

Feb. 6, 1945.

E. SCHMUED

2,369,076

ADJUSTABLE CHAIR

Filed July 15, 1941

4 Sheets-Sheet 1

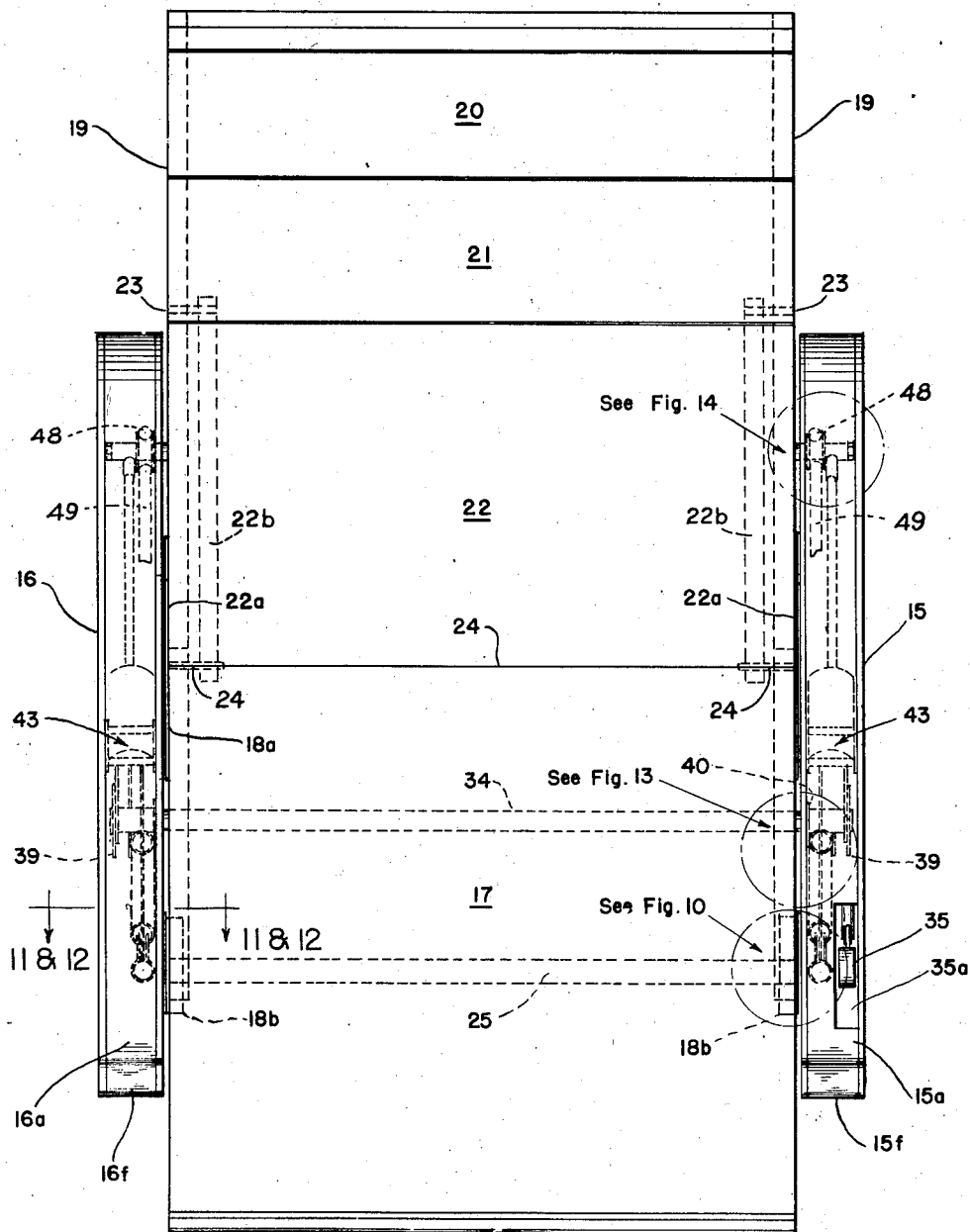


Figure 1

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Feb. 6, 1945.

