Our invention relates to an improved chair construction especially suitable for use in airplanes.

Owing to the length of continuous flights by airplane consideration of the personal comfort of the passengers becomes important. It is accordingly an object of our present invention to provide a chair having a plurality of adjustments and having means whereby the cooperating parts thereof may be easily and quickly adjusted without the exercise of any great force to accomplish the same. In this seat structure the seat member is supported in such a manner that the weight of the person sitting therein produces substantially no resistance to adjusting movement of the seat.

A further object of the invention is to provide a chair of the character described having a simple means for adjusting the back thereof entirely independently of the adjustment of the seat, the improved results obtained by the invention being contributed to by the simple back and seat adjusting mechanisms which we have provided.

A further object of the invention is to provide a chair of the above general character having a back which is reversible relative to the seat so that the passenger may ride either forwardly or rearwardly. In conjunction with the reversible back we have provided a simple reversible connector for connecting an end of the back member to an end of the seat member.

Further objects and advantages of our invention are concerned with the provision of an improved form of securing means for the passenger occupying the seat which may be readily secured in operative position, adjusted and released. Straps for holding passengers in chairs are employed with attachment hooks or buckles at the ends thereof, the length of the strap or belt being adjustable to suit the passenger, and generally requiring adjustment for each passenger. In our present securing means the strap does not require length adjustment but the effective length thereof is controlled by the position in which its free end portion is connected to the seat structure by means of a simple form of clamp. The chair is provided with cushioning means for securing it to a carrying structure, such as the walls of an airplane fuselage. These cushioning means have resilient load carrying elements adapted to absorb small shocks, with positive stop means for limiting the deflection of the resilient elements, one value of the stop means being to resist any tendency for the chair to set up a periodic vibrating or swaying motion. Operative between the seat member and the supporting structure therefor we provide stop means interengaging in a manner to restrain side sway of the seat member relative to its support.

In the invention the back member is provided with a simple means for limiting the downward movement of the back member, such means consisting of a dog-leg connecting an end of the adjustable linkage with the supporting structure of the chair in such a manner that the lower end of the linkage is held in an offset position and that a stop for limiting the downward movement of the back member is provided.

Additional advantages and further objects of our invention will be brought out in the following part of the specification.

Referring to the drawings, which are for illustrative purposes only,

Fig. 1 is a partly sectioned side elevation of a preferred embodiment of the invention. Fig. 2 is a sectional view taken on the plane represented by the line 2—2 of Fig. 1. Fig. 3 is an enlarged view of the mechanism within the dotted circle 3 of Fig. 2. Fig. 4 is a fragmentary section taken as indicated by the line 4—4 of Fig. 2 for showing details of the adjusting means for the seat member. Fig. 5 is an enlarged fragmentary section showing details of the construction of the latch means forming a part of the adjusting means for the back member.

Fig. 6 is a view taken as indicated by the line 6—6 of Fig. 1. Fig. 7 is an enlarged section on a plane represented by the line 1—1 of Fig. 2 for showing details of construction and the manner of operation of the releasable connection for the back member and the seat member. Fig. 8 is an enlarged fragmentary section taken as indicated by the line 8—8 of Fig. 1 showing the simple strap securing means of the passenger anchoring device.

Fig. 9 is a fragmentary view cooperating with Fig. 8 to show the manner in which the opposite end of the strap is secured to the opposite side of the seat member. Fig. 10 is an enlarged fragmentary section on the plane represented by the line 10—10 of Fig. 1. Fig. 11 is an enlarged fragmentary section on the plane represented by the line 11—11 of Fig. 1. Fig. 12 is an enlarged fragmentary section taken as indicated by the line 12—12 of Fig. 6.

