

Oct. 28, 1952

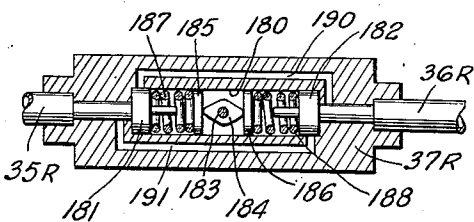
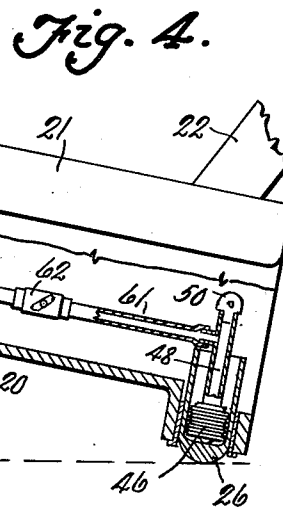
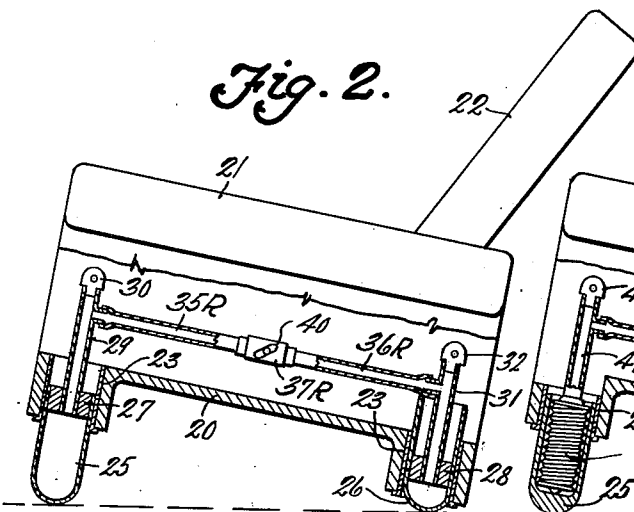
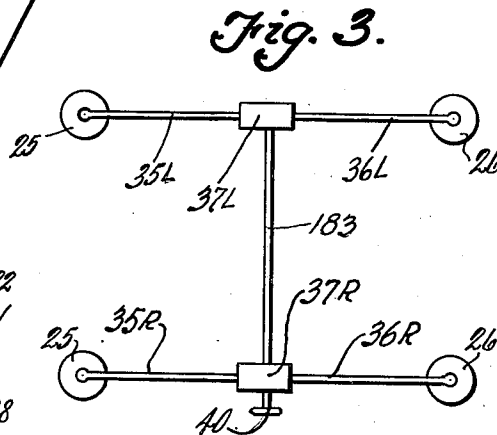
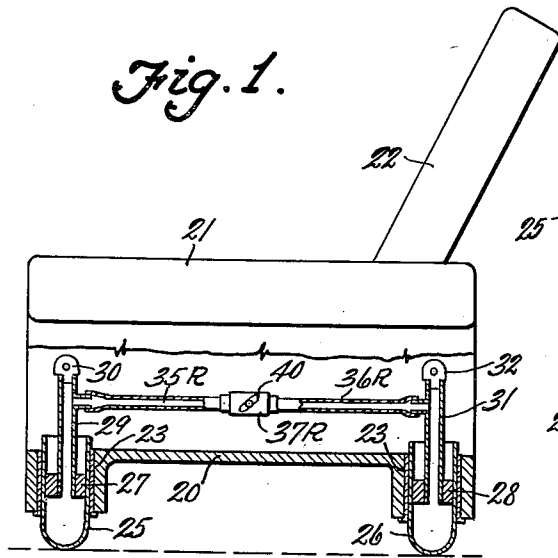
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2,615,499

HYDROTILT

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2 SHEETS--SHEET 1



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2 SHEETS—SHEET 2

Fig. 5.

