lounge shown in Fig. 1, wherein, however, a different type of locking device is arranged between the seat and the support,

Fig. 7 is a sectional view taken on line 7—7 of Fig. 6,

Fig. 8 is a side elevational view of a further embodiment of a lounge according to the invention, some parts being broken away,

Fig. 9 is a side elevational view of a further

embodiment of a lounget according to the invention,

Fig. 10 is a sectional view of an adjusting device of the lounget shown in Fig. 9, said sectional view being taken on line 10—10 of Fig. 9,

Fig. 11 is a perspective view of an element of the adjusting device shown in Fig. 10,

Fig. 12 is a perspective view of another element of the adjusting device shown in Fig. 10,

Fig. 13 is a side elevational view of a reclining chair according to the invention,

Fig. 14 is a diagram illustrating a graphical solution for the location of the pivot between the controlling link and the support when the effective length of the controlling link is larger than the effective length of the seat,

Fig. 15 is a diagram illustrating a graphical solution for the location of the pivot between the controlling link and the support when the effective length of the controlling link is equal to the effective length of the seat, and

Fig. 16 is a diagram illustrating a graphical solution for the location of the pivot between the controlling link and the support when the effective length of the controlling link is smaller than the effective length of the seat.

Referring now to Fig. 1, 10 generally indicates the support of an article of furniture known in the trade as chaise-longue or lounget. The support has front legs 12 and rear legs 14, the latter carrying wheels 16.

18 generally indicates a back-rest and 20 indicates a seat, the rear end of which is pivoted to said back-rest and lugs 34 of the support 10 at 22. A pair of connecting links 24 and 26 is arranged on each side of the lounget. The connecting link 24 of said pair of connecting links may be called a top connecting link, which forms an arm-rest; the connecting link 26 of said pair of connecting links will be designated hereinafter as a front connecting link. The top connecting link 24 and the front connecting link 26 are pivotally connected with each other at 28. The rear end of each top connecting link is pivoted at 30 to an intermediate point of the back-rest 18 above the seat 20. The lower end of each front connecting link 26 is pivoted to the front portion of the seat 20 at 32. The pivotally interconnected back-rest 18, seat 20, and pair of links 26, 24 form the movable members of a constrained kinematic polygonal link-system in the shape of a quadrilateral link-system, which is swingably mounted on the lugs 34 of the support 10 at the pivot point 22 between the back-rest 18 and the seat 20 for movement about a single axis. A guiding link 36 is arranged on each side of the lounget for controlling the movements of the movable members 18, 20, 24, 26. The lower end of each guiding link 36 is pivoted to the support 10 at 38, and the upper end of each guiding link 36 is pivoted to the top connecting link 24 at 40.

According to Fig. 1, the seat 20 rests on the support 10 when it occupies its horizontal sitting position as shown in full lines.

A leg-rest 42 is pivotally connected with the front portion of the seat 20 at 44. One end of a telescopic controlling link generally indicated by 48 is pivotally connected with the support 10 at the point 38 coinciding with the pivot point of the guiding link 36; said pivot point 38 is spaced from the pivot point 22 between the seat and the support. The other end of said telescopic controlling link 48 is pivotally connected with the leg-rest 42 at the point 50 of a lug 52 arranged on said leg-rest 42. The effective length of the

movable seat 20, i. e. the distance between the pivots 22 and 44, the effective length of the movable leg-rest 42, i. e. the distance between the pivots 44 and 50, the effective length of the controlling link 48, i. e. the distance between the pivots 38 and 50, and the stationary portion of the support 10 between the pivots 22 and 38 form a four-link-mechanism, wherein the seat, the leg-rest, and the controlling link are the movable links and said portion of the support is a stationary link. When the seat 20 is in its sitting position, the angle between the leg-rest 42 and the seat 20 is 180°. The controlling link 48 serves to control the movements of the leg-rest 42, when the seat 20 is swung from its sitting position (shown in full lines) into its extreme reclined position (shown in dash and dot lines) and vice versa, in such a manner that a change in the angle between the leg-rest and the seat occurs during such a movement. According to the embodiment shown in Fig. 1, the pivot point 38 of the controlling link is in such a relationship to the pivot point 22 of the seat and the controlling link 48 is of such a length that the angle between the leg-rest 42 and the seat 20 is decreased when the seat is moved from its horizontal sitting position into a reclined position 20' and, during such a movement of the seat, the leg-rest is brought into the position 42'.

The occupant of the lounget may readily move the seat 20 from its sitting position into the rearwardly inclined position 20' by leaning the weight of his body against the swingable back-rest 18, which is connected with the swingable seat through the pair of links 24, 26, the movements of which in turn are controlled by the guiding link 36. Thus, the back-rest and the seat may be moved in dependence on each other.