As shown in Figs. 1 and 2, the main elements...
The bracket 43 comprises a vertical leg 58 having a bearing structure 60 near the lower end thereof for receiving an end pin 51 of a shaft member 62 which extends horizontally and laterally under the seat member 16, and near the bottom plate 24 thereof, the central portion of the shaft member 62 consisting of a tube 53, the leftward end of which carries the member 61, as shown in Fig. 2, and the rightward end of which receives a tubular extension 64 adapted to project through a bearing bore 58 in the bearing plate 82. Below the bearing means 60 thereof the bracket 43 includes a bifurcated extension 70 adapted to engage a cushion block 71 which is secured to the side wall 23. The upper part of the bracket 43 has a lateral extension 78 which engages another cushion block 71 which is also secured to the wall 23. The members 61 and 64 have gears 72 formed thereon which rest in close proximity to the ends of the tube 53 and in such position are adapted to engage gears 73 provided on the curved legs 73 mounted on the sides of the seat member 16 below and eccentric with the pivot means represented by the pin members 66; consequently, rotation of the gears 72 will move the leg members 73 and swing the seat member 16 relative to the horizontal lateral axis defined by the pin members 66.

For driving the gears 72 we provide a lever 74, the inner end 75 of which extends across a collar 78 mounted, as shown in Fig. 3, on the outer end 36 of the member 58 and being hinged at 77 so as to swing outwardly a limited distance as indicated by dotted lines 76. The lever 74 is normally held leftward and inward by means of a tension spring 80, the inner end of which is connected to a bar or rivet 81 extending diametrically across the inner end of the member 68 and the outer end of which connects at 82 to the lever 74. Adjacent the collar 16, opposite the hinge means 77, the lever 74 is provided with a pin 83 adapted to selective engagement with holes 84 formed in the bearing plate 52 concentric with the bore thereof. The seat member 16 is held in suspension. The side plates 36 together with the pin members 66 form suspension means for the bottom plate 24 of the seat member 16. As viewed in Fig. 1, the pivot means are represented in dotted lines and are disposed toward the rightward or rearward end of the seat member 16 and at a material distance above the bottom plate 24 thereof. In this position the pivot means is above the approximate center of gravity of the person occupying the chair, the result being that the weight of the person occupying the chair does not resist a relatively free swinging of the seat member 16 by rotation of the gears 72 which is accomplished by moving the lever 74 outwardly into its dotted line position 18, Fig. 3, and then rotating the same. As clearly illustrated in Fig. 4, the angle or tilt of the seat member 16 is held in the position indicated by dotted lines 86, of the seat member 16 on an arc concentric with the pin members 66 may be readily accomplished. At this point it may be noted that we have, by the specific manner of suspension and operation shown, provided a means for seat adjustment which may be operated with such ease as to encourage the use thereof, by making it possible for the passenger to obtain greatest comfort throughout the entire seat member.

In conjunction with the seat structure 16 we provide a back structure 18 adapted independently of the seat member 16. This back structure 18 includes a back member 20 including a web 57 of vertically elongated shape out-
lined by a pair of frame members 82 and upper and lower end frame members 80 and 81. The frame members 88, 89 and 91 are of a tubular construction similar to the tube 25 shown in cross-section in Fig. 12 and have relatively inwardly projecting flanges 82 which are secured to the edge portions 87 of member 81 by use of rivets 93. The adjacent ends of the frame members 88, 89, and 91 are connected by tubular elbow-type fittings 94, each of which has a projecting lug or relatively outer wall member 95 with a lateral opening 96 therein. The projecting lugs are formed in the fittings 94 and when they are installed as shown in Figs. 2 and 6 they project in cooperating pairs from the upper and lower ends of the back member 20 which in certain claims is referred to as a primary member.