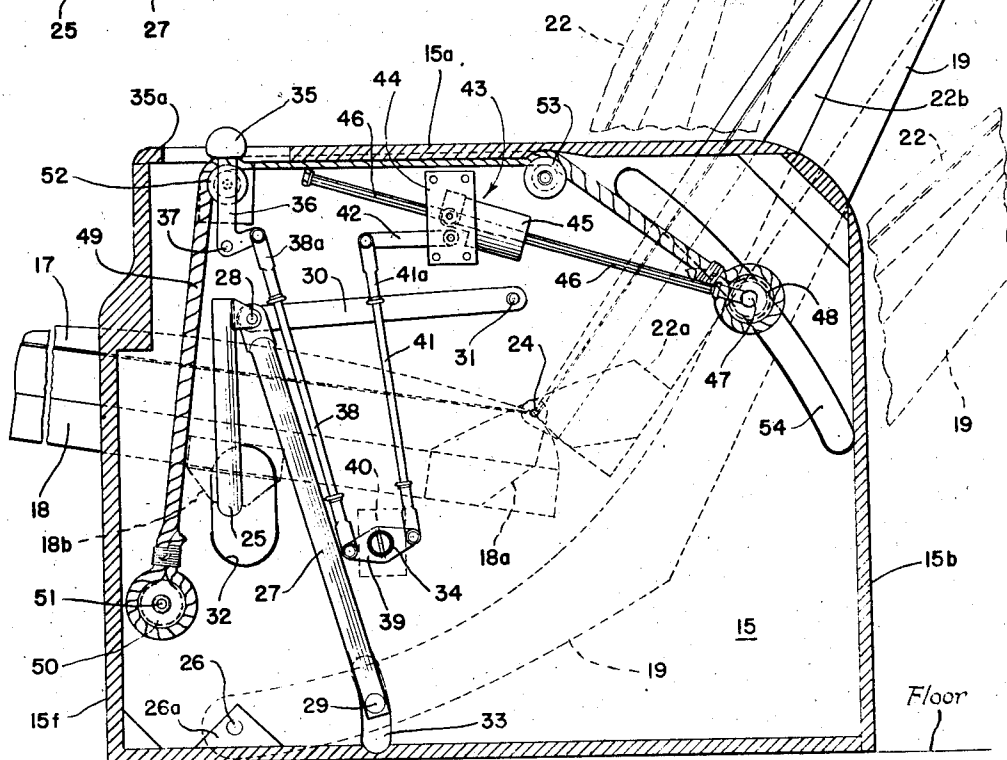
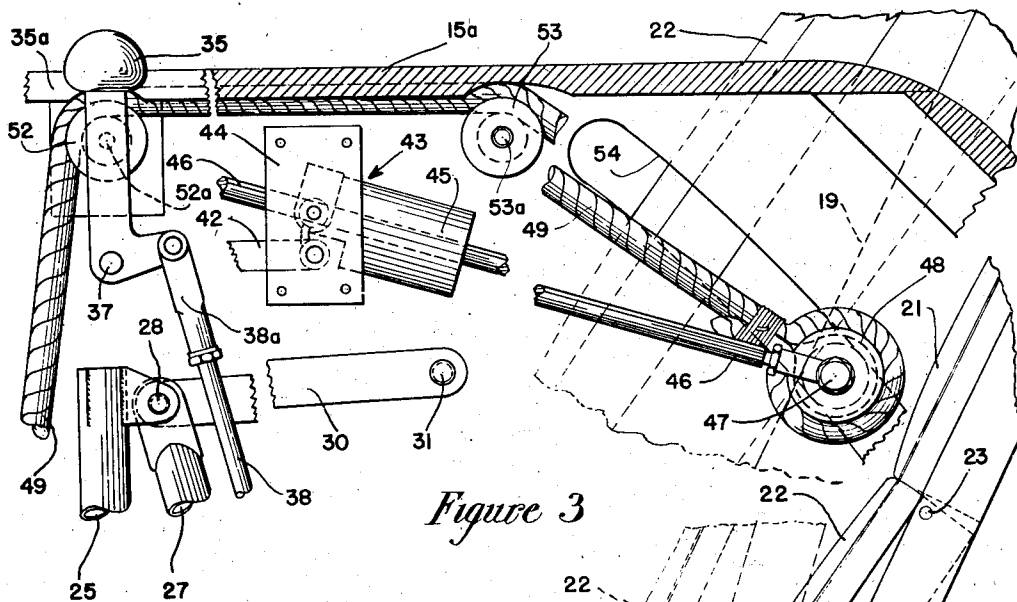
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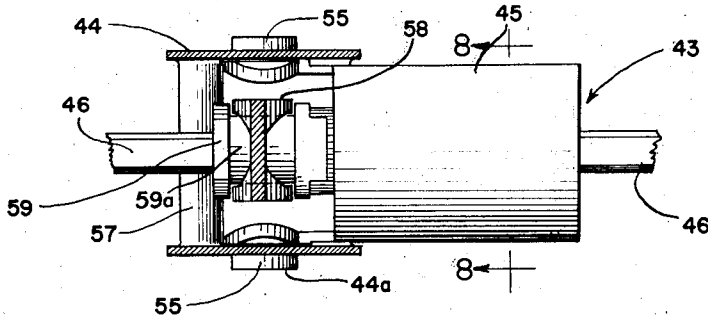