According to the embodiment shown in Fig. 1, the effective length 38—50 of the controlling link 48 is equal to the effective length 22—44 of the seat, and the effective length 44—50 of the leg-rest is equal to the distance 22—38 between the pivot points of the seat and the controlling link with the support, so that the pivots 22, 44, 50, 38 are arranged at the corners of a parallelogram. Therefore, the leg-rest 42 is moved through planes parallel to each other, when the seat 20 is swung about its pivot 22, and the end position 42' of the leg-rest is parallel to its initial position 42.

The back-rest, seat, and leg-rest may be held in any desired reclined position 18', 20', 42' by means of a locking device generally indicated by 61 and arranged on the pivot 32 connecting the seat 20 with the front connecting link 26. As best shown in Figs. 1 and 5, said locking device 61 comprises a handle 62 screwed on the threaded end of the pivot 32. Said pivot 32 has a head 63 resting against a surface of the frame of the seat 20. A square portion 65 of the pivot 32 is inserted into a corresponding square aperture of the frame of the seat 20, whereby the pivot 32 is prevented from rotation. When the user of the lounget loosens the locking handle 62, the surface of the hub 67 of said handle is disengaged from the surface of the front connecting link 26, so that the movable members of the lounget may be freely moved from one position into another one. When the locking handle 62 is tightened, the surface of the hub of the handle is pressed against the front connecting link 26, whereby the latter is pressed against the seat 20 engaged with the head 63 of the pivot 32, so that

the members of the lounget are held in their new positions.

Of course, if desired any other type of locking device may be used instead of above described locking device 61, for example a locking device generally indicated by 77 in Figs. 6 and 7. According to said Figs. 6 and 7, a bar 78 having a slot 80 is swingably mounted on the seat 20 at 82. A bolt 84 having a square portion 86 is inserted into a corresponding square aperture of the support 10, so that said bolt is prevented from rotation. The end of said bolt 84 projecting from said support 10 passes through the slot 80 of the bar 78 and is provided with a threaded portion. A locking knob 88 is screwed on said threaded portion of said bolt 84. If the locking knob 88 is loosened, the bar 78 may be freely moved, so that the seat 20 and, of course, the other members of the quadrilateral link-system 18, 20, 26, 24 of the lounget shown in Fig. 1 may be brought into any desired position. If, however, the locking knob 88 is tightened, so that it urges the bar 78 against the support 10, the seat and the other members of the quadrilateral link-system are firmly held in their position, for example, a reclined position.

Under certain conditions it may be desirable to change the position 42' of the leg-rest relative to the position 20' of the seat, when the latter is in a reclined position; for example, it may be desirable to bring the leg-rest into the position 42'' in alignment with the reclined position 20' of the seat. In order to carry out such an operation, a set screw 54 of the telescopic controlling link 48 comprising the telescopically arranged members 58 and 60 is loosened, when the seat is held in its reclined position 20' by means of the locking device 61 (Figs. 1 and 5) or the locking device 77 (Figs. 6 and 7), whereupon the leg-rest may be swung from the horizontal position 42' into the inclined position 42'' in alignment with the seat 20'. When the leg-rest and seat are brought into alignment with each other, the set screw 54 of the telescopic controlling link is tightened, so that the leg-rest is held in its position 42''. If, after such an adjustment of the leg-rest relative to the seat, the members of the lounget shall be returned into the sitting position shown in full lines in Fig. 1, the leg-rest is returned from the inclined position 42'' into the horizontal position 42' by reducing the length of the telescopic controlling link 48, whereupon the movable members of the lounget may be brought into the sitting position shown in full lines in Fig. 1. Of course, if desired, the leg-rest may be adjusted in positions relative to the seat, wherein the leg-rest is at any desired angle smaller than 180° to the seat.

According to the embodiment of a lounget shown in Fig. 1, at least one pivotal connection, for example the pivotal connection 30 of the quadrilateral link-system 18, 20, 26, 24 is disengageable. Thus, assuming the seat 20 and the leg-rest 42 are in the horizontal position shown in full lines in Fig. 1, the lounget may be readily converted into an article of furniture of the type of a bed, cot, or couch by disengaging the back-rest 18 from the top connecting link 24 at 30 and swinging the back-rest into the substantially horizontal position 18'', wherein it is held by a stop 74 arranged on the support 10. Likewise, the back-rest could be freely swung into the position 18'', if the pivotal connection 28 would be disengaged instead of or in addition to the pivotal connection 30. Furthermore, if the locking de-

vice 61 were replaced by a similar locking device arranged at a different part or parts of the lounget, similar results could be obtained by disengaging the pivotal connection 32.

As described above, the locking device 61 shown in Figs. 1 and 5 is arranged and constructed in such a way, that it locks two members of the quadrilateral link-system 18, 20, 26, 24 in a desired position relative to each other. Therefore, said locking device 61 may be effective only, if none of the pivotal connections of the quadrilateral link-system is disengaged.