The lugs or bodies 95 on the lower and upper ends of the back member 20 form part of a connecting means 97 for securing the lower end of the back member 20 to the rearward end of the seat member or secondary member 16, as shown in full lines in Fig. 1, and for securing the tubular end portions 20 of the back member 20 to the forward edge of the seat member 16 when the back member 20 is in reversed position, as shown by broken lines 98 in Fig. 1. To complete the connecting means 97 we employ projecting members or relatively inner wall members 108 forming walls or bodies adapted to extend into the space between the lugs 95, as shown in Fig. 6. The enlarged sectional view, Fig. 7, shows the manner in which the engaging members 101 are carried by the projecting members 100 in a manner to engage the openings 96 in the projections 95. In back member 20, together with means which may be quickly and easily operated to retract the engaging members 101. The bodies 100 are provided with openings or bores 102 aligned with the openings 96, and the engaging members 101 are made in cylindrical form to slide in the bores 102 and have rounded outer ends for guiding them readily into engagement with the openings 96. The facing or relative inner ends of the bodies 100 are constricted by inwardly projecting flange portions 103 so as to produce small openings 104 at the relative inner ends of the bores 102. Each engaging member 101 is provided with a projection 105 which bears against the flange portion 103, the spring 106 urging the engaging member 101 outwardly. To limit outward movement of the engaging members 101 relative to the bores 102, we provide a flexible member or operating member 107, the ends of which are connected to the engaging members 101, and for instance by securing such ends in axial openings 108 formed in the outer ends of the engaging members 101. Near the extremities of the flexible member 107, which is preferably a cord or cable, stop members 110 are secured in position so that they will engage the flange portions 103 when the engaging members 101 are in extended position, as shown in full lines in Fig. 7. To detach the connecting means 97 the intermediate portion 111 of the flexible member 107 is moved in a lateral direction toward the position indicated by broken lines 112. This action pulls the end portions of the flexible member 107 through the openings 104 and likewise pulls the engaging members 101 into the bores 102, thereby disengaging the members 101 from the openings 96 of the projections 95. It will be noted that the ends of the projections 95 are chamfered at 113 and that they may be channeled, as shown by dotted lines 114 in Fig. 1, for the purpose of guiding the engaging members 101 readily into engagement with the openings 96.

In order that the connecting means 97 may be of pivotal character the openings 96 and the engaging members 101 are axially aligned. The back member 20 may swing around pivot means 115 through various positions of inclination relative to the seat member 16, as indicated by broken lines 116 in Fig. 4, and to accomplish and expedite this adjustment of the back member 20 the adjustable securing means 120 are provided. The adjustable securing means 121 constitutes an extensible linkage between the back member and a part of the seat structure 15, the means 21 being preferably connected to the supporting means 17 of the seat structure 15. Adjusable link means 21 comprises preferably a U-shaped member 117 having a central portion 118 which extends laterally across the back member 20 and tubular arms or struts 120 disposed perpendicular to and on the ends of the central portion 118. The U-shaped member 117 may be readily bent from a length of metal tubing. Slidable within the tubular end portions 122 of struts 120 are cooperating strut members 121 which may be also tubular and the outer ends of which are connected to dog-leg brackets 123 which project leftwardly or forwardly, as shown in Fig. 1, and are pivotally connected to hinge means 125 in a manner as shown in Fig. 1, and are pivotally connected to hinge means 125 formed on the hinge fittings 51. The securing or link means 21, by being extended or shortened, control the slope or position of the back member 20.

To urge the slidably disposed strut members 120 and 121 tension coil springs 126 are disposed within the members 120 and 121, the lower end of each spring 126, as shown in Fig. 1, being secured to a rivet 127 employed for securing a bracket 123 to the lower end of a tube 121, and the upper ends of which spring 126 are secured to pins 128 extending across the tubular strut member 120 above the upper ends of the members 121. For securing the adjustable link means 21 in various positions of extension, we provide a simple latch means 130 which may be readily operated by a person seated in the chair. This latch means, as best shown in Fig. 1, employs a pin 131 carried by the lower portion 122 of an inverted pan-shaped lever member 133 which is immediately pivoted on a pin 134 carried in a lug 135 projecting from a fitting 136, one each of which is secured to the lower end of a tubular strut member 120. A hairpin spring 137 operates within the upper portion of the lever member 133 to exert an anti-clockwise rotating force to swing the lever member 133 in a direction to move the pin 131 through openings 138 and 140 respectively in the fitting 136 and the strut 120 into engagement with a selected one of a plurality of openings 141 in the strut member 121, such engagement being shown in Fig. 1. For pivotally connecting the link means 21 to the back member 20 cooperating hinge parts 142 and 143 are respectively mounted on the frame members 86 and the end portions of the central part 118 of the U-shaped member 117, these members 142 and 143 being connected by hinge pins 144 permitting a sufficient rotation of the back member 20 relative to the extensible link means 21 to realize a desired operation of these cooperating parts. In Fig. 1 the back member 20 is shown in upright position. Should it be desired to lower the back member, the upper portions of the lever members 133 are manually depressed to withdraw the pins 131 into positions such as indicated in Fig. 5. A rightward or rear-
ward force upon the back member will then cause the tubular struts 20 to move outwardly on the cooperating strut members 121 as the back member 20 is moved into the desired new position.