Figure 6

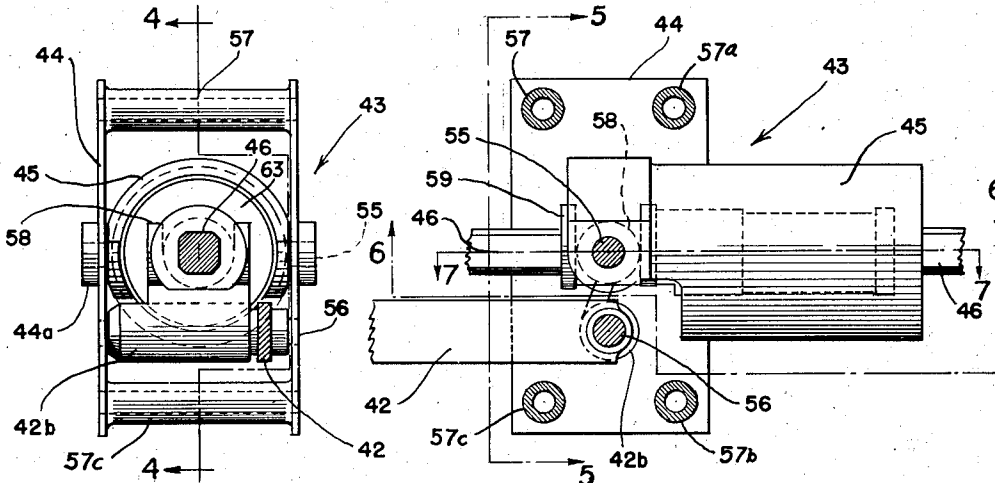


Figure 5

Figure 4

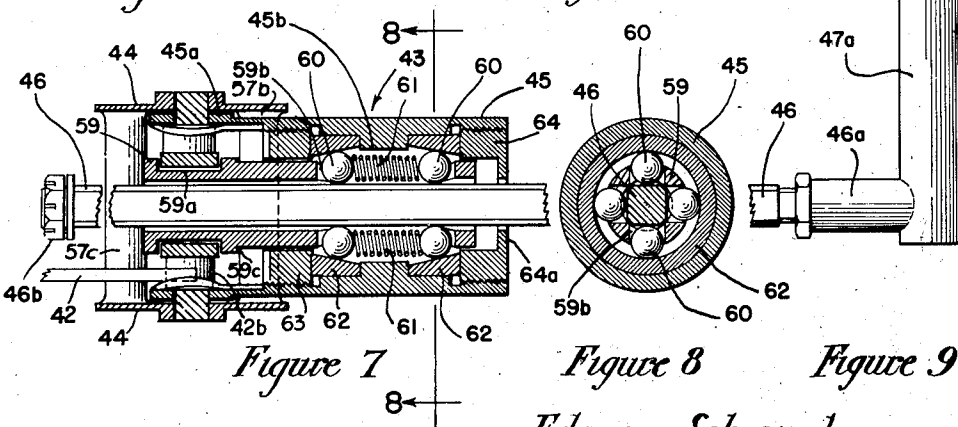


Figure 7

Figure 8

Figure 9

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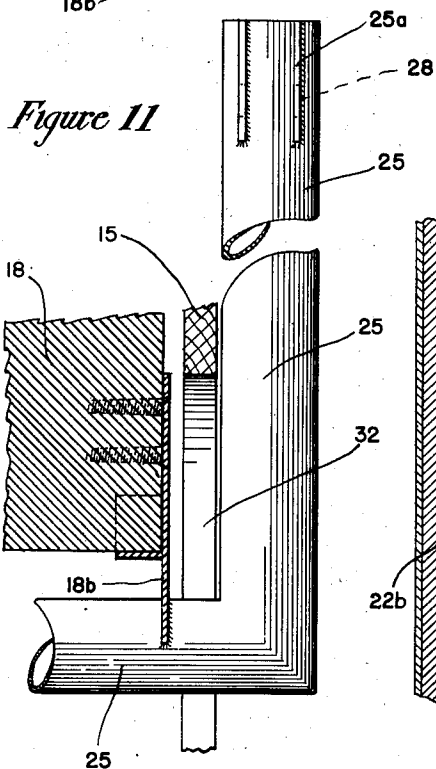
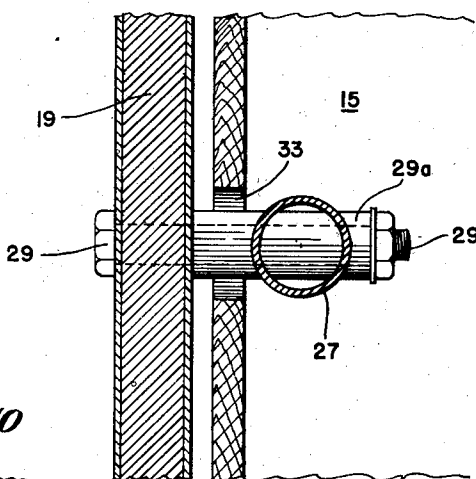
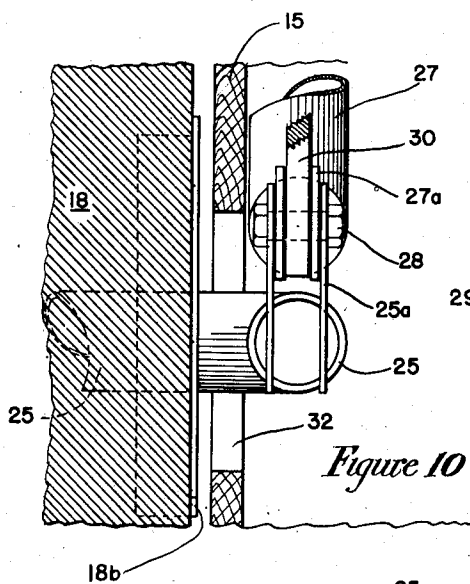
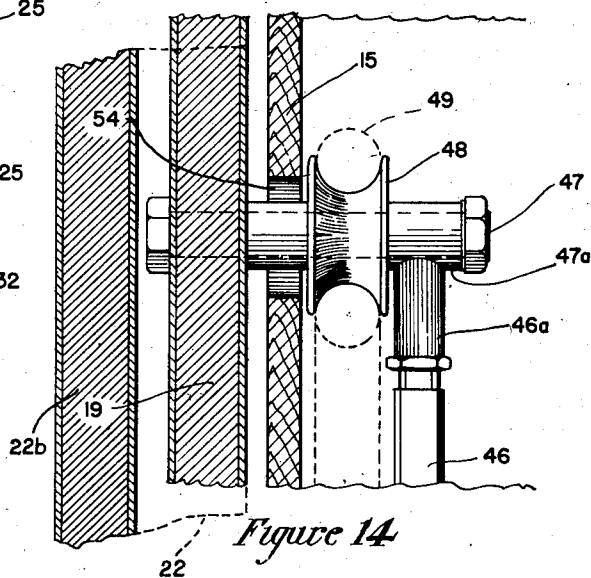


Figure 12



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UNITED STATES PATENT OFFICE

2,369,076

ADJUSTABLE CHAIR

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Application July 15, 1941, Serial No. 402,452

13 Claims. (Cl. 155—116)

The present invention relates to chairs or seats, and more particularly to chairs of the adjustable type suitable for use in aircraft, other vehicles, or in relatively fixed locations.

It is an object of this invention to provide a chair having a fixed supporting portion, and adjustable seat and back portions, together with means whereby the occupant may adjust the relative attitude of the seat and back portions both with respect to each other and to the fixed supporting portions. It is also an object to provide novel supporting means whereby the respective portions of the chair are articulated or pivoted to each other and relatively movable as they are adjusted into their respective positions. A further object of the present invention resides in the provision of an intermediate portion which is pivoted to and located between the seat and the back portions to assist in the support of the back of the occupant during certain reclining positions of adjustment of the chair.