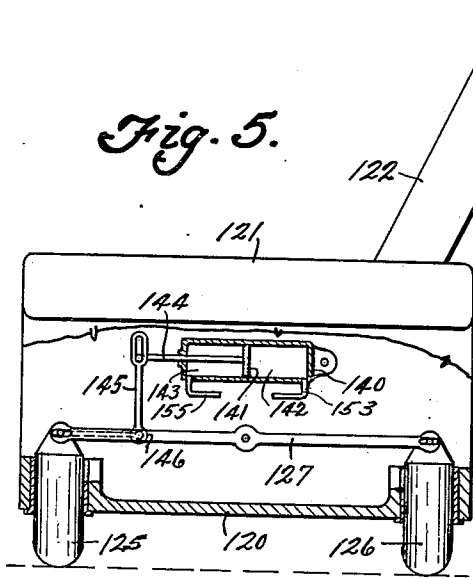


Fig. 6.

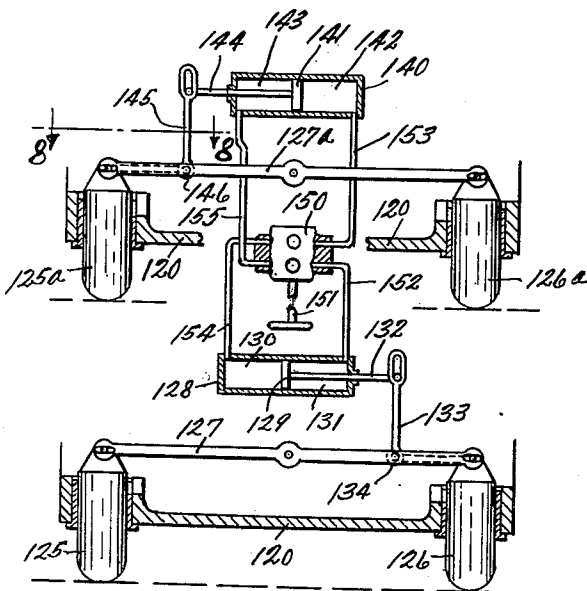
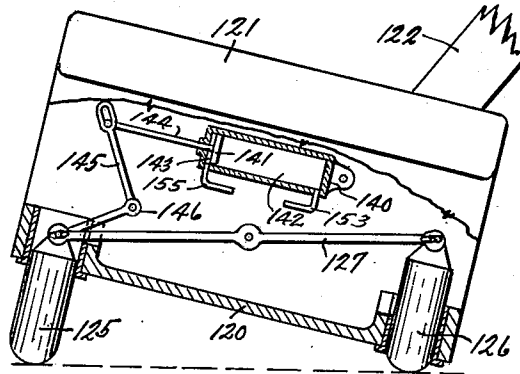
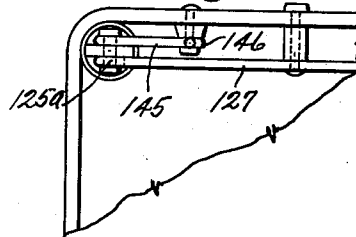


Fig. 7.

Fig. 8.



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1

This invention relates to improvements in adjustable lounge chairs.

It is among the objects of the present invention to provide an adjustable lounge chair which may be tilted into the desired position by the application of a predetermined tilting force, the chair being maintained in the adjusted tilted position when the required tilting force is reduced or discontinued.

A further object of the present invention is to provide a lounge chair, capable of being tilted into the desired position by the application of a predetermined tilting force, with modifying means operative to vary the required force to tilt the chair, whereby the chair may readily be adjusted for practical and comfortable use by either small or light weight persons or persons of greater corpulence.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

Fig. 1 is a side view of a chair, shown phantom-like, certain portions being illustrated in section to show structural features, the mechanism being in the normal position.

Fig. 2 is a view similar to Fig. 1, however, showing the position of the mechanism when the chair has been tilted.

Fig. 3 is a diagrammatic view illustrating the hydraulic connections between the various pedestals of the chair.

Fig. 4 is a view similar to Fig. 2, however, illustrating a modified form of fluid displacement mechanism.

Fig. 5 is a view similar to Fig. 1, however, showing a modified form of complete tilt control mechanism illustrated in a normal position.

Fig. 6 illustrates the tilt control mechanism of Fig. 5 in the position when the chair has been tilted.

Fig. 7 is a diagrammatic view of the complete hydraulic and mechanical connections of elements embodied in the structure illustrated by Fig. 5.

Fig. 8 is a fragmentary, detailed view of the pivotal mounting method of certain levers of the device.