When such new position is reached, the lever members 133 are released so that the pins 131 may enter cooperating openings 141 in the cooperating strut members 121. The outward movement of the back member 20 is limited by the stop means provided by the dog-leg brackets 123 which engage the supporting means 17 of the seat structure 15, as shown by broken lines 145 in Fig. 1, the result being that a fully lowered position for the back member 20, such as indicated by broken lines 145, is established. The seat member 16 and the back member 20 being separately and independently adjustable contribute to the general effect of providing maximum comfort for the passenger. As indicated in broken lines 56 in Fig. 4 the seat member 16 may be readily adjusted through a variety of positions relative to horizontal and, as shown in Figs. 1 and 4, the back member 20 may be adjusted independently of the adjustment of the seat member 16, through a variety of positions between upright and fully lowered. A further important feature of our chair is that the back member 20 is reversed relative to the seat member 16 to enable the passenger to ride backward should he desire. This reversal of the back member is accomplished as follows:

The connecting means 97 between the lower end of the back member and the rearward or rightward end of the seat member 16, as shown in Fig. 1, is released in the manner previously described. The back member 20 is then rotated in anti-clockwise direction on the hinge pins 144 and the extensible link means 121 is swung leftwardy or in anti-clockwise direction toward the position indicated by broken lines 147. An anti-clockwise rotation of the back member 20 will accordingly bring the upper end 140 of the back member 20 into conjunction with the forward edge of the seat 16 whereupon the lugs 95 of the upper end of the back member 20 may be engaged by the engaging members 101 disposed at the forward edge of the seat member 16, the result being that by proper extension of the link means 11 a position of the back member 20, such as indicated in broken lines 98, may be obtained. It will be recognized that during the reversed position of the back member 20 the seat member 16 and such reversed back member 20 may be readily and independently adjusted.

An important element of our invention employed in conjunction with the herebefore disclosed manner of supporting the seat member 16 in suspension from pivot means disposed above the bottom plate 24 thereof, consists in the means for limiting side-sway of the seat member between the leg structure 42 and the bracket member 43. This means consists of a projection or lug 150 extending from the leg structure 42 toward the lower portion of the seat member, and a lug or projection 151 on the bracket member 43. These members 150 and 151 are preferably so placed as to very nearly bear against the side faces of the track members 73, thereby limiting sideward motion of the lower portion of the seat member 16.

