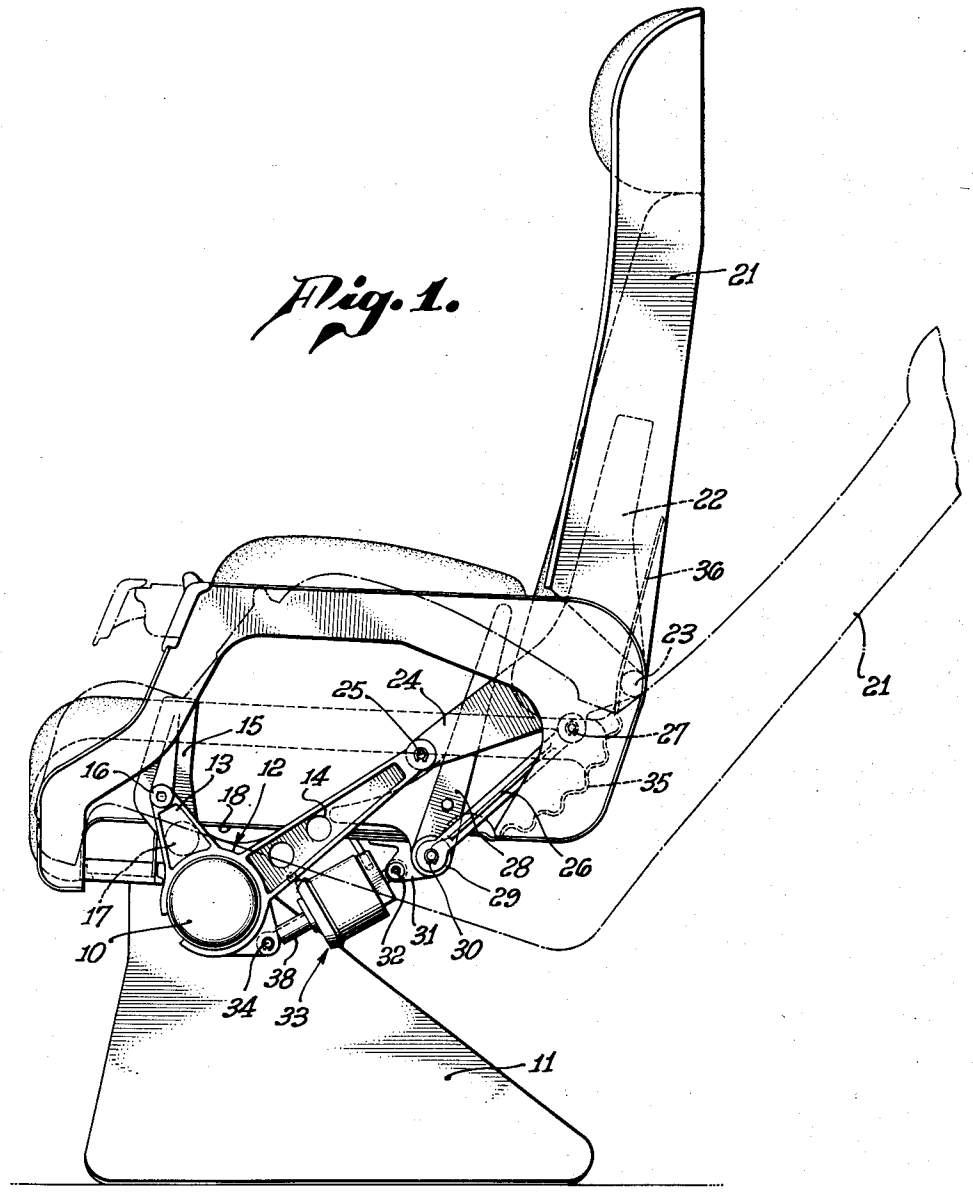
Feb. 17, 1953 C. W. MORRIS ET AL 2,628,662

ADJUSTABLE CHAIR

Filed March 20, 1947 3 Sheets-Sheet 1

Fig. 1.