Another object resides in the provision of a novel locking mechanism which is easily operable from a readily accessible position at the arm portion of the chair. A still further object of the present invention resides in the novel arrangement and relationship of the supporting, restoring and operating mechanism which is housed entirely within the supporting portions of the chair where it does not interfere with the comfort of the occupant but is readily accessible for servicing and repair.

Other objects and advantages of the present invention will become apparent to those skilled in the art after a reading of the following description and the accompanying drawings, in which:

Fig. 1 is a plan view of a preferred form of the chair embodying the present invention;

Fig. 2 is a side elevation of the chair with its side panel removed to more clearly show the operating mechanism;

Fig. 3 is an enlarged detail of the supporting portion of the chair showing the operating and locking mechanism adjacent to the arm rest;

Fig. 4 is an enlarged detail view of the locking mechanism with the supporting element partly broken away;

Figs. 5 and 6 are end and bottom views respectively, of the locking mechanism shown in Fig. 4;

Fig. 7 is a longitudinal sectional view of the locking device taken along line 7—7 of Fig. 4;

Fig. 8 is a cross sectional view of the lock as taken along the line 8—8 of Figs. 6 and 7;

Fig. 9 is a detail view of the terminal of the locking bar rod;

Fig. 10 is an enlarged sectional plan view of the seat supporting cradle as viewed facing rearwardly at the right hand of the seat shown in Fig. 1 (occupant's left hand);

Figs. 11 and 12 show enlarged views of the corresponding mechanism on the left side of the chair looking forwardly (occupant's right side);

Fig. 13 is an enlarged sectional plan of the strut connection of the pivoting back frame as viewed at the right side of the chair; and

Fig. 14 is an enlarged sectional plan view of the shock cord and locking bar attachment connections to the pivotal back frame also at the right side of the chair.