The fittings 48 at the lower end of the leg structure 42 form parts of cushion supporting members 152 which function to produce a limited resilient supporting of the leg structure 42 whereby to absorb high frequency vibration but to limit the movement of the cooperating parts thereof when the cushion element of the supporting member 152 is subjected to excessive strain. The cushion supporting means 71 for securing the bracket 43 to the side wall 23 are of the same construction as the cushion means 152 shown in Fig. 1, and accordingly the description relating to the cooperating means 152 also applies to the supporting means 71. The fitting 48 comprises a horizontal plate 153 from the edges of which walls 154 downwardly extend, as shown in Fig. 10. The horizontal wall 153 is also provided with projecting pins 155 and 156 angularly disposed so as to enter the lower ends of the members 44 and 45. The walls 154 are of round configuration, as shown in Fig. 1, and are of reduced length as compared to the horizontal wall 153 so that they will project into spaces 157 formed between ears or walls 158 which project upwardly near the ends and from the sides of a bottom plate 160 having openings therein through which securing screws 159 may be passed, the parts 158 and 160 forming a receiver or channel 161 for a rubber or resilient body 162 of rectangular prismatic form having side plates 163 along the side faces 164 and 165. As shown in Fig. 11, are provided with holes 164 for receiving bolts 165 which pass through the ears 158 and also through the rubber body 162. The intermediate portions of the plates 163 are provided with enlarged openings 166 through which bolts 167 pass in concentric relation. The bolts 167 pass through the central portion of the rubber body 162 and through openings 168 formed in the walls 164, the bolts 167 being closely fitted in the openings 168 and 169. The bolts 167 pass through the upper walls 160 and the rubber body 162 and are in engagement with the horizontal walls 153 of the fittings 48 so that the weight and forces received from the chair structure are transmitted directly to the rubber bodies 162. Accordingly, the resilient members 152 form resilient supporting means for the chair structure which will deflect and will absorb vibrations under ordinary loads. The movement of the fittings 48 relative to the receivers 161 is limited by the side bars 168 and the pins 167 which pass through the oversized openings 166 therein. Should an excessive force be applied, for instance in a downward direction, the rubber bodies 162 will deflect or compress downwardly under such force until the bolts 167 occupy the positions indicated by dotted lines 172.

To avoid the present difficulty of adjusting and securing straps for holding the passenger in a chair, we provide the improved securing means shown in Figs. 1, 8, and 9. The side plate 36 of the seat member 16, presented to view in Fig. 1 and shown in Fig. 8, has an opening 173 therein which is of rectangular form and disposed at an angle. Below this opening and aligned therewith is a clamping means 174 consisting of a plate 175 having outwardly extending ears 176 for carrying a pin or shaft member 177 on which a footed eccentric 178 is subjected to excessive strain. The such body 170 having an extending handle 180 whereby it may be swung from a disengaged position, such as indicated by broken lines 181, to a position of engagement with a flat strap member 182, as shown in full lines. On the outer face of the side plate 36 a guard and secured in the position of the opening 173 and slopes downwardly and outwardly so that when the end of the flexible securing member or strap 182 is passed into the opening in the general di-
An operating member normally stretched substantially tight and having the end portions thereof connected to said engagers and adapted through a transverse pull on said guide member to retract said engagers into positions of non-engagement with said openings.

3. A chair of the character described, including: a seat structure comprising a seat and supporting means therefor; link means having the inner end thereof pivotally secured to said seat structure; a back member secured to the outer end of said link means and being adapted to swing on said link means from a position of cooperation with the rearward end of said seat to a position of cooperation with the forward end of said seat; and detachable means for pivotally securing said back member selectively to said forward and rearward ends of said seat, said detachable means comprising a pair of relative outer bodies and a pair of relative inner bodies adapted to project into the space between said relative outer bodies, one pair of said bodies being in projecting position on the forward end of said seat and the other of said bodies being in projecting position on said back member, there being inwardly facing openings in said relative outer bodies and engagers slidably mounted on said relative inner bodies to enter said openings, means for urging said engagers outwardly toward positions of engagement with said openings, and a flexible retraction member extending between said engagers and having the end portions thereof secured to said engagers so that a lateral pull on said flexible member will move said engagers from said openings.

4. A chair of the character described, including: a supporting structure having a pair of pivot members in laterally spaced relation; a seat member having a bottom and upstanding suspension means aligned with the sides thereof, the upper parts of said suspension means being pivotally secured to said pivot members; a pair of curved rack members secured in downwardly projecting relation to the opposite sides of said seat member; a shaft extending laterally across said supporting structure under said seat member, said shaft having a tubular end portion; a pair of gears secured to said shaft in positions to engage said rack members; a lever member hinged on the end of said shaft in radially extending position, there being handle means on the outer end of said lever member; stationary engagement means around said shaft in position to be traversed by said lever member; and an engager carried by said lever member in a position between the end of said shaft and said handle means adapted to engage said stationary engagement means, there being a spring, having its inner end connected to said shaft at a point within said tubular end portion and having its outer end connected to said lever member, for urging said lever member toward said stationary engagement means.

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