# United States Patent

**Wolters**

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## [54] CHAIR CONTROL


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[52] **U.S. Cl.** ..... **248/373**

[51] **Int. Cl.** ..... **A47c 7/00**

[58] **Field of Search** ..... 248/373, 374, 389, 417; 297/304, 303, 302, 332; 267/57



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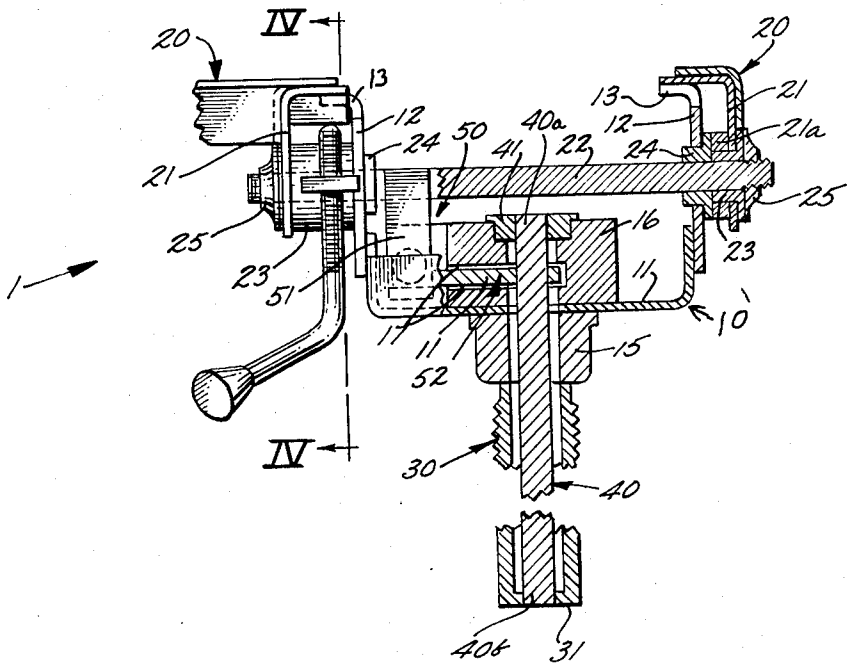
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[57] **ABSTRACT**

The chair control includes a seat support rotatably mounted on a housing, and a hollow spindle connected to the housing and depending downwardly therefrom. A torsion rod is mounted vertically within the spindle and has one end fixed against rotation at the bottom of the spindle. The seat support is connected for simultaneous rotation with an axle, which is rotatably mounted in the housing. A cam lever is secured to and extends downwardly from the axle and engages a follower lever which is operably connected to the free end of the torsion rod. A ball bearing is positioned between the abutting portions of the cam lever and follower lever to minimize friction.


**14 Claims, 7 Drawing Figures**



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3 Sheets-Sheet 1

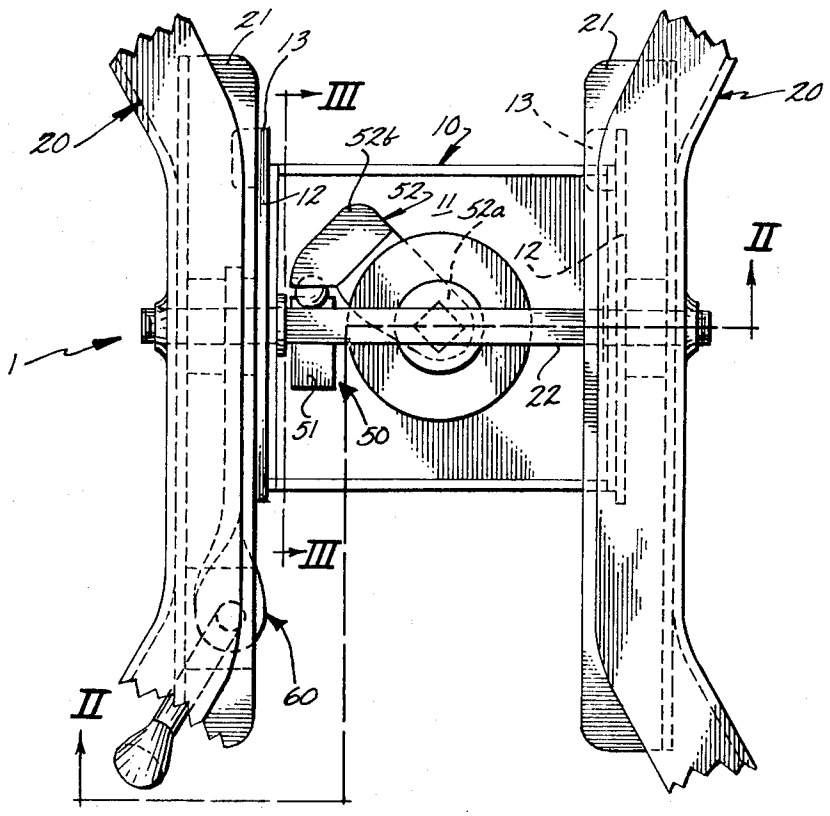



FIG. 1.