On the other hand, as described above, the locking device 77 shown in Figs. 6 and 7 is arranged and constructed in such a way, that it locks the seat 20 relative to the support 10 in any desired position. Therefore, said locking device 77 may also be effective, if one or more of the pivotal connections 30, 28, 32 of the quadrilateral link-system shown in Fig. 1 are disengaged. Consequently, if a lounget of the type shown in Fig. 1 is equipped with a locking device 77 according to Figs. 6 and 7 instead of the locking device 61 shown in Fig. 1, the pivotal connection 30, 28 and/or 32 may be disengaged for swinging the back-rest into the substantially horizontal position 18'' when the seat is locked in a reclined position 20' and the leg-rest is in a horizontal position 42' or in an inclined position, for example the position 42''. Thus, the movable members of a lounget shown in Fig. 1 and equipped with a locking device 77 shown in Figs. 6 and 7 may be readily adjusted in any position relative to each other, which may be the most comfortable to the occupant of the lounget or which may be required for the treatment of a sickness.

According to Fig. 1, the legs 12 and 14 are rigidly connected with the main body of the support 10; if desired, however, the legs may be swingably connected with said main body of the support, so that they may be folded upon said main body for a convenient carrying around and/or storing away of the lounget.

According to the embodiment of a lounget shown in Fig. 2, the back-rest 218 is rigidly secured to the seat 220, whereby the back-rest and the seat may be moved in dependence on each other. According to Fig. 2, the back-rest 218 and the seat 220 form an integral piece generally indicated by 264. Said piece 264 is swingably mounted on the support 210 at the point 222, which may also be considered the pivot point of the seat. The leg-rest 242 pivotally connected with the front portion of the seat 220 at 224 is controlled by the telescopic controlling link 248, one end of which is pivoted to an extension 266 of the support 210 at the point 238 spaced from the pivot point 222 of the seat. The other end of said controlling link 248 is pivotally connected at 250 with a lug 252 of the leg-rest 242. The extension 266 of the support 210 forms a stop for limiting the sitting position of the seat 220 shown in full lines. Said sitting position is inclined at a slight angle to the horizontal. Again, the pivotal connection 238 of the controlling link 248 is arranged in such a relationship to the pivot 222, and the controlling link 248 is of such a length, that a change in the angle between the leg-rest 242 and the seat 220 occurs when the seat 220 is swung into the reclined position shown in dash and dot lines. When the ends of the controlling link 248 are connected with the pivots 238 and 250 as shown in full lines, the pivots 222, 244, 250, 238 are arranged at the corners of a parallel-

ogram, so that the leg-rest 242 is moved through planes parallel to each other, when the seat structure 264 comprising the back-rest 218 and the seat 220 is swung into its extreme reclined position 264' limited by a stop 289 mounted on the support 210. Therefore, as the leg-rest 242 is in a substantially horizontal position when the seat is in its sitting position as shown in full lines, the leg-rest will be again in a substantially horizontal position 242', when the seat is in its extreme reclined position as shown in dash and dot lines.

The movable members of the lounge shown in Fig. 2 may be held in the extreme reclined position 264', 242' or in any other intermediate reclined position by means of a locking device of suitable construction, for example of the type shown in Figs. 6 and 7. In said extreme reclined position or in any other reclined position of the seat structure 264, the position of the leg-rest relative to the seat may be altered in the same manner as described above in connection with Fig. 1 by changing the effective length of the controlling link when the seat is held in such a reclined position.

Fig. 2 illustrates further adjusting means according to the invention, which are not shown in Fig. 1, which are, however, applicable to the embodiment shown in Fig. 1. According to Fig. 2 the support 210 is provided with a series of holes 268. If, for example, the leg-rest 242 shall not be moved through planes parallel to each other during a swinging movement of the member 264, the controlling link 248 may be lengthened by means of an adjustment through the medium of the set screw 254, and one end of such a lengthened controlling link 248 may be pivotally connected with one of said holes 268 by inserting the pivot therein. Of course, the holes 268 are arranged in such an area, that the pivot of the left-hand end of the controlling link 248 when inserted therein is in such a position relative to the pivot 222, that a change in the angle between the leg-rest and the seat occurs during above mentioned swinging movement, and that further the angle between the leg-rest and the seat is not smaller than 90° and not larger than 180° when the seat is in its extreme reclined position. If, for example, the right-hand end of the controlling link 248 remains pivotally connected with the lug 252 of the leg-rest 242 at 250 and the left-hand end of the controlling link 248 will be pivotally connected with the right-hand hole of the series of holes 268, and if the seat structure 264 is again moved into the extreme reclined position 264', the leg-rest will be brought into the position 242' shown in dash and dot lines. Further adjustments of this type may be obtained by pivotally connecting the right-hand end of the telescopic controlling link 248 with one or the other additional lugs 270 arranged on the leg-rest 242. As will be readily understood, depending on the effective length of the controlling link 248, and on the selective pivotal connection of its ends with one of the holes on the support and on the lugs of the leg-rest respectively, the angle between the leg-rest and the seat will be decreased or increased during a movement of the seat from its sitting position into its extreme reclined position.

