United States Patent [19]

Johnson

[11] **3,792,905**

[45] **Feb. 19, 1974**

[54] **POWER-OPERATED CHAIR**

[75] Inventor: **Philip C. Johnson**, Cincinnati, Ohio

[73] Assignee: **Dentsply Research & Development Corp.**, Milford, Del.

[22] Filed: **Sept. 11, 1972**

[21] Appl. No.: **288,185**

[52] **U.S. Cl.** **297/330**, 297/76

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

[58] **Field of Search** 297/75, 76, 330, 429–436

[56] **References Cited**

UNITED STATES PATENTS

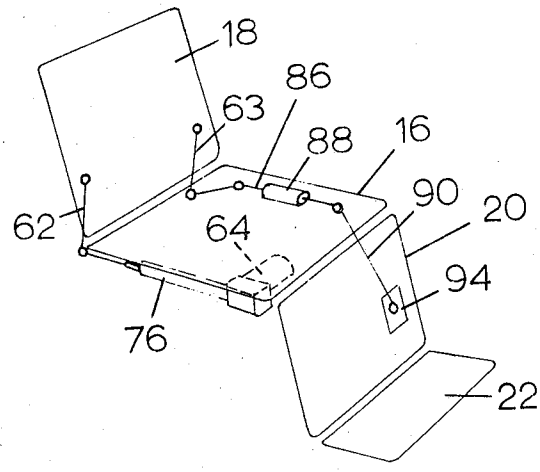
2,714,922	8/1955	McKibban et al.	297/330 X
3,476,495	11/1969	Church	297/330 X
1,753,470	4/1930	Meyer	297/76 X
2,514,447	7/1950	Hendrickson et al.	297/436
1,534,272	4/1925	Koken	297/76
1,675,547	7/1928	Grimmich	297/76
2,770,289	11/1956	McKendrey	297/76 X
3,172,699	3/1965	Naughton	297/330

Primary Examiner—Paul R. Gilliam

[57] **ABSTRACT**

A chair for medical and quasi-medical use comprising a back rest and leg rest respectively pivotally connected to the rear and front edges of a seat rest, power means connected to said back rest to move it between upright and horizontal positions, and linkage means interconnected between said back rest and leg rest to move the leg rest between vertically depending and horizontal positions incident to corresponding movement of said back rest between said positions thereof.