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Filed March 20, 1947 3 Sheets-Sheet 2

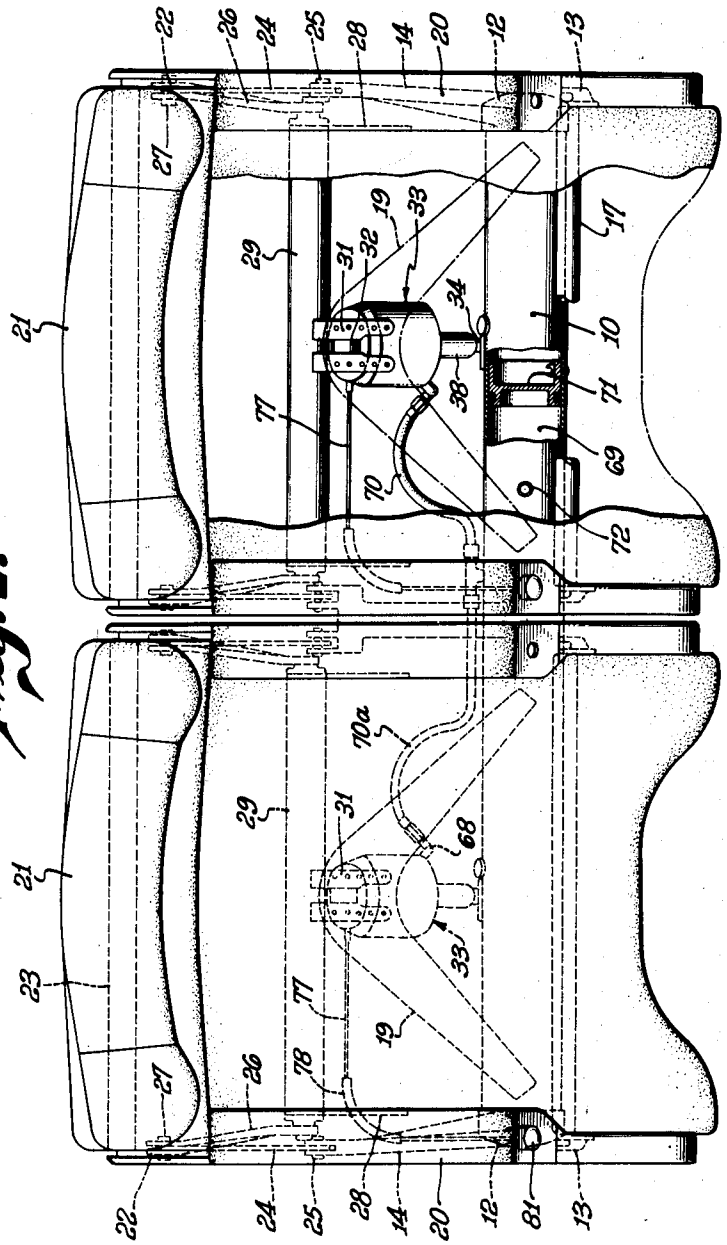

Fig. 2.

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Filed March 20, 1947 3 Sheets-Sheet 3

Fig. 3.

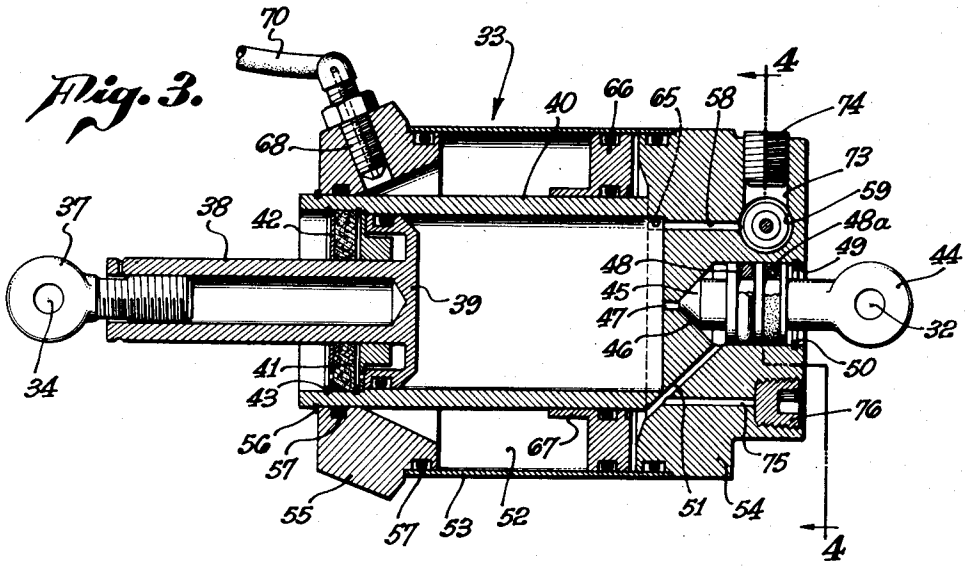


Fig. 4.