Figs. 3 and 4 illustrate a lounge according to the invention, wherein the support 310 is made of tubular material. The lounge may be moved along the ground by means of wheels 316 journaled in suitable bearings arranged at the rear

portion of the support 310. The back-rest 318 is swingably mounted on the support 310 by means of pivots 322, which furthermore provide for a movable connection of the back-rest 318 with the rear end of the frame of the seat 320. The back-rest 318 has a lower extension 372 in the center of the lounge. Said extension 372 rigidly connected with the back-rest 318 projects downwardly beyond the pivotal connection 322 between the back-rest and the seat. A pair of connecting links 324, 326 pivotally connected with each other at 328 is arranged below the seat. The rear end of the connecting link 324 designated hereinafter as a lower connecting link is pivoted to the extension 372 of the back-rest 318 at 330; the upper end of the connecting link 326, hereinafter called the front connecting link, is swingably mounted on a transverse rod 332 the ends of which are connected with the frame of the seat 320. The pivotally interconnected seat 320, pair of connecting links 326, 324, and lower extension 372 of the back-rest 318 form the movable members of a constrained kinematic polygonal link-system in the shape of a quadrilateral link-system, which is swingably mounted on the support 310 at the pivot point 322 between the back-rest 318 and the seat 320 for movement about a single axis. The movements of the back-rest 318 with its extension 372, the lower connecting link 324, the front connecting link 326, and the seat 320 are controlled by a guiding link 336; the lower end of said guiding link is pivoted to the lower connecting link 324 at 340, the upper end of said guiding link is swingably mounted on a transverse rod 338, the ends of which are secured to the support 310.

The rear end of the frame of the leg-rest 342 of the lounge shown in Figs. 3 and 4 is hinged to the front end of the frame of the seat 320 at 344. During a swinging movement of the seat 320, the movements of the leg-rest 342 are controlled by a controlling link 348; one end of said controlling link 348 is swingably mounted on said transverse rod 338, at a point spaced from the pivot point 322 of the seat 320, the other end of said controlling link 348 is swingably connected with a transverse rod 350, the ends of which are secured to lugs 352 carried by the frame of the leg-rest 342.

In the same manner as mentioned above in connection with Figs. 1 and 2, the pivot point 338 of the controlling link 348 (shown in Figs. 3 and 4) and the effective length thereof is such, that a change in the angle between the leg-rest and the seat occurs when the seat is moved from its sitting position into its extreme reclined position. According to the embodiment shown in Figs. 3 and 4, the distance between the axis of the pivot 322 and the axis of the pivot 344 is equal and parallel to the distance between the axis of the transverse rod 338 and the transverse rod 350, so that the leg-rest 342 is moved through planes parallel to each other.

If the user of the lounge swings the back-rest 318 about the pivots 322, the movable members of the lounge may be brought into the reclined position 318', 320', 342' shown in dash and dot lines in Fig. 3. The lounge may comprise locking means, for example of the type shown in Fig. 1 or Figs. 6 and 7 or of any other suitable construction by means of which the movable members of the lounge may be held in such a reclined position or in any other intermediate reclined position.

According to the embodiment shown in Figs.

3 and 4, the pivotal connection between the lower extension 372 of the back-rest 318 and the lower connecting link 324 is disengageable, so that the lounge may be converted into an article of furniture of the type of a cot, couch, or bed. For such a conversion the movable members of the lounge are brought into the full line position shown in Fig. 3, wherein the seat 320 and the leg-rest 342 are in alignment with each other. After the disengagement of the pivotal connection 330, the back-rest 318 with its extension 372 is swung into the horizontal position 318'', 372'', wherein the back-rest is in alignment with the seat and the leg-rest. The substantially horizontal position 318'' of the back-rest is limited by a stop 374 in the shape of a transverse rod connecting the side frames of the support 310 with each other.

The lounge shown in Figs. 3 and 4 does not show means for varying and adjusting the effective length of the controlling link 348, but it is understood, that the means for varying and adjusting the effective length of the controlling link as shown in Figs. 1 and 2 or any other suitable means may be applied to the lounge shown in Figs. 3 and 4.