2 Claims, 8 Drawing Figures



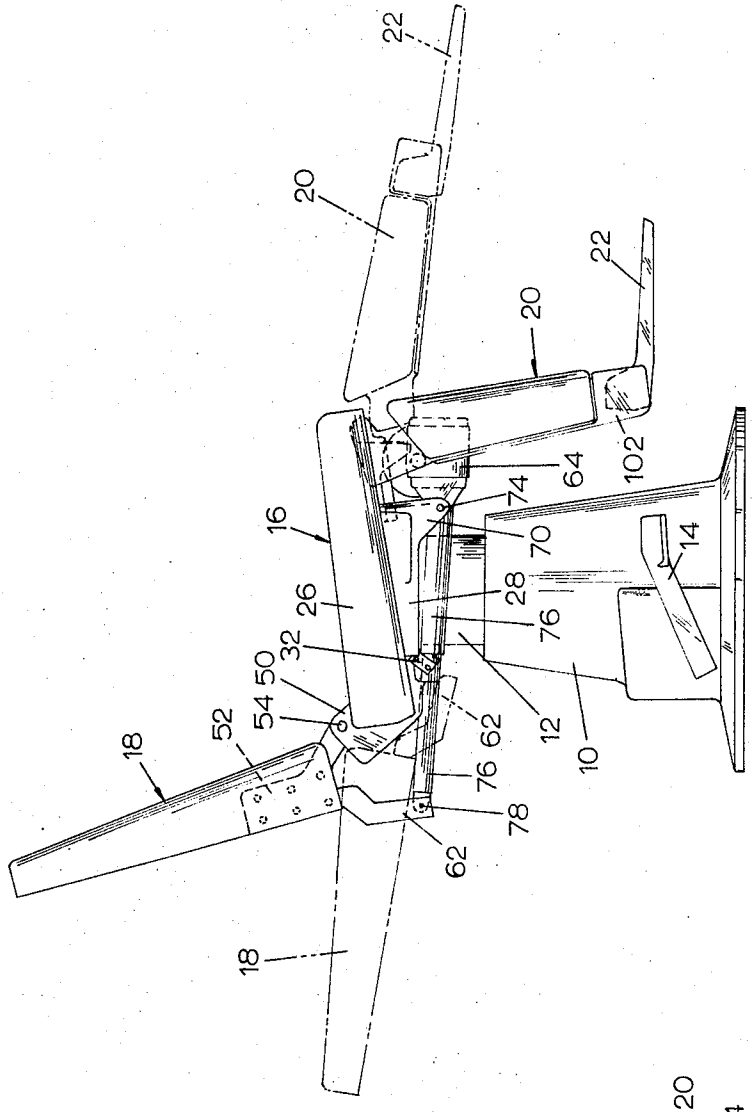

22
20
22
20
102
64
74
70
16
14
26
28
76
32
50
54
52
62
12
10
18
76
62
78
62
18

FIG. 1

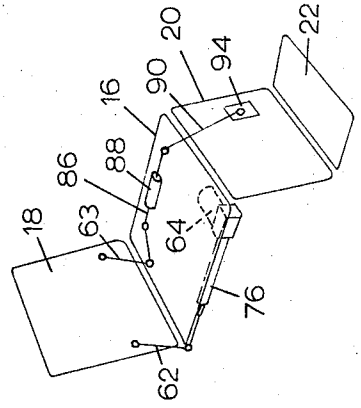

20
22
94
90
16
86
88
18
63
64
76
62

FIG. 2

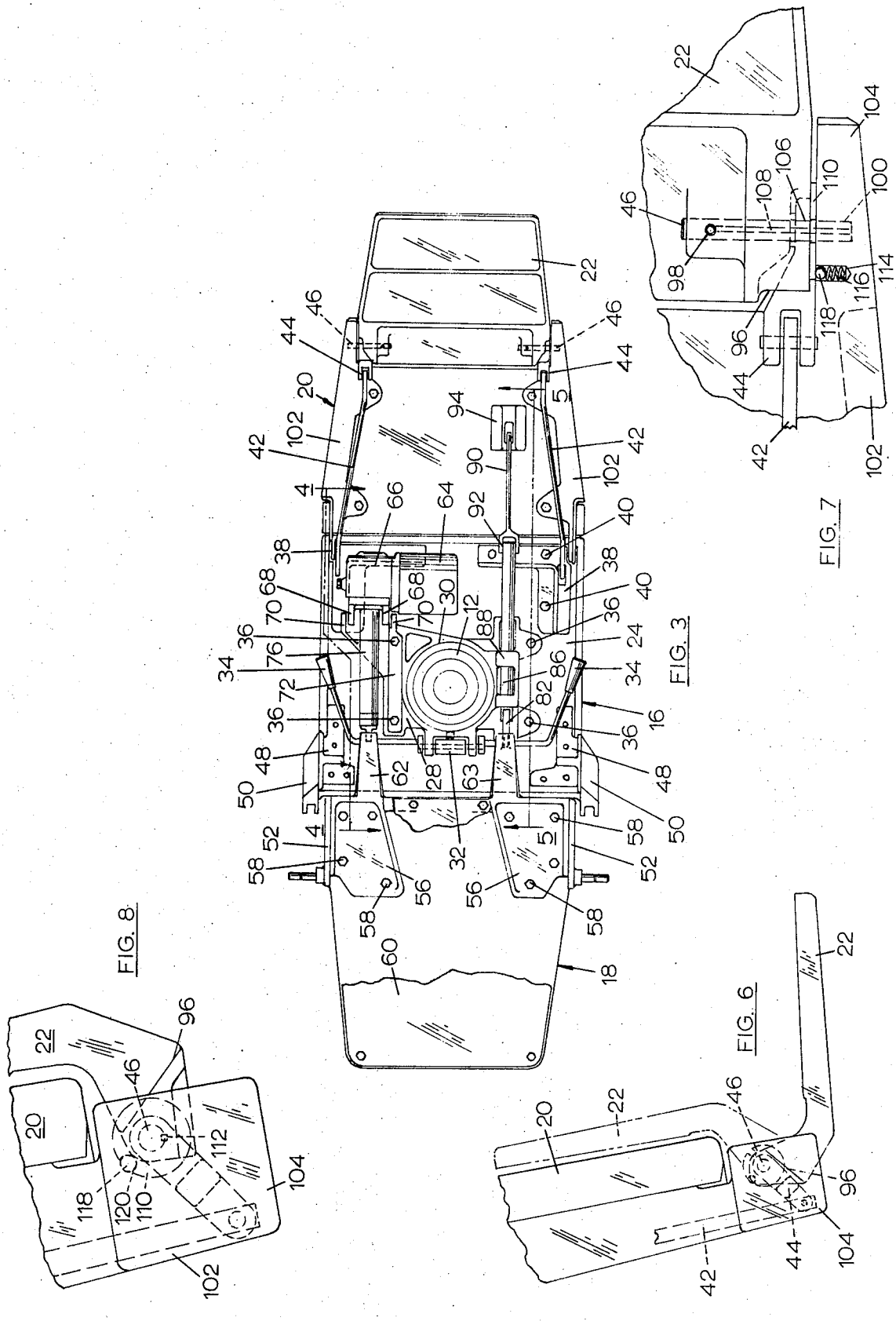


FIG. 3

FIG. 7

FIG. 8

FIG. 6

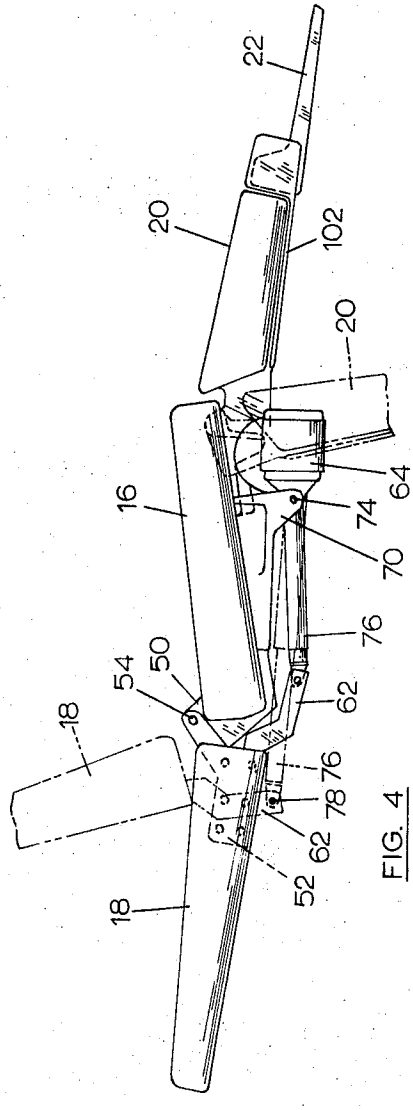

22
20
102
20
64
74
16
70
76
54
50
62
18
76
78
62
52
18

FIG. 4

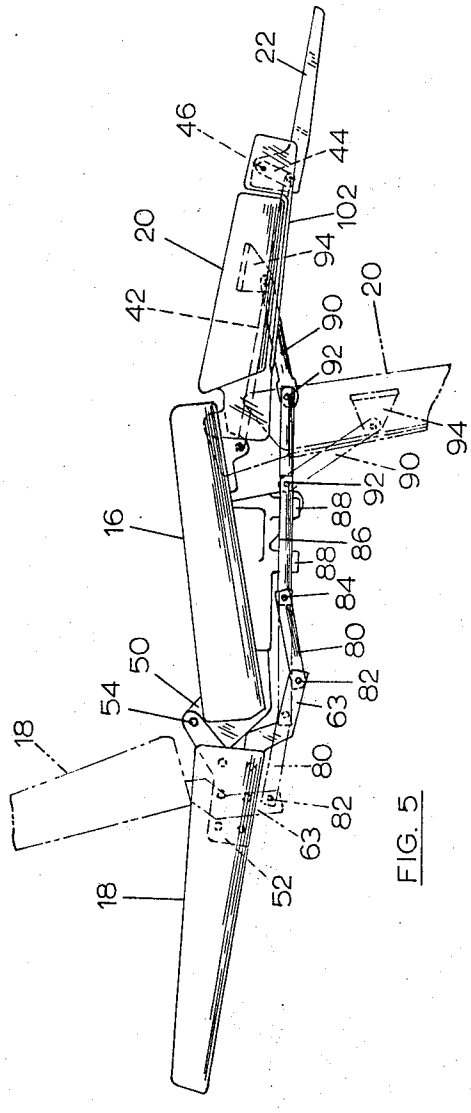

22
46
44
20
102
94
42
90
92
20
94
90
92
88
16
86
88
84
80
54
50
82
63
18
80
82
63
52
18

FIG. 5

POWER-OPERATED CHAIR

BACKGROUND OF THE INVENTION

The present invention primarily relates to power-operated chairs which are highly suited for medical and quasimedical purposes, such as are suitable for use in dental operatories, ophthalmology diagnostic and treatment purposes, and other similar uses. It is customary in such medical and quasi-medical uses of a chair of a type to which the present invention pertains to provide a back and leg rest which respectively are pivotally connected to the rear and front edges of the seat of the chair. A patient normally is seated in the chair when the back and leg rests are substantially in vertical positions with respect to the horizontal seat. Certain services to be rendered a patient are undertaken when the patient is seated upright in the chair, while other services and operations upon the patient are performed when the patient is inclined angularly in various positions relative to the horizontal seat, such inclinations frequently extending to horizontal positions in which the patient is substantially entirely reclined in such horizontal position.