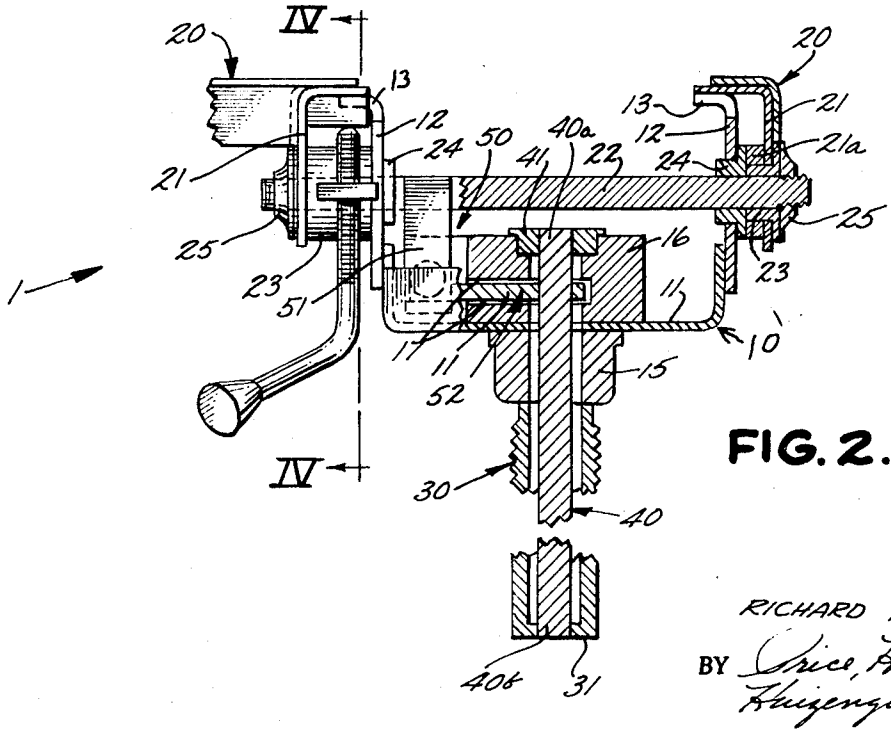



FIG. 2.

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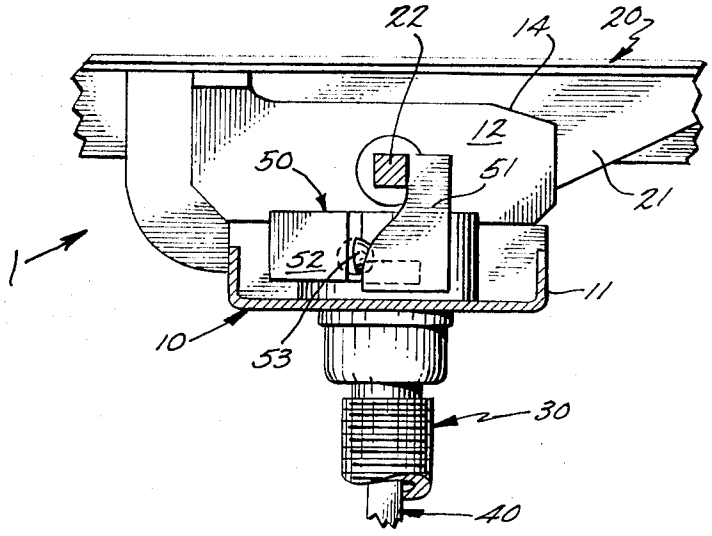



FIG. 3

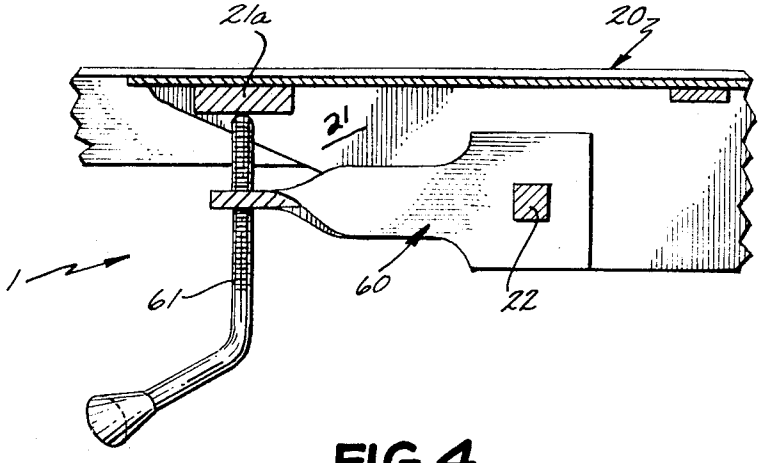



FIG. 4.