Fig. 9 is a schematic sectional view of a fluid flow control valve used in the present invention.

The mechanism or device forming the subject matter of this invention may be applied to any

2

chair, lounge or seat for homes, offices, airplanes, busses, railway cars or the like.

For purposes of illustration, an ordinary lounge chair has been shown in phantom-like view, the chair comprising a frame which provides a rectangular base 20 having arms 21 and a back rest 22. The base 20 has a sleeve receptacle 23 secured at each corner thereof. These receptacles are in the form of a sleeve in which a foot or pedestal is slidably carried. The front pedestals, or more particularly the pedestals at the two front corners of the rectangular frame, are designated by the numerals 25 and the pedestals supported at the two rear corners of the rectangular frame are designated by the numerals 26. Each pedestal has a rounded end adapted to rest upon the floor, the opposite ends of the pedestals being open. In each pedestal 25 there is provided a piston 27 shown in the present instance to be ring-shaped. A similar piston 28 is contained in each pedestal 26. A tubular piston rod 29 is secured in the central opening of ring-shaped piston 27, the other end of said rod being closed by a plug 30 which is anchored to the side of the frame 20 supporting the respective pedestal 25. Fig. 1 shows the interior of the right front pedestal 25 beneath the piston 27 to be in communication with the interior of the hollow piston rod 29. Likewise, a hollow piston rod 31 has its one end secured within the central opening of piston 28, a plug 32 closing the opposite end of the rod 31 and anchoring said rod to the side of the chair frame 20 in which the right rear pedestal 26 is slidably supported. It will, of course, be understood that the left front pedestal 25 at the opposite front corner of the chair frame 20, as well as the left rear pedestal have similar piston and piston rod constructions, the piston rods at this opposite side of the frame being anchored to the adjacent or opposite side member of frame 20.

It will be seen that the two pedestals at each side of the chair are hydraulically interconnected, the pedestals 25 and 26 at the right side of the chair, by the conduits 35R and 36R, the pedestals 25 and 26 at the left side of the chair by the conduits 35L and 36L. Conduits 35R and 36R communicate with opposite sides of a normally closed, two-way fluid flow control device or valve 37R. A similar valve 37L is interposed between the conduits 35L and 36L. A type of these valves 37L and 37R is detailedly illustrated in Fig. 9 as being yieldable, normally closed and capable, in response to a predetermined pressure, to be opened for establishing a restricted fluid

flow therethrough in one direction or the other to permit fluid transfer between the respective pairs of pedestals 25—26. Each valve is provided with a mechanism for modifying the fluid flow control characteristics thereof, a single element 40 being connected with both mechanisms for simultaneously adjusting them so that both provide the same fluid flow control. One kind of valve 37R or 37L which may be used in the present invention is schematically shown in Fig. 9 in which pipes 35R and 36R communicate with the interior chamber 180 in the valve casing. Two valves 181 and 182 are yieldably urged against the respective end walls of chamber 180 normally to shut off said communication of the pipes with the chamber. A duct 190, normally closed by the valve 181 in its normal position provides communication between chamber 180 and the pipe 36R when pressure has moved valve 181 from its seat. A similar duct 191, normally closed by valve 182 leads to pipe 35R and connects chamber 180 with pipe 35R when valve 182 is unseated by fluid pressure in pipe 36R. Actuating element 40 is attached to a rod 183 which extends into and through chambers 180 of both valves 37R and 37, said rod having a cam 184 attached thereto in each valve chamber. This cam is engaged by abutments 185 and 186 which are moved apart by operation of the cam to compress springs 187 and 188 against the respective valves 181 and 182 to urge them upon their seats with greater pressure. Actuation of the cam 184 will also permit said springs to expand and thus exert lesser pressure upon their respective valves. This varies the resistance to the transfer of fluid between the pipes 35R and 36R and 35L and 36L in either direction. The Figs. 1 and 2 clearly illustrate the aforescribed device, the Fig. 1 showing the chair in its normal or level position. When the user desires to tilt the chair backwardly, pressure is exerted against the frame 20 and particularly the back rest 22 thereof causing the rear pedestals 26 right and left to be forced inwardly of their supports 23. This inward movement of the rear pedestals 26 results in fluid displacement from said pedestals to their associate front pedestals, fluid being displaced from the rear right pedestal 26 through conduit 36R, exerting a pressure upon the valve 37R to open and establish a restricted flow through conduit 35R into the interconnected pedestal 25 at the front of the chair. Similarly fluid displaced from the left rear pedestal 26 flows through the conduit 36L against valve 37L, opening said valve to establish the flow through the conduit 35L into the pedestal 25 at the left front side of the chair. It will be understood that the valves 37R and 37L are adjusted to open at the same predetermined pressure exerted thereagainst. As long as the predetermined tilting force is applied to the back rest 22 of the chair tilting movement of the frame will obtain. However, when said tilting force against the back rest 22 is reduced below the predetermined fixed value or is discontinued, then the chair will be maintained in the adjusted tilted position and, upon reduction of fluid pressure against valve 37, said valve will close and thus stop any fluid transfer between the front and rear pedestals.