For many years, chairs used for the foregoing purposes have included pivoted back and leg rests associated with a substantially horizontal seat. Disposing of the back and leg rests between vertical and horizontal positions was effected manually. Examples of chairs of this type are found in U.S. Pat. No. 481,040, dated Aug. 16, 1892, in the name of Longanecker; Pat. No. 792,207, dated June 13, 1905, in the name of Francis; and Pat. No. 822,164, dated May 29, 1906, in the name of Tarwater et al.

In more recent years, chairs of a household furniture nature have been devised in which back rests and leg rests are pivotally associated with respect to a seat for disposition between vertical upright arrangement and various degrees of inclination approaching a substantially horizontal position. To effect comfortable operation of the chairs, as well as providing for automatic retention of the back rest and leg rest in an adjusted angular position with respect to the seat, power means,-such as electric motors which drive screw jacks and the like,have been employed. Example of a chair of this type is found in U.S. Pat. No. 2,714,922, dated Aug. 9, 1955, in the name of McKibban et al. Sophistication of operation of household type chairs also has found expression in chairs for medical and quasi-medical purposes, such as dental chairs and chairs for ophthalmology purposes, especially to the extent of rendering the same power-operated. One example of a relatively complex chair of the latter type is the subject matter of U.S. Pat. No. 3,414,324, dated Dec. 3, 1968, in the name of Taylor et al.

It is the principal purpose of the present invention to provide a chair particularly suitable for dental and ophthalmology purposes, as well as any related medical and quasi-medical purposes, in which the chair and the operation thereof provide adequate comfort both for the patient as well as the operator, but in which operating structure a relatively simple design is utilized without sacrificing dependability or sound engineering principles, particularly for purposes of maintaining the selling price of such chair within a reasonable range, as well as to minimize the possibility of servicing requirements. Details of the objectives of the present invention are as follows:

SUMMARY OF THE INVENTION

It is the principal object of the present invention to provide a power-operated chair which, without restriction thereto, particularly is suitable for dental operations, ophthalmology examinations and operations, as well as other similar services and operations, and in which a back rest is pivotally supported adjacent the rear edge of a seat and a leg rest is pivotally supported adjacent the forward edge of said seat, power means is connected to the back rest and,through the back rest, is transmitted to the leg rest so as to provide a simple means for actuating the back rest and leg rest simultaneously for pivotal movement with respect to the seat.