Referring now to Fig. 1 there is shown a plan view of the chair in a preferred form of the present invention which comprises essentially the two fixed sides or supporting portions 15 and 16 from which are adjustably carried the seat portion 17, the back supporting rails 19, the back cushions 20 and 21 and the intermediate cushion 22. For purposes of convenience in describing the present invention the right side of the chair has been designated by the numeral 15 and the left side of the chair by the numeral 16, these being on the right and left hand sides, respectively, as viewed by a person standing before the chair and looking rearwardly at it as the reader would view Figure 1 (being opposite to the right and left sides of the seated occupant). As will be seen from Fig. 2 the substantially rectangular side supporting sections 15 and 16 of the chair are formed in a hollow box or housing, the bottom of which is supported directly upon the floor, the right section 15 being provided with a front end 15f, a back end 15b and a top or arm rest portion 15a. The latter is provided with a slot 35a through which the locking knob 35 protrudes slightly in the region of the occupant's left hand when it is resting upon the arm 15a. Each side or supporting chair portion has a removable outside panel for access to the chair operating mechanism, the side panel having been removed from the support portion of Fig. 2.

The adjustable back portions of the chair are carried upon the back supports 19 which are substantially J-shaped in side elevation, having an arcuately curved lower portion and a relatively longer straight upper portion. The forward lower terminal of each back support or rail 19 is pivotally mounted upon the side sections 15 and 16 by the pivots 26 carried by the supporting plates 26a. The upper back or head rest cushion 20 and the next lower back cushion 21 are each fixedly attached to the upper portions of the supporting

rails 19. The intermediate cushioned portion 22 has its own side rail frames 22b which are pivotally mounted upon the supporting rails 19 by means of the pivots 23 disposed closely adjacent the lower edge of the back cushion. The lower edge of each frame 22b of the intermediate cushion 22 is hinged at 24 to the rear edge of the seat cushion 17, the hinge being supported from the cushion 22 and its frame 22b by the plate 22a and from the seat support 18 by its corresponding gusset plate 18a.

The cushion 22 projects laterally beyond its side frames 22b to the same width as the adjacent cushions 17 and 21, with which it is flush with the outer faces of the rails 19.

The seat cushion 17 is supported by the seat support frame 18 which is in turn supported by the cradle or yoke 25 which is formed from a substantially U-shaped tubular arrangement, a side and lower corner being shown in Fig. 12. A plate 18b having an angle or shelf element beneath the seat support 18 is attached to the latter by screws or other suitable fastenings and is in turn welded or otherwise fixed to the transverse tubular element 25, causing the latter to form a rigid support for the seat extending upwardly within the sides 15 and 16 of the chair.

The upper terminal of each of the upwardly directed portions of the cradle 25 is each provided with rearwardly extending ear portions 25a to which are pivotally connected the struts 27 by means of the pin bolts 28. The lower terminals of each of the struts 27 are provided with transverse tubular members 29a which are pivotally supported from the rail members 19 by means of the pivot bolts 29. Between the bifurcated lug portions 27a at the upper terminals of the struts 27 there are disposed the link members 30 also free to pivot about the pins 28 and pivoted at their other, or rearward, terminals by the pivots 31 supported by the side sections 15 and 16. It will be seen that the seat 17 with its cradle 25 fixed thereto together with the struts 27 and the links 30 form an articulated linkage assembly, the seat position being determined by the fixed axis of the pivots 31, the arcuately movable pivots 29 as they may rotate with the rails 19 within restricted limits about the pivots 28, and by its pivotal connection at 24 to the movable back assembly of the chair. Accordingly, the inner side panels of the supporting sections 15 and 16 are each provided with elliptical openings 32 to provide suitable clearances for the movement of the cradle 25, as well as arcuate slots 33 to provide for the movement of the transverse pivots 29.

Each of the above described elements comprising the cradle 25, the strut 27 and the link 30 forms the suspension linkage from which the seat portion 17 is carried and together with the cushion section 22, also serves to determine the position of the seat portion. In order to lock or fix the movable portions of the chair in any of its positions there is provided a locking mechanism in both of the fixed side portions 15 and 16 of the chair, the lock having been shown as operable from the right section of the chair only as shown in Fig. 1. Both halves of the locking mechanism are operated in unison by the torque tube 34 which extends between the side sections in which it is journaled in the bearing plates 40, which are secured to the side portions 15 and 16. These plates 40 are laterally spaced sufficiently therebelow to clear the seat portion 17. This transverse torque tube 34 is manually rocked

by the occupant by forward or rearward pressure against the knob 35 carried upon the upper terminal of the hand lever or bellcrank 36 which is pivotally mounted upon the side structure 15 at the fixed pivot 37. The remaining arm of the bellcrank 36 is pivotally connected to the upper adjustable terminal 38a of the push-pull rod 38, the lower terminal of which is in turn pivotally connected to the double lever plate 39 which is fixedly attached to the torque tube 34. The aforementioned elements of the locking system, with the exception of the tube 34 and levers 39, are provided in one of the side sections only, although under certain circumstances it may be desirable to have locking knobs in both arms of the chair to be operated either singly or simultaneously by the occupant.