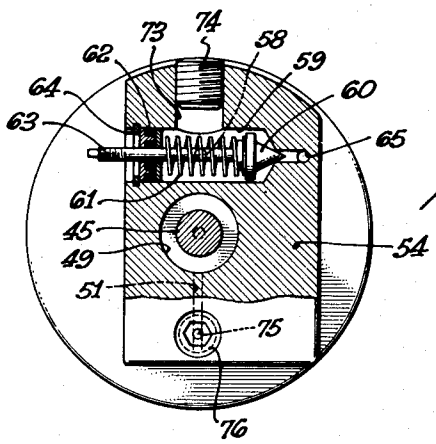
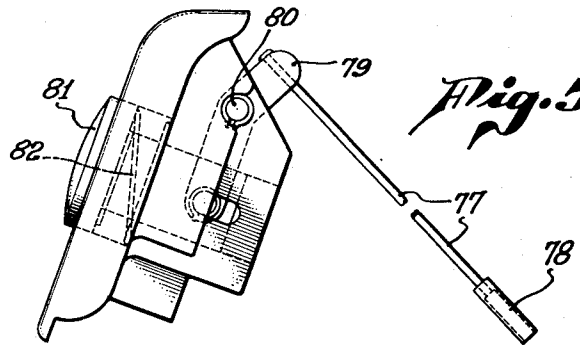


Fig. 5.



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Patented Feb. 17, 1953 2,628,662

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2,628,662

ADJUSTABLE CHAIR

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Application March 20, 1947, Serial No. 736,052

4 Claims. (Cl. 155—116)

1

This invention relates to improvements in reclining chairs and has been primarily designed for use on airplanes, busses, passenger coaches, and similar travel conveyances, although it may be used wherever a chair capable of assuming a reclining position is desired.

A primary object of the invention is to provide an improved chair having a seat which is tiltably supported adjacent its forward end and which has a back rest which is tiltably mounted for movement relatively to the seat as the seat is tilted rearwardly. More specifically, an object of the invention is to provide a chair construction wherein the back rest, instead of being merely hinged to the rear end of the seat, is so mounted that it will tilt relatively to the seat as the seat inclines rearwardly in such a manner as to be of greater comfort to the user in the course of and after having made desirable adjustments.

Another object of the invention is to provide an improved chair having a seat and back rest tiltably mounted on a suitable support and which employs a novel mechanism for enabling adjustments to be made and which will facilitate the return of the chair to its normal or upright position.

Another object of the invention is to provide an improved reclining chair which is so constructed that when the chair is unloaded or the passenger has gotten up therefrom the chair will automatically return to its normal or upright position. In many public conveyances adjustable chairs have heretofore been provided which may assume either an upright position or a reclining position. However, if the passenger gets up from the chair while it is in a reclining position the chair will remain therein so that at frequent intervals a porter, stewardess, or other attendant must restore the chair to its upright position in order that the conveyance may have a suitably presentable appearance. With the improved chair, inasmuch as the chair will automatically return to its normal or upright position whenever it is unloaded, this restoration of the chair to the upright position by the stewardess is unnecessary.

Still a further object of the invention is to provide a chair which will automatically return to its normal position when unloaded, as above stated, but which can be effectively locked in any adjusted position and remain so locked as long as the chair is loaded.

Another object is to construct a reclining chair wherein the seat and backrest pivots are so arranged that the lengthening or shortening of the

2

linear distance from the front of the seat to the back and up the back during operation of the chair is minimized.