If the valves 37R and 37L are adjusted initially to require a substantial high fluid pressure for opening them, it would be difficult for a person of small stature or a child to exert sufficient force or weight against the chair frame to cause

it to tilt. In order to render the chair capable of practical and comfortable use by persons of either small stature or greater corpulence or size, there is provided a modifying device in each valve adapted to be operated to vary the fluid flow characteristics of the valve. A single actuating element 40 is connected with both modifying devices so that upon actuation of this device 40 both valves may concurrently be adjusted to render the chair suitable for use either by a child or light weight person or by a larger or heavier person. If a child desires to use the chair and finds it is improperly adjusted, the modifying device actuator 40 is operated to adjust valves 37R and 37L so that a lesser fluid pressure is required to open them. On the other hand, if a heavier person desires to use the chair and finds it is too freely tiltable the actuator 40 may be operated to modify the control characteristics of the valves so that a greater fluid pressure is necessary to open them for establishing the fluid transfer which is necessary to permit tilting of the chair.

If both front and rear pedestals 25 and 26 are of equal size then the chair will tilt about a point, substantially midway therebetween and thus the front of the chair seat supporting the limbs of the user beneath the knees will be raised a distance substantially equal to the lower movement of the rear portion of the seat. In some instances this may cause inconvenience inasmuch as the original design of the chair provided for proper height for the limbs of the user. In order that the front portion of the seat be maintained substantially at constant level even though the chair be tilted backwardly as shown in Fig. 2, the rear pedestals 26 may be predeterminedly smaller in diameter and therefore of lesser fluid capacity than the two front pedestals 25. Thus a complete collapse of the smaller rear pedestals 26 would displace an amount of fluid which when transferred to the larger front pedestals 25 would cause very little outward movement thereof and thereby the normal level of the front portion of the seat would be maintained. Contrariwise, if it is desired to effect greater movement of the front portion of the seat than the rear portion thereof, the front pedestals may be of smaller fluid flow capacity than the rear pedestals.

The construction shown in Fig. 4 is a modification of that shown in Figs. 1 and 2. Here, instead of fluid being contained within the pedestal itself, a closed expansible and contractable element, preferably a bellows, is housed within the pedestal which now is not a fluid container but a housing for the element which contains the fluid. The bellows in the front pedestals are designated by the numeral 45 and the rear pedestals by the numeral 46. Fig. 4 illustrates the two pedestals at the front and rear right side of the chair. Each bellows has a tubular extension secured thereto, the closed end of the bellows resting against the closed end of the pedestal, the opposite end of the bellows having the communicating, tubular extension provided thereon. Bellows 45 has a tubular extension 47 which has a plug 49 at its outer end closing the extension and anchoring it toward the side of the frame of the chair. Bellows 46 seated in the pedestal 26, at the rear of the chair, has a tubular extension 48 provided with a closure cap 50 which anchors the extension 48 to the side of the chair to which tube 47 is anchored. An adjustable, normally closed valve 62 has one side connected to the

5

tubular extension 47 by means of a conduit 60, a similar conduit 61 connecting the opposite side of the control valve 62 with the tubular extension 48. It will be understood that this same mechanism is duplicated at the opposite side of the chair.