The following described portions of the locking mechanism are, however, provided in each side section of the chair, the parts being either identical or opposite hand duplicates of those shown in Fig. 2 in the right side of the chair. Adjacent either terminal of the torque tube 34 there is provided the double lever plate 39 which is pivotally connected at its rearward portion to the lower terminal fittings of the push-pull rods 41, the upper adjustable terminals 41a of which are pivoted to the forward extremity of the locking levers 42. Lock assemblies 43 are provided on each side of the chair and each comprises essentially a fixed supporting frame portion 44 attached to the side section and a trunnioned cylindrical body portion 45 within which the locking bar 46 is adapted to be releasably locked in a plurality of positions. Each locking bar 46 is provided at its rear terminal with pivotal connections 47 to the back rails 19. It will accordingly be seen that as the back rails 19 are rotated simultaneously about their lower pivotal mountings 26 they can be maintained in any of the adjusted positions by locking of the assembly 43 thereby fixing the pivot point 47 with respect to the fixed sides 15 and 16.

In order that the movable portions of the chair may be readily restored from reclining to upright positions without the exertion of too great forces by the occupant, or to resiliently restrain its being lowered, the weight of the rear or upper portions of the chair is counterbalanced by means of the elastic shock cord 49 having its rear terminal engaging the sheave or spool 48 concentrically rotatable about the lock bar pivot terminal 47. Each rubber shock cord 49 extends from this movable terminal upwardly and forwardly beneath the arm rests of each side section, being guided over the idler shafts 52 and 53, pivotally mounted at 52a and 53a. The cords thence extend downwardly adjacent the front of the side sections 15 and 16 and the remaining terminals are anchored to the fixed sheave 50 supported on the side sections by the bolts 51. In order to provide suitable clearance for the movement of the pivot 47 in its arcuate path about the pivot 26 a clearance slot 54 is provided in each side section, being more clearly shown in Figs. 3 and 14.

The locking assembly 43 is shown in detail in Figs. 4 to 9 inclusive. The supporting frame 44 is provided with apertured bosses 44a within which the cylindrical lock body 45 is trunnioned by means of the pivot pins 55. The cylindrical body 45 is similarly provided with apertured boss portions 45a pivotally engaging the pins 55 and forming a semicircular portion which is open on its lower side to accommodate the hub portion

42b of the cam lever 42. The latter is also pivotally mounted between the sides of the supporting frame 44 by means of the pivot pin 56. The side portions of the lock support 44 are interconnected by tubular tie portions 57, 57a, 57b and 57c through which are extended suitable fastening bolts by which the lock assembly 43 is rigidly anchored to the side sections 15 and 16 of the chair.

The hub portion 42b of the lock cam lever 42 is provided with spaced ears 58 forming a bifurcated portion which closely engages the reduced diameter portion 59a of the sliding sleeve 59. The latter is provided with a central opening preferably of squared cross section through which the locking bar 46 is adapted to be reciprocated. The sleeve 59 is also provided with four elongated openings 59b exposing the four faces of the squared locking bar 46, the sharp corners of which are preferably chamfered as shown in cross section in Figs. 5 and 8. Within each opening 59b are provided two hardened steel balls 60 which are at all times urged apart by the compression springs 61 interposed between each pair of balls. The cylindrical lock body 45 is provided interiorly with stepped diameter portions and a reduced central opening at 45b against which are seated the tapered rings 62. These tapered rings are spaced such that they are adjacent and outside the sets of balls 60 and in the centralized position of the sleeve 59 with respect to the body 45 the balls 60 are pressed apart by the springs 61 such that they wedgingly engage both the rod 46 and the rings 62 and prevent relative movement of the rod with respect to the lock assembly 43. The tapered rings 62 are retained at the rear of the body element 45 by the end retainer 64 which is suitably fastened to the body 45 and is provided with an inwardly extending lip portion 64a which serves as a limit stop for the sliding cylinder 59. A similar retaining ring 63 is provided to maintain the forward tapered ring 62 in its position with respect to the body 45, serving as a limit stop when it is engaged by the raised portion 59c of the sleeve. The inner portions of both retaining rings 63 and 64 are suitably bored to accommodate the sliding sleeve 59. The rod 46 is provided with a terminal nut 46b to limit its movement with respect to the raised terminal of the sleeve 59 and is provided at its opposite terminal with an adjustable connection 46a to the pivot sleeve 47a as shown in Figs. 9 and 14.