With the foregoing and other objects in view, which will be made manifest in the following detailed description and specifically pointed out in the appended claims, reference is had to the accompanying drawings for an illustrative embodiment of the invention, wherein:

Figure 1 is a view in side elevation of the improved chair illustrating in broken lines the position that the chair may assume;

Fig. 2 is a top plan view of a pair of chairs arranged in side by side relationship, one of which is illustrated in side elevation in Fig. 1;

Fig. 3 is a sectional view through the locking and controlling mechanism which controls the adjustment of the improved chair;

Fig. 4 is a sectional view taken substantially upon the line 4—4 upon Fig. 3; and

Fig. 5 is a partial view illustrating a detail of construction.

Referring to the accompanying drawings wherein similar reference characters designate similar parts throughout, the improved chair is supported on a transversely extending torque tube 10 which, in turn, is supported on the floor of the conveyance such as by supports 11. If a plurality of chairs are to be arranged in side by side relationship such as, for example, the pair of chairs illustrated in Fig. 2, the torque tube 10 is of such a length as to extend continuously across both chairs beneath the seat thereof. On this torque tube at the sides of each seat there are castings or stampings 12 which are rigidly secured to the torque tube and which provide short forward arms 13 which extend upwardly and forwardly therefrom and longer rear arms 14 which extend upwardly and rearwardly therefrom. Castings or stampings 15 are pivotally connected to the forward arms 13 as indicated at 16.

These castings or stampings have their lower ends connected to each other by a transversely extending tube 17 so as to cause them to move in unison about their respective pivots 16. This tube constitutes a forward support for the seat bottom indicated at 18 that is preferably, but not necessarily, formed of sheet metal that may be stiffened or reinforced by a stiffening member 19. The upper ends of the stampings or castings 15 may be rigidly secured to sides or arm rests 20 so that these arm rests will tilt rearwardly along with the seat bottom 18 as a unitary structure when the seat is tilted about the axis of the

pivots 16. A back rest 21 is provided which is preferably formed mainly of sheet metal and which is transversely curved or shaped as indicated in Fig. 2. At the lower ends of the sides of the back rest there are reinforcing members 22 which are connected together by a transversely extending tube 23 so that these reinforcing members will be rigidly connected and will move in unison. These reinforcing members have downwardly and forwardly extending portions 24 that are pivotally connected as at 25 to the upwardly and rearwardly extending arms 14. These pivots are arranged somewhat forwardly of the back rest and forwardly of the rear end of the seat bottom 18 and are intended to be generally located in the neighborhood of bending at the passenger's hips. The reinforcing members 22 have links 26 pivotally connected thereto at 27 and these links extend downwardly and forwardly to brackets 28 that may be rigidly secured to the arm rests 20 and which are connected to each other by a transversely extending tube 29 that is disposed beneath the seat bottom 18. The downward and forward ends of the links 26 are pivotally connected to the brackets 28 and consequently to the tube 29 as indicated at 30. The seat bottom 18 and the tube 29 are equipped adjacent the center thereof with a fitting 31 which, in turn, is connected by a pivotal connection 32 to a compressible locking unit generally indicated at 33 which, in turn, is connected pivotally as at 34 to the torque tube 10.

In tilting the chair from the full line position shown in Fig. 1 to the dotted line position, the seat bottom 18 and its associated arm rests tilt downwardly and rearwardly about the axis of the pivots 16. During such tilting movement the back rest 21 swings downwardly and rearwardly about the pivots 25 as centers and during such movement the links 26 move downwardly and forwardly a short distance compressing or shortening the compressible locking unit 33. It will thus be appreciated that during the tilting of the seat the back rest swings downwardly and rearwardly relatively to the seat itself but instead of being merely hinged to the rear end of the seat bottom it swings about a stationary pivot 25 that is disposed somewhat forwardly of the back rest. In order to accommodate this swinging movement of the back rest relatively to the seat bottom the rear end of the seat bottom is transversely corrugated as indicated at 35 so that it will be transversely stiffened but quite flexible in a longitudinal direction and the extreme rear end indicated at 36 is brought upwardly over the forward side of the tube 23 and anchored thereto. When the seat is returned from the dotted line position or the reclining position, illustrated in Fig. 1, to the upright or normal position, the back rest will swing upwardly and forwardly about the pivots 25 as the center and the seat will return to its normal or substantially horizontal position about the pivots 16 as centers. During this movement the compressible locking unit 33 has its overall length increased accommodating the required movements of the links 26. It will be understood that the seat bottom 18 and the back rest 21 are suitably cushioned or upholstered in any conventional or preferred manner and the tops of the arm rests may be similarly cushioned or upholstered.