Another object of the invention is to effect the foregoing connecting of the power means to the back rest, as well as transmit movement from the back rest to the leg rest by means of extensions depending downwardly from the back rest adjacent opposite sides thereof, appropriate linkage extending from one of said extensions to the leg rest, while the power means is connected to the other extension on the back rest.

A further object of the invention is to provide a screw jack which extends from one end of an electric motor supported beneath the seat adjacent the forward end thereof, and the screw jack extending rearwardly for connection to one of said aforementioned extensions on the back rest.

Still another object of the invention is to provide slidable, intermediate link means between additional links respectively connected to opposite ends of the slidable link to provide connection for transmittal of movement from one of said extensions on the back rest to the leg rest.

A still further object of the invention is to provide appropriate support means for the motor and screw jack, whereby limited pivotal movement is afforded the motor relative to the support means due to the slight changes in angular disposition of the axis of the screw jack relative to the plane of the seat incident to moving the back rest about its pivot through the pivotal attachment of the outer end of the screw jack to one of said extensions on the back rest.

Details of the foregoing objects and of the invention, as well as other objects thereof, are set forth in the following specification and illustrated in the accompanying drawings comprising a part thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevation of an exemplary power-operated chair embodying the principles of the present invention and in which the back rest and leg rest are illustrated in full lines in their substantially vertical position, while the same are illustrated in phantom in their extended, substantially horizontal position.

FIG. **2** is a diagrammatic illustration of the essential movable elements of the power-operated chair illustrated in FIG. **1**.

FIG. **3** is a bottom plan view of the power-operated chair shown in FIG. **1**, and in which the back rest and leg rest are shown in extended, substantially horizontal positions with respect to the seat.

FIG. **4** is a side elevation arranged to illustrate details of the power means which include an electric motor

and screw jack connected thereto and the outer end of the screw jack being pivotally connected to an extension on the back rest, substantially as seen on the line 4–4 of FIG. 3.

FIG. 5 is a view similar to FIG. 4, but being arranged to illustrate the linkage by which one of the extensions on the back rest is connected to the leg rest in order to transmit direct movement thereto resulting from pivotal movement of the back rest with respect to the seat, as seen on the line 5—5 of FIG. 3.

FIGS. 6, 7 and 8 are various fragmentary views showing details of mechanism to control movement of the foot rest relative to the leg rest.

DETAILED DESCRIPTION

For purposes of completeness, there is illustrated in FIG. 1 a chair base 10 which is adapted to be mounted in conventional manner upon a supporting surface such as a floor. The base may either be powered-operated to elevate or lower a vertical movable support plunger 12 or the same may be raised and lowered by foot power, for example, by operation of a treadle member 14. In view of the fact that the chair base 10 and the means to raise and lower the support plunger 12 do not comprise part of the novel aspects of the present invention, said base mechanism primarily is for illustrative purposes to represent an appropriate structure capable of supporting the seat rest 16, which normally is substantially horizontal, although preferably slightly inclined downwardly toward the rear as shown in FIG. 1, and to which a back rest 18 is pivotally interconnected adjacent the rear edge of the seat rest 16 and a leg rest 20 is pivotally connected to the forward edge portion of the seat rest 16.

The seat rest 16, back rest 18, and leg rest 20 may be appropriately unholstered in accordance with conventional practice. The actuating and positioning mechanism comprising the novel aspects of the present invention are adapted to be used with a wide variety of chairs of the type referred to, and therefore, the manner of upholstering the seat rest, back rest, and leg rest is relatively immaterial as far as the present invention is concerned. In accordance with usual construction, however, said various elements usually include base frame members of one kind or another to which an upholstered member is connected. Details of such base frame members for such elements are best illustrated in FIG. 3, to which attention is directed.

Referring to FIG. 3, which is a bottom plan view of the chair assembly comprising the seat rest 16, back rest 18, and leg rest 20, as well as foot rest 22, which is pivotally connected to the outer end of the leg rest 20, it will be seen that the seat rest 20 comprises a suitable base panel 24, which may be formed from any suitable material, such as metal, plywood, or otherwise. An upholstered seat cushion 26 is connected to the upper surface of the base panel 24 by suitable screws or otherwise. Also connected to the lower surface of base panel 24 is a head casting 28, which has a central socket 30 which receives the upper end of the support plunger 12 and relative to which the head casting 28 is rotatable about the vertical axis of support plunger 12. For purposes of locking the head casting 28 and the seat means connected thereto with respect to the support plunger 12, appropriate locking means 32 is provided on the head casting 28 and is operable from either side of the seat rest 16 by means of handled levers 34.