According to the embodiment of a lounge shown in Fig. 8 the rear end of the seat 420 is pivoted to the lower end of the back-rest 418 and lugs 434 of the support 410 at 422. On each side of the lounge, the rear end of a top connecting link 424 forming an arm-rest is pivoted to an intermediate point of the back-rest 418 at 439. Said top connecting link 424 is pivoted at its other end at 428 to the upper end of the front connecting link 426. The lower end of said front connecting link 426 is pivoted to the front portion of the seat at 432. The pivotally interconnected back-rest 418, seat 420, and pair of connecting links 426, 424 form a quadrilateral link-system, which is swingably mounted on the lugs 434 of the support 410 at the pivot point 422 between the back-rest 418 and the seat 420 for movement about a single axis. A guiding link 436 is arranged on each side of the lounge for controlling the movements of the movable members 418, 424, 426, 420 of the quadrilateral link-system. The lower end of each guiding link 436 is pivoted to a bracing rod 411 of the support 410 at 438, the upper end of each guiding link 436 is pivoted to the top connecting link 424 at 440.

A leg-rest 442 is pivotally connected with the front portion of the seat 420 at 444. The movements of said leg-rest are controlled by a controlling link 448 arranged in the center of the lounge. One end of said controlling link is pivoted to a lug 452 on the leg-rest 442 at 450, the other end of said controlling link is bent upwardly and swingably mounted on a transverse rod 439 connecting the side frames of the support 410 with each other. Of course, two controlling links, one on each side of the lounge, could be arranged, if desired. The effective length of the seat 420, the effective length of the leg-rest 442, the effective length of the controlling link 448, and the portion of the support 410 between the pivots 422 and 439 form a four-link-mechanism, wherein the seat, the leg-rest, and the controlling link are the movable links and said portion of the support is a stationary link. As clearly shown in Fig. 8, the effective length of the controlling link 448 is larger than the effective length of the seat 420.

The sitting position of the movable members of the lounge shown in full lines in Fig. 8 is limited by a stop 466 mounted on the support 410 for co-

operation with the seat 420. When the seat 420 is in its sitting position, the angle between the leg-rest 422 and the seat is approximately 155°. The pivot point 439 of the controlling link 448 is in such a relationship to the pivot point 422 of the seat, and the effective length of the controlling link 448 is such, that during a movement of the movable members of the lounge into the extreme reclined position (shown in dash and dot lines) limited by the stop 489 mounted on the support 410 the angle between the leg-rest and the seat is increased to 180°.

The movable members of the lounge may be held in any desired reclined position by means of a locking device 461 arranged on the pivot 439. The locking device 461 may be of the type shown in Fig. 5.

The seat 420, the top connecting link 424, the front connecting link 426, and the guiding link 436 are provided with series of holes 467 for selective engagement of the pivots 440, 428, 432, and 438 respectively, whereby the effective length of the members of the quadrilateral link-system may be varied and adjusted. Furthermore, the lug 452 of the leg-rest is provided with a series of holes 469, so that the pivot 450 connecting the controlling link 448 with the lug 452 of the leg-rest 442 may be selectively engaged with one of said holes 469 for an adjustment of the angle between the leg-rest and the seat.

The stops 466 and 489 limit the extreme sitting position and extreme reclined position of the movable members of the lounge. In order to obtain a fine adjustment of a sitting position and reclined position, which may be different from the extreme positions limited by said stops 466 and 489, the adjustable stops 471 and 473 may be used. Each of said adjustable stops is in the shape of a nut threaded on threaded portions 475 and 477 respectively of the bracing rod 411. Upon a displacement of said adjustable stops 471, 473 by rotating same, they may be brought into a position, that they cooperate with the guiding link 436 for limiting its extreme positions.

Fig. 9 illustrates a lounge wherein the rear portion of the seat 520 is pivoted to the support 510 at 522. The back-rest 518 of tubular material is swingably mounted on the support 510 at the same pivot point 522. The sitting position of the seat 520 is limited by a stop 566 mounted on the support. A connecting element 523 of tubular material forming an arm-rest is arranged on each side of the lounge. One flattened end of said connecting element 523 is connected with the seat 520 at 533. Said connecting element 523 has elongated slots 590 at its other end. Each of said slots 590 is curved along an arc with the pivot 522 as center. As best shown in Fig. 10, a bolt 591 having a square portion 592 engaged with a corresponding square aperture of the back-rest 518 rests with its head 581 against one side of the back-rest 518 and projects from the other side thereof. Said projecting end of the bolt 591 passes through a bore 593 of a first clamping member 595 (Figs. 10 and 11), through the slots 590 of the tubular connecting element 523, and through a bore 596 of a second clamping member 597 (Figs. 10 and 12). An adjusting knob 598 is screwed on the threaded end of said bolt 591. The square portion 592 of the bolt 591 engaged with the square aperture of the back-rest 518 prevents the bolt 591 from rotation when the adjusting knob 598 is turned. As best shown in Fig. 11, the first clamping member 595 has a curved surface 599 fitting the curvature of the tubular member

forming the back-rest 518 and has a curved surface 600 fitting the curvature of the tubular connecting element 523. Furthermore, as best shown in Fig. 12, the second clamping member 597 has a curved surface 601 fitting the curvature of the tubular connecting element 523 and a straight surface 602 for engagement with a corresponding straight surface of the adjusting knob 598. Thus, when the adjusting knob 598 is tightened, the back rest 518 is rigidly connected with the connecting element 523 at a predetermined angle relative to the seat 520. Now, when the back-rest 518 is swung into a reclined position, for example the extreme reclined position 518' shown in dash and dot lines, the connecting element 523 swings the seat 520 into the reclined position 520' without any change in the angle between the back-rest and the seat.