A feature of the invention resides in the construction of the compressible locking unit 33, the details of which are illustrated in Fig. 3. The pivotal connection at 34 is provided by a knuckle 37 that is threaded into a hollow piston rod 38 for purposes of adjustment. This piston rod has a piston 39 that is reciprocable within a hydraulic cylinder 40. Piston 39 is equipped with O rings or other sealing rings and if any leakage should take place past these rings it is effectively absorbed and stopped by absorbent packing 41 around the piston rod which is retained in position by plates 42 and split rings 43. The pivotal connection at 32 is provided by a knuckle 44 on a valve 45 that is adapted to seat on a seat 46 in a port 47 in the opposite end of the cylinder 40. This valve carries an O or sealing ring 48 backed up by absorbent packing 48a and is disposed within a cylinder 49 so that in effect the valve together with its sealing rings forms a small piston on the valve having a very short stroke. The length of stroke of the valve 45 and its piston formed by the sealing rings 48 need be only a very short distance and is limited by an expansion split ring 50 that is seated in a groove in the outer end of the cylinder 49. The valve 45 controls the flow of liquid through a by-pass 51 that establishes communication between the hydraulic cylinder 40 and a surrounding cylinder 52 which hereinafter will be referred to as a combined hydraulic and pneumatic cylinder. This cylinder may be formed in any suitable manner although I prefer to provide it by slipping an outer sleeve 53 onto the enlargement 54 on the cylinder 40 and then position a head 55 therein which is locked in place by means of a contracting split ring 56 seated in a groove on the forward end of the casting that provides the cylinder 40. Suitable packing rings 57 prevent leakage from this outer combined hydraulic and pneumatic cylinder.

A bore or passage 58 leads from the cylinder 40 to a transversely extending bore 59 that is formed in the enlargement 54. This transversely extending passage provides a valve seat for a needle valve 60 that is urged into seating position by means of a compression spring 61 that is compressed between the head of the valve and packing 62 arranged around the valve stem 63 and retained in place by means of an expansion split ring 64 seated in a groove in the end of the transverse passage. This needle valve will consequently control the flow of liquid through the bore 58 and passage 59 to an outer bore 65 that communicates with the outer or combined hydraulic and pneumatic cylinder 52 so that when the valve 60 is open piston 39 may expel liquid from the hydraulic cylinder 40 through bore 58, passage 59 and bore 65 into the combined hydraulic and pneumatic cylinder 52. Also, when the valve is open, fluid may flow in the reverse direction through these passages.

In the outer cylinder 52 there is a floating diaphragm or piston 66, the skirt of which, indicated at 67, slides on the exterior of the casting that provides the hydraulic cylinder 40. This floating piston or diaphragm merely serves to separate the liquid forced into the outer cylinder from air that is in the forward end thereof. This air may be compressed by the floating piston 66 and expelled from the combined hydraulic and pneumatic cylinder 52 through an outlet 68 that is connected to an air chamber 69 by means of a flexible hose 70. The air chamber 69 is located within the torque tube 10, suitable bulkheads 71 defining its extremities. If two chairs embodying the present invention are arranged in side-by-side relationship as illustrated in Fig. 2, a single air chamber 69 within the torque tube 10 may serve for both chairs and, as illustrated, the left

hand chair as viewed in Fig. 1 may have its compressible locking unit connected to the same air chamber 69 such as by the flexible hose 70a. Any suitable type of fitting 72 may be provided on the torque tube to enable air under pressure to be initially supplied to the air chamber 69 or to replenish the air therein if leakage should occur.

In the top of the enlargement 54 there is a bleeding passage 73 that is normally closed by a plug 74 for bleeding air from the hydraulic cylinder 40 when this cylinder is initially filled with liquid such as oil. A similar passage 75 that is normally closed by a plug 76 may be utilized for filling the hydraulic end of the combined hydraulic and pneumatic cylinder 52 and the hydraulic cylinder 40 while the air is being expelled through the bleeding passage 73. Thus, with oil or other liquid filling the hydraulic cylinder 40 and the outer cylinder 52 to the right of the piston 66, an incompressible medium is in the unit between pistons 39 and 66 whereas a compressible gas, such as air, is between the piston 66 and the air chamber 69.