The aforescribed mechanism operates as follows: When a predetermined and necessary force is exerted upon the chair and particularly its back rest 22 to urge the pedestal 26 inwardly of its support, bellows 46 is collapsed, displacing fluid through the tube 48 and conduit 61 and exerting fluid pressure upon the valve 62 which, at a predetermined pressure, will open to establish a restricted transfer of fluid from conduit 61 to conduit 60 and thence through the tubular extension 47 into the expanding bellows 45. The mechanism at the opposite side of the chair will function in the same manner. The valves 62 of the mechanisms at both sides of the chair are each provided with a modifying device adjustable concurrently by an actuator similar to the actuator 40 as in the device shown in Figs. 1 and 2. By means of the adjustment of the valve 62 the action of these valves may be modified to require either lesser or greater fluid pressure to open said valves thereby rendering the chair usable by either persons of small stature or greater corpulence respectively.

Figs. 5, 6, 7 and 8, shown on the second sheet of drawings, illustrate a modified form of tilt control mechanism. In this type of construction, no fluid is contained in the pedestals of the chair but on the contrary, fluid displacement elements are provided and mounted upon each side member of the frame. In this modified construction, the respective front and rear pedestals 125 and 126 are slidably supported in sleeves secured at the four corners of the frame 120. A lever 127 is pivoted substantially at its center to the one side of the frame, one end of said lever being secured to the front pedestal 125, the other end to the rear pedestal 126 at said one side of the chair frame. As shown in Fig. 7, the opposite front pedestal 125a is secured to one end of a lever 127a, the other end of said lever being attached to the other rear pedestal 126a. Thus when one pedestal, for instance, the pedestal 126 is moved inwardly of the frame, lever 127 moving counterclockwise about its central, pivotal support as regards Fig. 7, will urge pedestal 125 outwardly of the frame. The pedestals at the opposite side of the chair act in a similar fashion when the necessary force is applied to the chair to urge the rear pedestals inwardly of the frame.

This type of construction provides two separate fluid displacement elements, one at each side of the chair frame. The fluid displacement element associated with the pedestals 125 and 126, consists of a cylinder 128 secured to the right side of the chair frame, said cylinder having a piston 129 which divides the cylinder into two fluid containing compartments 130 and 131. A piston rod attached to piston 129 extends through the cylinder chamber 131 and the one end head of the cylinder to the exterior thereof. This piston rod, designated by the numeral 132, has its outer end operatively secured to one end of a right angled lever 133, which is pivoted at the point 134 to the side of the frame supporting the pedestals 125 and 126 and also the cylinder 128. The opposite angular arm of said lever is secured to the rear pedestal 126. Thus it may be seen that actuation of the pedestal 126 will operate the piston 129 toward the left as regards

6

Fig. 7, when the pedestal 126 is moved inwardly of the frame and toward the right in cylinder 128 when the pedestal 126 is moved outwardly of the frame. Similarly, a cylinder 140 is secured to the left side of the chair frame 120, this cylinder having a piston 141 dividing the cylinder into two fluid containing compartments 142 and 143. Piston 141 has a rod 144 secured thereto, extending through cylinder chamber 143 to the exterior of the fluid displacement member, the outer end of this rod 144 being operatively secured to one arm of a right angled lever 145 which is pivoted at 146 to said left side of the chair frame. The opposite arm of this right angled lever 145 is operatively connected to the front pedestal 125a at the left front side of the chair frame.

This mechanism has a unitary, two-way pressure control valve 150 of any suitable standard design, provided with any suitable manually operable modifying device 151 which may be actuated to change the control characteristics of this valve. This valve mechanism is normally closed to prevent fluid flow therethrough but may be actuated at a predetermined fluid pressure to be opened and establish a restricted flow of fluid therethrough in one direction or the other. A conduit 152 provides communication between the chamber 131 of cylinder 128 with one side of the valve and a similar conduit 153 provides communication between the same side of valve 150 and the chamber 142 of the cylinder or fluid displacement member 140. Another conduit 154 connects the opposite side of the valve with the chamber 130 of the fluid displacement cylinder 128 and a conduit 155 connects this same side of the valve with the chamber 143 of the fluid displacement cylinder 140. The connections of the conduits, just mentioned, with the valve and the channels within the valve 150 are such that, when the valve is opened, conduits 153 and 154 will be in communication with each other and conduits 152 and 155 will be in communication.