In operating the lock assembly 43 the wedging or locking action of the balls 60 is released by movement in the proper direction of the hand knob 35 which in turn imparts movements in the same direction to the sliding sleeve 59 due to rolling contact of the circular bifurcated ears 58 on the locking lever 42. Assuming that the knob 35 is moved forwardly the torque tube 34 is rotated in a clockwise direction and the sleeve 59 is caused to move forwardly with respect to the fixed supporting portion 44 and the trunnioned body 45 of the lock assembly 43. This forward movement of the sleeve 59 with respect to the tapered rings 62 causes the rearmost set of balls 60 to be moved or released from its wedging fit against the rearmost tapered unit 62 and permits the occupant to push the back of the seat rearwardly together with the attached locking rod 46 which is permitted to slide rearwardly between the rolling balls 60. The chair cannot, however, be moved forwardly under this condition since the forward set of balls has not been re-

leased from its wedging relationship with the forward bevel ring 62. When the occupant has adjusted the chair back to the desired position release of the forward pressure upon the hand knob 35 permits the sleeve 59 to be returned to its centralized position with respect to the body portion 45 due to the action of the compression springs 61 which urge the balls 60 apart again into wedging engagement with both tapered rings 62, and the chair back is again locked through the intermediacy of the rods 46, in fixed positions with respect to the side sections 15 and 16. Similarly, as the knob 35 is moved rearwardly the rearmost set of balls 60 is kept in wedging relationship and the rods 46 can only be moved together with the attached chair back in a forward direction.

When the locking assemblies 43 are released for movement of the chair back in either direction the chair may be adjusted either into its extreme rearward or reclining position, or to a forward upright position, or into any of the intermediate positions. As the back of the chair is released from a reclining position the shock cord 49 which exerts an upward and forward tensile pull upon the pivot 47, serves to counteract the weight of the seat and back, and occupant rearward of the rail pivots 26. The shock cords 49 return the chair back 21-22 to the upright position. The chair may be adjusted by the occupant into either position while seated, being moved into the reclining position by pressure exerted upon the seat back. In the reclining attitudes of the chair back it will be noted that the lower portions of the rails 19 become more widely spaced from the chair seat 17 and its pivotal connection 24 with the intermediate cushion 22, such that the latter is caused to rotate in an opposite direction about its pivot 23 and thereby assumes a position which serves to lessen the sharpness of the angle between the upper cushion 21 and the seat cushion 17 conforming to the reclined form of the back of the occupant. At the same time rearward movement of the pivot 23 away from the cradle pivot 28 causes the seat to be rocked about the latter pivot 28, and its rear edge adjacent pivot 24 to be raised tending toward alignment of the seat with the section 22. This assists materially in supporting the back and shoulders of the occupant, achieving the desired contour for a reclining position and permitting greater relaxation and comfort.

As the rails 19 are rotated upwardly and forwardly about their pivots 26 it will be seen that they more closely approach the pivotal connection 24 between the seat 17 and the lower back 22 causing the intermediate or lower back cushion 22 to be rotated about its pivot 23 such that it becomes substantially aligned with the rails 19 and the upper cushions 21, the seat back then assuming a nearly vertical position in which the occupant is permitted to sit comfortably in an erect or upright attitude.

Other forms and modifications of the present invention may occur to one skilled in the art after a reading of the foregoing description, but all are intended to fall within the scope and spirit of this invention as more clearly defined in the following claims.

I claim:

1. A chair comprising fixed supporting portions, back supports pivotally carried upon said supporting portions, a seat portion pivotally carried by a linkage assembly pivoted to said fixed supporting portions and to said back supports

and an intermediate chair portion between the seat and back pivotally connected to said seat and said back supports.

2. In an adjustable chair comprising a fixed support portion, a back rotatably adjustable about a pivot carried upon said fixed portion, a strut element pivoted to said back, a link element pivotally interconnecting a second pivot on said strut element with said fixed chair portion, a seat supporting element suspended from the pivotal junction of said strut and link elements, a seat carried by said supporting element, and means pivotally interconnecting said seat with said back adapted to cooperate with said strut element in tilting and positioning said seat dependent upon pivotal rotation of said back with respect to said fixed support portion.

3. In a chair, a fixed supporting portion, a back support rotatably adjustable about a pivotal support upon said fixed portion, a seat portion, an element pivotally mounted at one terminal upon said fixed portion, a second element pivotally mounted upon said back support, both said elements having a common pivotal connection with said seat portion, an intermediate cushion portion pivotally supported upon said seat portion and said back support, and means for locking the said back support in any one of its positions of adjustment.