The head casting 28 is connected to the under surface of the base panel 24 of the seat rest 16 by means of a plurality of bolts 36. Also connected to the lower surface of the base panel 24 are a pair of right-angled brackets 38, which are secured to the panel 24 by additional bolts 40. The brackets 38 are provided for purposes of pivotally connecting one end of each of a pair of links 42 to the lower surface of the seat 16, while the opposite ends of the links are pivotally connected to clevises 44 which project from one end of the foot rest 22 adjacent opposite sides thereof, said foot rest being connected to the outer end of the leg rest 20 by pivots 46 of appropriate type, as shown in FIG. 5. The purpose of the links 42 is to effect suitable positioning of the foot rest 22 with respect to the leg rest 20, regardless of whether the leg rest 20 is in extended, horizontal position, or the depending position with respect to the front edge of the seat rest 16. The foot rest 22 and its positioning mechanism also comprises part of the improvement afforded by the invention, but in addition, shows certain conventional features of the chair in connection with which the present invention is concerned.

An additional pair of hinge brackets 48 is connected to the lower surface of the base panel 24 of the seat rest 16 adjacent the rear edge thereof and respectively at opposite sides of said seat rest. These are best illustrated in FIG. 3. The outer side edge of each of the brackets 48 has an upwardly extending ear 50 to which another hinge bracket 52 is pivotally connected by a hinge bolt 54. The portion of hinge brackets 52 which are pivotally connected to the other hinge brackets 48 are connected to and extend perpendicular to a base member 56 which is of appreciable area as can be seen from FIG. 3. The base members 56 respectively are adjacent opposite sides of the back rest 18 and are connected thereto by a series of screws or bolts 58. In the finished chair, the base members 56 are covered by a suitable finishing panel 60 so as to render the back rest aesthetic in appearance.

The base members 56 also serve another very important function with respect to the present invention. Base members 56 respectively have integral extensions 62 and 63 projecting therefrom which, as can be seen from FIGS. 1, 4 and 5, depend from the lower edge of the back rest 18 when the same is in substantially vertical position. The terminal end portions of each of the extensions 62 and 63 are substantially parallel to the longitudinal plane of the back rest 18, but are laterally offset a slight distance from the rear surface of the back rest 18 to facilitate the pivotal action thereof with respect to the pivot 54 by power means, details of which are as follows:

The power means primarily comprises an electric motor 64, which is provided with a reduction gear housing 66 at one end thereof. The gear housing 66 is provided with a transversely spaced pair of lugs 68, which respectively extend between a pair of complementary ears 70 provided on bracket 72 which is connected by the bolts 36, which also affixes one side of the head casting 28, to the lower surface of the base panel 24 of seat rest 16. A suitable pivot shaft 74 extends between the lug 68 and ears 70 to pivotally connect the same and, thus, support the power means com-

prising motor **64** and its associated mechanism with respect to the seat rest **16.**

The power means of the chair also includes a screw jack **76** of conventional type. The extensible member thereof moves between the full line and dotted line positions thereof shown in FIG. **4,** for example. The outer end of the extensible portion of the screw jack **76** is connected to one of the extensions **62** by means of a pivot pin **78,** as clearly shown in FIGS. **1** and **4.** It will be understood that the motor **64** is connected in an appropriate electric circuit extending from a source of power and controlled by a switch located at a convenient location, now shown, with respect to the chair unit. The motor **64** preferably is of the reversible type and because of the pivoted mounting thereof by means of the pivot shaft **74,** it will be seen that the limited amount of angular movement of the screw jack **76,** which occurs when moving the back rest **18** between upright and reclined, horizontal position, can be accommodated without injury to the motor or screw jack.