If it is desired to have a larger angle between the back-rest and the seat than the angle between said members as shown in full lines, the adjusting knob 598 is loosened, whereupon the bolt 591 may freely be displaced along the curved slots 590, so that the back-rest may be displaced relative to the connecting element 523 and the seat 520. When the desired angular position between the back-rest and the seat is obtained, the adjusting knob 598 is again tightened, so that the back-rest is again rigidly connected with the connecting element 523 and the seat 520. If, for example, the back-rest 518 is displaced relative to the seat 520 into such a position that the bolt 591 abuts against the extreme left-hand end of the slots 590, the back-rest will be in the position 518'' shown in dash and dot lines, when the seat is in the reclined position 520'.

The leg-rest 542 pivoted to the front portion of the seat 520 at 544 is controlled by a controlling link 548. One end of said controlling link is pivoted to the leg-rest 542 at 550, the other end of said controlling link is pivoted to the support at 539 at a point spaced from the pivot 522. During a movement of the seat from the sitting position into the reclined position and vice versa, the controlling link 548 controls the movement of the leg-rest 542 relative to the seat. The effective length of the seat 520, the effective length of the leg-rest 542, the effective length of the controlling link 548, and the portion of the support 510 between the pivots 522 and 539 form a four-link mechanism wherein the seat, the leg-rest, and the controlling link are the movable links and said portion of the support is a stationary link. As clearly shown in Fig. 9, the effective length of the controlling link 548 is smaller than the effective length of the seat 520.

Fig. 13 illustrates a reclining chair according to the invention. The lower end of the back-rest 618 is pivoted to the support 610 at 621. The rear end of the seat 620 is pivoted to the support 610 at the point 622 spaced from the pivot point 621. The rear end of a top connecting link 624 is pivoted to an intermediate point of the back-rest 618 at 630. The other end of said top connecting link 624 is pivotally connected with the upper end of the front connecting link 626 at the point 628. The lower end of said front connecting link is pivoted to the seat at 632. The back-rest 618, the top connecting link 634, the front connecting link 626 and the seat 620 form the movable members, and the portion of the support between the pivots 621 and 622 forms the stationary member of a constrained kinematic polygonal link-system in the shape of a quinquelateral link-system. The movements of said link-system are controlled by a guiding link

636, the upper end of which is pivoted to the top connecting link 624 at 628, and the lower end of which is pivoted to the support 610 at 633. The sitting position of the movable members of the chair is limited by a stop 666 mounted on the support 610 for cooperation with the seat 620, and the extreme reclined position of the movable members of the chair is limited by a stop 689 arranged on the support for cooperation with the guiding link 636.

A leg-rest 642 is pivoted to the seat 620 at 644. One end of a controlling link 648 is pivoted to said leg-rest 642 at 650, the other end of said controlling link is pivoted to the support 610 at the point 639 spaced from the pivot point 622 of the seat. The pivot point 639 is arranged in such a manner and the controlling link 648 is of such a length, that the angle between the leg-rest and the seat is smaller than 90° when the seat is in the sitting position shown in full lines, and that said angle is increased to approximately 145° when the seat is in the extreme reclined position shown in dash and dot lines. Again, the effective length of the seat 620, the effective length of the leg-rest 642, the effective length of the controlling link 648, and the portion of the support 610 between the pivots 622 and 639 form a four-link-mechanism, wherein the seat, the leg-rest, and the controlling link are the movable links and said portion of the support is a stationary link.

The support is provided with a series of holes 668. The pivot 639 may be selectively inserted into one of said holes 668 for an adjustment of the angle between the leg-rest and the seat.

Above described Figs. 1-4, 8, 9 and 13 illustrate loungers and a reclining chair with a control for the leg-rest comprising a controlling link, one end of which is pivoted to the leg-rest, and the other end of which is pivoted to the support. Said controlling link is a movable link of a four-link-mechanism comprising the effective length of the movable leg-rest and the effective length of the movable seat as further movable links and the portion of the stationary support between the pivot points of the seat and the controlling link as a stationary link. The sitting position angle between the leg-rest and the seat, i. e. the angle between the leg-rest and the seat when the seat is in its sitting position which may be in the horizontal plane or may be slightly inclined to the horizontal plane, is smaller than 181° (180° according to Figs. 1 and 3, smaller than 180° according to Figs. 2, 8 and 9, and smaller than 90° according to Fig. 13). The controlling link is of such an effective length and the pivot point between the controlling link and the support is at such a location, that the reclined position angle between the leg-rest and the seat, i. e. the angle between the leg-rest and the seat when the seat is in its extreme reclined position, is not smaller than 90° and not larger than 180°.