This type of construction operates in the following manner:

When a sufficient tilting force is applied to the frame 120 of the chair, or more particularly, the back rest 122, for instance, to tilt the chair backwardly into the position as shown in Fig. 6, the pedestals 126 and 126a will be urged inwardly of the frame. This movement of pedestal 126 through its lever connections with the piston rod 132 urges the piston 129 to the left as regards Fig. 7, while the inward movement of pedestal 126a into the frame will cause the lever 145 to actuate the piston 141 in cylinder 140 also toward the left in said cylinder. As the piston 129 moves toward the left, it urges fluid from chamber 130, through conduit 154, against the valve 150 and as the piston 141 in cylinder 140 moves toward the left as regards Fig. 7, fluid in the chamber 143 of cylinder 140 will be forced through conduit 155 into the valve. When the pressure from fluid chambers 130 and 143 reach the predetermined value in response to the predetermined tilting force applied to the back rest 122 of the chair, the valve 150 will be opened, thereby establishing a transfer of fluid from chamber 130 through the valve 150 and conduit 153 into the chamber 142 of cylinder 140, chamber 142, and chamber 130, being the rod free chambers of the respective cylinders and thus of equal fluid displacement capacity per unit of piston movement. Likewise, as the piston 141 moves to displace fluid in chamber 143, the valve

150, opening at the predetermined pressure, will permit the fluid to flow through the valve into the chamber 131 of cylinder 128, these two chambers 131 and 143 being the rod containing chambers and of like fluid displacement capacity per unit of piston movement. As soon as the tilting force upon the chair frame, and more particularly, the back rest 122 thereof, is reduced or discontinued, fluid flow through the valve 150 will be discontinued due to the closing of the valve in response to a decrease in fluid pressure thereupon and thus the chair will be maintained in the adjusted tilted position. As in the case of the mechanism shown in Figs. 1 to 4 inclusive, this type of mechanism may be adjusted by manual operation of the modifying device 151 to be adapted for use by either small, light weight persons or persons of greater corpulence. In any of the constructions illustrated and described the chair may be adjusted tiltably forward and backward but the mechanism prevents any tilting side-wise or diagonally.

From the foregoing, it may be seen that the present invention provides automatic means which permits adjustable tilting of a lounging chair forward and backward but not sidewise upon the application of a predetermined tilting force applied thereto, said mechanism holding the chair in the adjusted position when said tilting force is reduced or discontinued. The mechanism is also adaptable to be adjusted, rendering the chair practically and comfortably usable by either a person of light weight or a larger and heavier person. The complete mechanism is so designed that it may be assembled within the frame of the chair and completely hidden thereby, in no way effecting the outward appearance of the chair.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. A chair adapted to be adjustably tilted by the application of a predetermined tilting force applied thereon, said chair being maintained in the adjusted position when the required tilting force is reduced or discontinued, comprising in combination, a frame providing a seat and a back support; two independent pairs of interconnected pedestals, each pair consisting of a front and rear pedestal movably carried by the frame; hydraulic mechanism associated with and operatively connecting each pair of pedestals; and normally closed fluid flow control means for said hydraulic mechanisms, operative, when said predetermined tilting force is applied to the frame of the chair, for permitting a controlled transfer of fluid between the two oppositely moving pedestals of each pair.

2. A chair adapted to be adjustably tilted by the application of a predetermined tilting force applied thereon, said chair being maintained in the adjusted position when the required tilting force is reduced or discontinued, comprising in combination, a frame providing a seat and a back support; a pedestal movably secured to the frame adjacent each front and rear corner thereof; a fluid transfer means operatively connecting a front and rear pedestal on the frame and operative to transfer fluid therethrough in either direction in response to movement of the respective pedestals relatively to the frame; and fluid flow control mechanism for permitting such fluid

transfer only in response to said predetermined tilting force applied to the frame.

3. A chair adapted to be adjustably tilted by the application of a predetermined tilting force applied thereon, said chair being maintained in the adjusted position when the required tilting force is reduced or discontinued, comprising in combination, a frame providing a seat and a back support; a pedestal telescopically supported in the frame adjacent each front and rear corner thereof; a fluid transfer mechanism operatively connecting a front and a rear pedestal whereby oppositely disposed telescopic movements of said front and rear pedestals in response to tilting force being applied to the frame will cause fluid movement within said transfer mechanism; and a fluid flow control device in said fluid transfer mechanism, operative only in response to said predetermined tilting force applied to the frame, for permitting fluid flow through said mechanism.