Movement of the back rest **18** by the power means **64** and its associated mechanism is transmitted to the leg rest **20** by operation of the extension **63** which is integral with the other base member **56** from that which supports the companion extension **62,** which is rigid with respect to back rest **18.** Extension **63** is interconnected to a linkage system comprising a connecting link **80,** one arm of which is connected to the extremity of extension **63** by a pivot bolt **82.** The opposite end of link **80** is connected by a pivot bolt **84** to one end of a slidable crosshead rod **86,** which is guided for movement longitudinally of itself by a pair of stationary bearings **88,** as best seen in FIGS. **3** and **5.** The opposite end of the rod **86** is connected to one end of another link **90** by means of a pivot bolt **92** and the opposite end of link **90** is pivotally connected to a bracket **94,** which is affixed in a suitable manner to a portion of the frame structure to which the upholstery of leg rest **20** is connected.

From the foregoing, especially with reference to FIG. **5,** it will be seen that as the back rest **18** moves between upright position, shown in phantom is said figure, and extending substantially horizontal position as shown in full lines in the figure, the leg rest **20** correspondingly is moved between its depending position shown in phantom in FIG. **5** and its full line or extended, substantially horizontal position shown in said figure. When in such substantially horizontal positions of the back rest **18** and leg rest **20,** an occupant upon the chair is in a supine position. Movement of the back rest **18** and leg rest **20** occurs simultaneously as such movement is effected by the power means comprising motor **64** and the driving mechanism connected thereto which engages extension **62** on back rest **18,** and in turn, causes companion extension **63** on the back rest to effect corresponding movement of the leg rest **20** through the linkage described above, as especially illustrated in detail in FIG. **5.** Hence, it will be seen that the power means and actuating mechanism operated thereby for moving the back rest **18** and leg rest **20** simultaneously between the different optimum positions thereof with respect to the seat rest **16** is relatively simple without sacrificing efficiency, strength, and durability. The simplicity and durable aspects result in only minimum servicing of the chair, even over long periods of use. The simplicity of the operating mechanism also can be appreciated at a glance from inspecting the diagrammatic view comprising FIG. **2.**

The foot rest **22** is pivotally connected to the outer ends of the leg rest **20** by pivot pins **46.** Details of the pivotal support for the foot rest **22** are best illustrated in detail in FIGS. **6–8.** Said foot rests preferably are formed by casting from suitable metal. Due to the pivot pins **46** being adjacent the inner edge of the foot rest, it is apparent that said foot rest is supported in cantilever manner, whereby gravity normally tends to move the outer end of the foot rest downwardly. For example, when the leg rest **20** is in the depending position, such as when the back rest **18** is upright, gravity tends to dispose the foot rest in substantially horizontal position. Similarly, when the back rest **18** and leg rest **20** are disposed in substantially horizontal position, such as shown in full lines in FIGS. **4** and **5,** gravity will tend to maintain the foot rest **22** in similar horizontal position. This is due to the fact that the foot rest **22** is freely rotatable with the pivot pins **46.** In order to maintain the foot rest **22** in substantially horizontal position when the leg rest **20** is depending downwardly, opposite side portions of the inner edge of the foot rest **22** are provided with shoulders **96** which extend in abuttable relationship with respect to the clevises **44,** one edge of said clevises being abutted by the shoulders **96** when the foot rest **22** is pivoted downwardly to its fullest extent, which position is slightly below that illustrated in FIG. **6** since said figure illustrates a slight space between the clevise **44** and the adjacent shoulder **96.** When the leg rest **20** is projected to horizontal position, the links **44** are actuated automatically to move the clevises **44** clockwise and, in so doing, will dispose them in the position illustrated in FIG. **5,** in which position gravity will also pivotally move the foot rest **22** clockwise when the leg rest **20** is being elevated from its depending position. The shoulders **96** on the foot rest will similarly engage the clevises **44** when the elements are in the position shown in FIG. **5,** for example.