Figs. 14-16 show diagrams illustrating a graphical solution for locating the pivot point between the controlling link and the support within a certain area, so that above mentioned reclined position angle between the leg-rest and the seat amounts to a value between 90° and 180°. In said Figs.:

a indicates the effective length of the seat,
b indicates the effective length of the leg-rest,
c indicates the effective length of the controlling link,

- O indicates the pivot point between the seat and the support,
 A indicates the pivot point between the seat and the leg-rest,
 B indicates the pivot point between the leg-rest and the controlling link,
 C indicates the pivot point between the controlling link and the support,
 α indicates the sitting position angle between the leg-rest and the seat, and
 α' indicates the reclined position angle between the leg-rest and the seat.

According to Fig. 14, the length c of the controlling link is larger than the length a of the seat.

According to Fig. 15, the length c of the controlling link is equal to the length a of the seat.

According to Fig. 16, the length c of the controlling link is smaller than the length a of the seat.

The following has reference to each of the diagrams illustrated by Figs. 14, 15, and 16. The plane area AR, wherein the pivot point C may be located for obtaining a reclined position angle α' of a value between 90° and 180° , may be found as follows:

A horizontal line OE'' of a length $a + b$ or OA'' + A'E'' is laid through the pivot point O. A straight line OA of the length a is laid through said pivot point O at an angle β representing the angle of the seat relative to the horizontal in its sitting position. For example said angle β may be 3° . A straight line OE' of the length $a + b$ or OA' + A'E' is laid through said pivot point O at an angle β' representing the angle of the seat relative to the horizontal in its extreme reclined position. For example, said angle β' may be 45° . A 90° auxiliary arc au_1 , or E'F' is drawn with a radius r_1b of the length b about the point A' on said straight line OE' from the point E' at the end of said straight line. A first arc a_1 is drawn with a radius r_1c of the length c of the controlling link about said point E' at the end of said straight line OE', a second arc a_2 is drawn with a radius r_2c of the length c of the controlling link about the point F' at the end of said 90° auxiliary arc au_1 , and a third arc a_3 is drawn with a radius r_3c of the length c of the controlling link about the point E'' at the end of the horizontal line OE''. The arc a_1 intersects with the arc a_2 at the point G, the arc a_2 intersects with the arc a_3 at the point H, and the arc a_3 intersects with the arc a_1 at the point K. The area GHK or AR confined by the arcs a_1 , a_2 , and a_3 is the desired locus of point C to satisfy the conditions outlined above. The point C may be placed anywhere within said area AR. An arc x is drawn with the radius c about the chosen point C located within said area AR, and an arc y is drawn with the radius b about the point A at the end of the line CA. Said arcs x and y intersect with each other at the point B. OA, AB, BC represent the movable links, and CO represents the stationary link of the four-link-mechanism, when the seat is in its sitting position; α is the sitting position angle between the leg-rest and the seat. OA', A'B', B'C represent the movable links, and CO represents the stationary link of the four-link-mechanism, when the seat is in its extreme reclined position; α' is the reclined position angle between the leg-rest and the seat.

As mentioned above, the point C may be placed anywhere within the area AR. When said point C is placed along the arc a_1 , the re-

clined position angle α' will be 180° . When said point C is placed along the arc a_2 the reclined position angle α' will be 90° . Furthermore, the closer said point C is placed to the arc a_1 , the larger will be the reclined position angle α' .

Moreover, depending on the particular location of the point C in said area AR, the reclined position angle α' will be larger than or equal to or smaller than the sitting position angle α . When said point C is placed above the curved d , the reclined position angle α' will be larger than the sitting position angle α . When said point C is placed along said curve d , the reclined position angle α' is equal to the sitting position angle α . When said point C is placed below said curve d , the reclined position angle α' is smaller than the sitting position angle α . Said curve d may be found as follows:

A second 90° auxiliary arc au_2 is drawn with a radius r_2b of the length b about the point A'' on the horizontal line OE'' from the point E'' at the end of said horizontal line. The first 90° auxiliary arc au_1 , and the second 90° auxiliary arc au_2 are then divided into corresponding divisional arcs, so that the divisional arc E'L' is equal to the divisional arc E''L'', the divisional arc L'M' is equal to the divisional arc L''M'', the divisional arc M'N' is equal to the divisional arc M''N'', and the divisional arc N'F' is equal to the divisional arc N''F''. A first series of curve constructing arcs is drawn with a radius of the length c of the controlling link about the series of spaced points E', L', M', N', F', and a second series of curve constructing arcs is drawn with a radius of the same length c about the series of spaced points E'', L'', M'', N'', F''. Said first series of curve constructing arcs intersects with said second series of curve constructing arcs at the points of intersection K, L, M, N, F. A line drawn through said points of intersection K, L, M, N, F represents the curve d .