The needle valve 60 has its stem 63 connected to an operating wire 77 that is slidably disposed in a housing 78. This operating wire is connected to a lever 79 that is pivoted as at 80 adjacent the forward end of one of the arm rests. A push button 81 is slidably mounted in this arm rest and is urged into its forwardmost position by a compression spring 82. This push button has a pin and slot connection with the lever 79 so that when the push button is depressed or pressed rearwardly it swings the lever 79 in a counterclockwise direction as viewed in Fig. 5, pulling on the wire 77 and consequently opening the valve 60 against the action of its compression spring 61. On release of the push button 81 its compression spring returns the push button to its forwardmost position and the compression spring 61 returns the valve 60 to its seated or closed position.

The operation of the construction above described is substantially as follows: When the passenger seats himself upon the seat, his weight tends to urge the seat bottom 18 to tilt rearwardly about its pivots 16. The pressure of his back against the back rest may also urge the back rest to swing rearwardly about the pivots 25. There is, consequently, a force that is effective in a downward and forward direction on the pivot 32 which is effective to keep the valve 45 seated on its seat 46. This force that is thus effective on the unit 33 tends to compress the unit or, in other words, to move the pivots 32 and 34 toward each other. Such movement is resisted by the incompressible liquid in the hydraulic cylinder 40 as long as the needle valve 60 remains closed, entrapping the incompressible oil in the hydraulic cylinder. If the passenger desires to tilt the chair rearwardly, he merely depresses the button 81 which, as above explained, opens the needle valve 60. This permits of egress of oil from the hydraulic cylinder 40 through the bore 58, the transverse passage 59, and the bore 65 to the outer cylinder 52 in the space to the right of the piston 66. The oil that is thus forced from the hydraulic cylinder 40 into the outer cylinder 52 causes the piston 66 to move from right to left as viewed in Fig. 3, compressing the air in the cylinder 52 to the left of piston 66 and expelling some of it through the outlet 68, hose 70, into the air chamber 69. This air that is thus compressed is retained in its compressed condition and functions as a

pneumatic spring, urging the piston 66 from left to right and thus urging the chair to return to its normal or upright position. When the passenger has caused the chair to assume the desired adjusted position or the desired degree of rearward tilt, the mere release of the push button 81 permits the needle valve 60 to close, thus entrapping the remaining oil in the hydraulic cylinder 40 and, as this oil is relatively incompressible, the chair is locked against any further rearward tilt. When the passenger desires to return the chair to its normal or upright position, it is merely necessary for him to depress the button 81 and to shift his weight forwardly while the button is depressed. The compressed air may then be effective to shift the piston 66 from left to right, returning oil from the combined pneumatic and hydraulic cylinder 52 through the passage or bore 65, the passage 59, and bore 58, to the hydraulic cylinder 40. On returning the chair to normal position, release of the button 81 allows the valve 60 to close, entrapping the oil in the hydraulic cylinder and thus locking the chair in the normal or upright position.

If the passenger has had the chair in its rearwardly tilted or inclined position and arises therefrom, the chair will automatically return to its upright or normal position. It will be noted that the piston formed by the sealing ring 48 is at all times subject to the pressure of the oil that is in the cylinder 52 to the right of piston 66. This pressure, together with the pressure within the hydraulic cylinder 40 which is effective on the face of the valve 45, urges the valve to open. However, when the chair is loaded with the weight of the passenger, the effect of these pressures is insufficient to open the valve 45 against the force of the load. However, when the chair is unloaded by the passenger arising therefrom, the pressures effective on the valve 45 and its associated piston are sufficient to cause this valve to open and thus open the by-pass passage 51 from the right hand end of cylinder 52 back to the hydraulic cylinder 40. When this by-pass passage is thus opened the compressed air in the cylinder 52 to the left of piston 66 is effective to return oil from the cylinder 52 back to the hydraulic cylinder 40 through the by-pass passage even through the needle valve 60 remains closed. Consequently, when the passenger arises from the chair while it is in rearwardly tilted position, the unloading of the chair causes the mechanism to automatically return the chair to its normal or upright position. In this way the chair will be in an upright position for a subsequent passenger and it is unnecessary for a steward or stewardess to return the chairs to the upright position after passengers have arisen therefrom while they were in a reclining position.