4. A device in accordance with claim 1, characterized by the fact that the fluid flow control means is provided with a modifying means operative to alter the flow control characteristics of said control means in accordance with the desires of the user.

5. A device in accordance with claim 2, in which, however, said fluid flow control mechanism is provided with modifying means operative to adjust the said mechanism to decrease or increase its restriction to fluid flow whereby a reduced or increased tilting force is required to establish a fluid flow through said mechanism for permitting tilting of the chair.

6. A chair adapted to be adjustably tilted by the application of a predetermined tilting force applied thereon, said chair being maintained in the adjusted position when the required tilting force is reduced or discontinued, comprising in combination, a frame providing a seat and a back support; a fluid displacement device provided at both front and both rear corners of the frame, each of said devices consisting of a cylinder closed at the outer end and slidably carried by the frame to form a pedestal for the chair and a hollow piston in the cylinder, the outer end of the piston being closed and anchored to the frame; separate conduits, one providing communication between the hollow pistons and their respective cylinders at the front of the frame, the other conduit providing communication between the hollow pistons and their cylinders at the rear of the frame; and a normally closed, two-way fluid flow control device connected between said two conduits, said control device being operative to permit a transfer of fluid between the two front and the two rear fluid displacement devices in response to a predetermined tilting force being applied to the frame of the chair.

7. A chair adapted to be adjustably tilted by the application of a predetermined tilting force applied thereon, said chair being maintained in the adjusted position when the required tilting force is reduced or discontinued, comprising in combination, a frame providing a seat and a back support; a pedestal slidably carried at both front and both rear corners of the frame, each pedestal being tubular with its outer, floor engageable end closed; an expansible and contractible fluid container in each pedestal, each container having a rigid, tubular extension the closed outer end of which is anchored to the frame; separate conduits providing communication between the two front and the two rear

fluid containers; and a normally closed, two way valve connected between the two conduits, said valve being operative to open communication between said conduits and permit fluid displacement between the front and rear fluid containers in response to actuation of the respective pedestals by the application of a predetermined tilting force upon the frame of the chair.

8. A chair adapted to be adjustably tilted by the application of a predetermined tilting force applied thereon, said chair being maintained in the adjusted position when the required tilting force is reduced or discontinued, comprising in combination, a frame providing a seat and a back support; a pedestal slidably supported in the frame at each of the front and rear corners thereof; two levers, each centrally pivotally secured to the frame, the ends of one lever being secured to the respective front and rear pedestals on one side of the chair frame, the ends of the other lever being secured to the respective front and rear pedestals at the opposite side of the chair frame; two fluid displacement members each secured at a respective side of the chair frame, each member consisting of a closed cylinder having a piston forming two chambers therein and a rod attached to the piston and extending through one of said chambers and a cylinder end to the exterior of the cylinder; two levers, each pivotally secured to a respective side of the frame, the one end of each lever being connected with one pedestal, the other end to a piston rod at the same side of the frame; a conduit connecting the rod containing chambers of both cylinders; a second conduit connecting the rod free chambers of both cylinders; and a normally closed fluid flow control valve in each of said conduits, operative to permit the transfer of fluid between the rod containing chambers and the rod free chambers of said cylinders in response to the actuation of the chair pedestal connected to

the piston rods of said cylinders, by application of a predetermined tilting force upon the frame of the chair.

9. A device in accordance with claim 8, in which, however, said fluid flow control valves are provided in a unitary structure having a modifying device manually operable concurrently to adjust said valves for varying the force required to tilt the chair and establish fluid transfer.

10. In combination with a tiltable chair having a frame; fluid displacement means supported in the frame and providing front and rear pedestals operative by tilting the chair; a normally closed, two way valve operative at a predetermined fluid pressure to permit a restricted fluid flow therethrough in one direction or the other; conduits connecting the fluid displacement means at the front of the chair with one side of the valve and the fluid displacement means at the rear of the chair with the other side of the valve whereby restricted transfer of fluid between the said front and rear displacement means is effected when a predetermined tilting force is applied to the chair to actuate either the front or rear pedestals; and means accessible to the chair user for modifying the control characteristics of the valve.

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