4. In a chair, a fixed supporting portion, a back support rotatably adjustable about a pivotal support upon said fixed portion, a seat portion, an element pivotally mounted at one terminal upon said supporting portion, a second element pivotally mounted at one of its terminals upon said back support, the remaining terminals of said elements having a common pivotal connection with said seat portion, an intermediate cushion portion pivotally supported upon the rear of said seat portion and said back support, lock means for fixing the said back support in any one of its adjusted positions with respect to said fixed position, and resilient means connecting said back support with said fixed supporting portion tending to restore said back toward a vertical position.

5. In an adjustable chair comprising a fixed support portion, a back rotatably adjustable about a pivot carried upon said fixed portion, a strut element pivoted to said back portion, a link element pivotally interconnecting a further portion of said strut element with said fixed portion, a seat-supporting element suspended from the pivotal junction of said strut and link elements, a seat carried by said supporting element, means pivotally interconnecting said seat with said back adapted to cooperate with said strut and link elements in tilting and positioning said seat dependent upon pivotal rotation of said back with respect to said fixed portion, and locking means adjustably connecting said fixed support and back portions.

6. In an adjustable chair comprising a fixed support portion, a back rotatably adjustable about a pivot carried upon said fixed portion, a strut element pivoted to said back portion, a link element pivotally interconnecting a spaced pivot on said strut element with said fixed portion, a seat-supporting element suspended from the pivotal junction of said strut and link elements, a seat carried by said supporting element, means pivotally interconnecting said seat with said back adapted to cooperate with said strut and link elements in tilting and positioning said seat dependent upon pivotal rotation of said back

with respect to said fixed support portion, locking means adjustably linking said fixed support and back portions, and resilient restoring means interconnecting said back with said fixed support portion tending to rotate said back toward said seat portion.

7. In an adjustable chair, fixed connected side supports, a tiltable back pivotally supported upon said side supports, a movable chair seat on a seat-supporting cradle, struts carried by said back pivotally supporting said cradle, link elements pivotally supported upon said side supports and said struts adapted to cooperatively determine therewith the location of said seat supporting cradle, and an intermediate chair portion interconnecting the rear portion of said seat with said back adapted to impart opposite tilting movements to said seat dependent upon the tilted relationship of said back with respect to said side supports.

8. In a lock for an adjustable chair comprising relatively fixed and movable chair portions, a rod element pivotally connected to a movable portion of said chair, a ball-carrying sleeve element slidably embracing said rod element, a cylinder element having outwardly reducing wedging rings engageable by said balls, said cylinder pivoted to a fixed chair portion and within which said sleeve element is slidable, and manual means for moving said sleeve with respect to said cylinder element for the release of the wedging relationship of certain of said balls between said rod and cylinder elements.

9. In an adjustable chair comprising a support, a back portion pivotally supported by said support, a seat portion pivotally supported at a movable point at the convergence of a pair of relatively movable links separately supported from said support and back portions, an intermediate cushion portion pivotally interconnecting said back and seat portions adapted to impart tilting movements to said seat portion corresponding to adjusted positions of said back, and means to lock said chair portions in each of their adjusted positions with respect to said support.

10. In an adjustable chair comprising fixed side portions and movable seat and back portions, a locking device including a rod element pivotally connected to one of said movable portions, a ball-carrying sleeve having an opening engaged by said rod element, a trunnioned cylinder having opposed outwardly reducing wedging elements engageable by said balls, said cylinder pivotally mounted upon one of said fixed side portions and adapted to form a housing within which said sleeve is reciprocable, resilient means disposed between said balls urging them into a locking relationship between the wedging elements of said cylinder and said rod element, and manual means adapted to move said sleeve with respect to said cylinder moving said balls for the release of said rod from locking relationship with said ball-carrying sleeve.

11. The combination with an adjustable chair comprising seat and back portions pivotally interconnected and relatively adjustable with respect to a support portion, of means for the pivotal support of said seat portion including a pair of diverging links pivotally interconnected to each other in the region of said seat support and pivotally connected at their divergent terminals, one to said back portion and the other to said support portion.

12. An adjustable chair comprising connected

fixed portions, a seat portion, back supports pivotally supported from said fixed portions, a cradle element having pivotal connections for the support of said seat portion, strut elements pivotally interconnecting said cradle pivots and said back supports, means pivotally interconnecting said struts and cradle pivots with said fixed portions, and a portion intermediate the seat portion and back supports interconnecting said seat portion and back supports.

13. An adjustable chair comprising connected fixed portions, a seat portion, back supports pivotally supported from said fixed portions, a cradle

5 element having pivotal connections for the support of said seat portion, strut elements pivotally interconnecting said cradle element and said back supports, means pivotally interconnecting said struts and cradle pivots with said fixed portions, a portion intermediate the seat portion and back supports interconnecting said seat portion and back supports, and locking means including an adjustable length member pivotally intercon-
10 nected between one of said fixed portions and a back support.

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