Particularly when the leg rest **20** is disposed in depending position as shown in FIGS. **1** and **6,** it is sometimes desirable to pivotally move the foot rest **22** upwardly so as to somewhat closely overlie the front surface of the leg rest **20,** as shown in dotted lines in FIG. **6.** Such movement is accomplished manually and is permitted by means of the free rotation of the foot rest with the pivot pins **46** to which they are fixed by means of set screws **98,** shown in FIG. **7.** The opposite ends of the pivot pins **46** are rotatably supported within bearing sockets **100** formed in the side frame members **102** of the leg rest **20** which terminate in relatively square bosses **104** within which the bearing sockets **100** are located. One end of each of the clevises **44** is also provided with a bearing hole **106** through which the pivot pins **46** extend, as shown in FIG. **7,** and upon which the clevises **44** are freely rotatable. The pivot pins **46** also are provided with a longitudinally extending spline **108,** as shown in FIG. **7,** and into which the set screws **98** extend, for example. In addition, a washer **110** which is substantially larger in diameter than the pivot shaft **46,** as seen from FIGS. **7** and **8,** also is mounted upon at least one of the pivot shafts **46** and has a tang **112** thereon, as shown in FIG. **8,** for purposes of keying said washer to said shaft, whereby the same is rotatable with the foot rest **22** which the same is pivotally moved with

the pivot shaft **46** relative to their bearing sockets **110.**

The washer **110** serves an important function with respect to maintaining the foot rest **22** in elevated position, such as shown in dotted lines in FIG. **6,** to insure that the foot rest will not fall accidentally to its horizontal position from the elevated position due to the action of gravity upon the same. This is accomplished by providing within the boss **104** of side frame member **102** a blind bore **114** which is shown in FIG. **7.** Disposed within the bore is a compressed spring **116** which urges a metal ball **118** outwardly for disposition of the same within a notch **120** formed at a precise location within the periphery of the washer **110,** shown in FIG. **8.** When the foot rest **22** is disposed in the vertical position as shown in FIG. **8** and also in the dotted line position of FIG. **6,** the ball **118** will be in registry with the notch **120** and be projected into the same a sufficient distance to yieldably maintain the foot rest in such upstanding, vertical position. When desired to move the foot rest to its lower, horizontal position, the forces of spring **116** readily is overcome to release the notch **120** from engagement by ball **118,** and thus, permit downward pivotal movement of the foot rest from its elevated position. Otherwise, the frictional engagement of the ball **118** against the surface of washer **110** when the foot rest is moving to its various pivoted positions is inadequate to overcome the force of gravity and therefore, will not interfere with such pivotal movement of the foot rest to any of its operative positions of those illustrated in the various figures with respect to the depending and horizontally extending positions of the associated leg rest **20.**

While the invention has been described and illustrated in its several preferred embodiments, it should be understood that the invention is not to be limited to the precise details herein illustrated and described since the same may be carried out in other ways falling within the scope of the invention as illustrated and described.

I claim:

1. A chair including a back rest, a seat rest, and a leg rest; hinge means respectively positioned adjacent opposite sides of said rests and pivotally connecting the back rest to the rest portion of said seat rest and pivotally connecting the leg rest to the front portion of the seat rest; a pair of extensions fixed rigidly to and depending from the pivoted end of said back rest respectively adjacent the inner side edges of said hinge means at opposite sides of said seat rest and back rest and extending beyond the pivot axes of said hinge means; power means comprising an electric motor and speed reduction unit supported beneath said seat rest adjacent one side thereof, a screw jack interconnected at one end to said motor for actuation thereby and the opposite end of said screw jack being connected to the extension on said back rest adjacent said one side of said seat rest and operable to move said back rest between substantially upright and horizontal positions relative to said seat rest; and linkage means beneath said seat rest supported for movement adjacent the other side thereof and connected between said other extension on said back rest adjacent said other side of seat rest and including a bar slidably supported within guide bearing means fixed to said seat rest, and links pivotally connected to the opposite ends of said bar and the opposite ends of said links respectively being connected to said other extension and said leg rest and operable automatically by movement of said back rest by said power means to move said leg rest relative to said seat rest between substantially vertically depending and horizontal positions, respectively when said back rest is moved between said upright and horizontal positions thereof.

2. The chair according to claim **1** in which said gear reduction unit is contained within a housing supported by bearings interconnected to the under side of said seat rest for support thereby and adapted to permit limited pivotal movement of said housing as required by pivoted movement of the threaded sleeve incident to the back rest being pivotally moved relative to said seat rest.

* * * * *