Although two or more chairs may have their hoses 70 and 70a connected to the same air chamber, the fact that all of the chairs may be simultaneously in reclining position is immaterial in that this merely increases the pressure of the air within the air chamber that is used as a form of pneumatic spring that urges the chairs into upright position.

A feature of the improved chair resides in the manner in which the back rest tilts with relation to the seat. If the back rest were to be merely hinged to the rear end of the seat it would be observed that on reclining the chair that there

would be an increase in the linear distance over the cushions between the forward end of the seat to the back of the seat and up the back rest. In such a construction if the passenger should remain seated with his back pressed against the cushions on the back rest the coat or blouse would be pulled upwardly on reclining the chair. However, with the pivots between the back rest and the seat arranged as herein disclosed the change in this linear distance is reduced to a minimum so that the passenger may remain seated with his back engaging the back rest and during the reclining movement the lifting of the coat or blouse does not take place to any noticeable or objectionable extent.

Various changes may be made in the details of construction without departing from the spirit and scope of the invention as defined by the appended claims.

I claim:

1. A chair having a supporting means, a seat tiltably mounted adjacent its forward end on the supporting means for tilting movement relatively thereto, a back rest, means pivotally supporting the back rest on the supporting means for tilting movement relatively thereto about a point adjacent the rear end of the seat, means providing an extensible brace between the supporting means and the rear of the seat, said extensible brace being pivotally connected to the supporting means and to the rear of the seat respectively, and linkage pivotally connected to the extensible brace and to the back rest at a point spaced from the pivotal connection between the back rest and the supporting means whereby on lengthening or shortening the extensible brace the seat may be tilted relatively to the supporting means and support objects on the seat in any adjusted position and in the course of adjustment of the seat the back rest will have its inclination relatively to the seat automatically varied.

2. A chair having a supporting means, a seat tiltably mounted adjacent its forward end on the supporting means, a back rest pivotally mounted upon the supporting means adjacent the rear of the seat, means including a hydraulic piston and cylinder providing an extensible brace pivotally connected to the supporting means and the rear of the seat, and linkage pivotally connecting the extensible brace and the back rest at a point spaced from the pivotal connection between the back rest and the supporting means whereby on extending or shortening the extensible brace the inclination of the seat may be varied and as the seat is tilted rearwardly the back rest will be automatically caused to assume a greater inclination with respect to the seat.

3. A chair having a supporting means, a seat tiltably mounted adjacent its forward end on the supporting means, a back rest pivotally mounted upon the supporting means adjacent the rear of the seat, means including a hydraulic piston and cylinder providing an extensible brace pivotally connected to the supporting means and the rear of the seat, linkage pivotally connecting the extensible brace and the back rest at a point spaced from the pivotal connection between the back rest and the supporting means whereby on extending or shortening the extensible brace the inclination of the seat may be varied and as the seat is tilted rearwardly the back rest will be automatically caused to assume a greater inclination with respect to the seat, and means for controlling the flow of liquid to and from the hydraulic cylinder.

4. A chair having a supporting means, a seat tiltably mounted adjacent its forward end on the supporting means, a back rest pivotally mounted upon the supporting means adjacent the rear of the seat, means including a hydraulic piston and cylinder providing an extensible brace pivotally connected to the supporting means and the rear of the seat, linkage pivotally connecting the extensible brace and the back rest at a point spaced from the pivotal connection between the back rest and the supporting means whereby on extending or shortening the extensible brace the inclination of the seat may be varied and as the seat is tilted rearwardly the back rest will be automatically caused to assume a greater inclination with respect to the seat, and means for controlling the flow of liquid to and from the hydraulic cylinder including a valve connected to the seat and urged thereby to close a port of egress from the cylinder when the seat is loaded but enabling fluid to pass into the cylinder when the seat is unloaded to restore the seat to its normal position.

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