As may be gathered from Figs. 14, 15, and 16, the controlling link is of such a length c and the point C is spaced from the point O at such a location, that the pivot B between the controlling link and the leg-rest is moved along an arc x being outside the arc z along which the pivot A between the seat and the leg-rest is moved during a movement of said seat from its sitting position into its extreme reclined position and vice versa.

According to Fig. 15, the locus of the point C within the area AR is chosen in such a manner, that the distance OC is equal and parallel to the length b when the seat is in its sitting position. Furthermore, the length c is equal to the length a , so that c is parallel to a when the seat is in its sitting position. Therefore, the position of the leg-rest, when the seat is in its extreme reclined position, is parallel to the position of the leg-rest, when the seat is in its sitting position. The reclined position angle α' is smaller than the sitting position angle α .

The graphical solution described in connection with Figs. 14-16 may be applied to any of the constructions shown in Figs. 1-4, 8, 9, and 13 and may likewise be applied to any other construction with different dimensions of the various members of a reclining chair or the like of a type according to the present invention.

I have described preferred embodiments of my invention, but it is understood that this disclosure is for the purpose of illustration, that the invention will also be applied to various other types of furniture, such as chairs for use in rail-

road cars, chairs for use in airplanes, etc., and that various omissions and changes in shape, proportion and arrangement of parts as well as the substitution of equivalent elements for those herein shown may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

What I claim is:

1. A reclining article of furniture comprising a support, a structure including a seat, a back-rest and means connecting said back-rest with said seat for controlling the movements of said back-rest and said seat in dependence on each other, the seat of said structure being swingably mounted on said support for movements from a sitting position into an extreme reclined position, limiting means arranged on said support for limiting the sitting position of the elements of said structure, a leg-rest, said leg-rest being pivoted to the front portion of said seat, and a controlling link, one end of said controlling link being pivoted to said leg-rest, the other end of said controlling link being pivoted to said support at a point spaced from the pivotal connection between the seat and the support, the effective lengths of said movable seat, said movable leg-rest, said movable controlling link, and the stationary portion of said support between the pivotal connections with said seat and said controlling link forming a four-link-mechanism, and the effective length of said controlling link being such that the pivot between the controlling link and the leg-rest is moved along an arc being outside the arc along which the pivot between the seat and the leg-rest is moved during a movement of said seat from its sitting position into its extreme reclined position.

2. A reclining article of furniture comprising a support, a structure including a seat, a back-rest and means connecting said back-rest with said seat for controlling the movements of said back-rest and said seat in dependence on each other, the seat of said structure being swingably mounted on said support for movements from a sitting position into an extreme reclined position, limiting means arranged on said support for limiting the sitting position of the elements of said structure, a leg-rest, said leg-rest being pivoted to the front portion of said seat, and a controlling link, one end of said controlling link being pivoted to said leg-rest, the other end of said controlling link being pivoted to said support at a point spaced from the pivotal connection between the seat and the support, the effective lengths of said movable seat, said movable leg-rest, said movable controlling link, and the stationary portion of said support between the pivotal connections with said seat and said controlling link forming a four-

link-mechanism, the effective length of said controlling link being such that the pivot between the controlling link and the leg-rest is moved along an arc being outside the arc along which the point between the seat and the leg-rest is moved during a movement of said seat from its sitting position into its extreme reclined position, the sitting position angle between said leg-rest and said seat being smaller than 181° when the seat is in its sitting position, and said pivotal connection between said controlling link and said support being located in such a position that the reclined position angle between said leg-rest and said seat amounts to a value between 90° and 180° when the seat is in its extreme reclined position.

3. In a reclining article of furniture as claimed in claim 1, said means connecting the back-rest with the seat being disengageable so as to permit a swinging of the back-rest into a substantially horizontal position independently of the seat, and holding means arranged on the support for holding said back-rest in said substantially horizontal position.

4. In a reclining article of furniture as claimed in claim 1, said means connecting the back-rest with the seat being disengageable so as to permit a swinging of the back-rest and the seat independently of each other into a substantially horizontal position, and holding means arranged on the support for holding said back-rest, said seat and said leg-rest in a substantially horizontal position substantially in alignment with each other.

5. In a reclining article of furniture as claimed in claim 1, said back-rest being rigidly connected with said seat.

6. In a reclining article of furniture as claimed in claim 1, said means connecting the back-rest with the seat including a connecting element connected with the back-rest and the seat at spaced points, at least one of the connections of said connecting element being adjustable whereby the angle between the back-rest and the seat may be adjusted at a predetermined degree.

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