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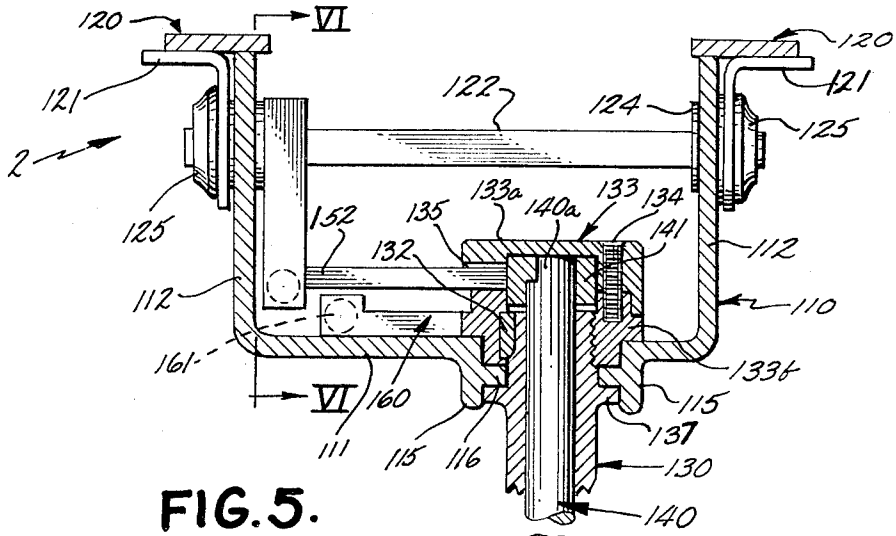



FIG. 5.

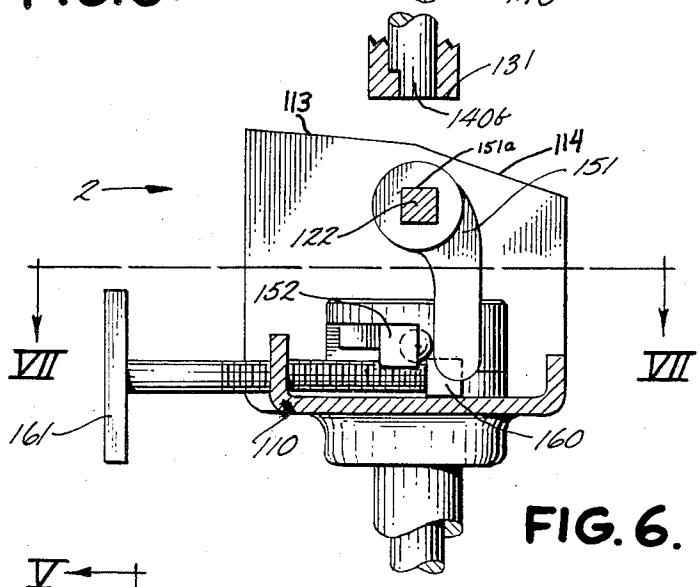



FIG. 6.

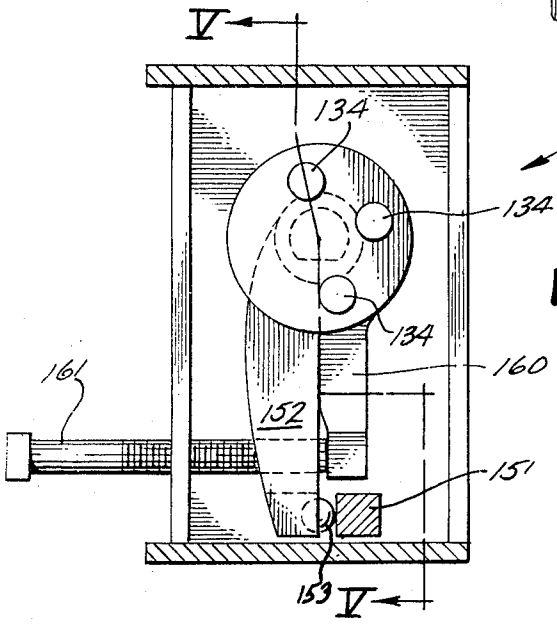



FIG. 7.

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# CHAIR CONTROL

## BACKGROUND OF THE INVENTION

This invention relates to chair controls, particularly those utilizing torsion rods as the bias means. Chair controls are used in tilt chairs to control the rate at which the chair is tilted. Some type of bias means is always provided to resist the tilting movement of the chair. Finally, means are provided to apply a pretension to the bias.

Torsion rods are frequently utilized as such bias means. These torsion rods are mounted horizontally in an elongated housing, with one end of the torsion rod being fixed against rotation with respect to the housing and with the other end being freely rotatable. A lever extends from the free end of the torsion rod to a position in abutment with a seat support which is rotatably mounted on the elongated housing. In this manner, tilting of the seat support causes the torsion rod to twist and thereby resist the tilting movement of the chair.

Such torsion rod chair controls suffer from a number of drawbacks, one of which is the fact that, in any torsion rod control, it is necessary to use a rather long torsion rod. This necessitates the use of an elongated and bulky housing for the rod which provides the chair with an unsightly appearance. Additionally, tremendous stress is applied to the elongated housing when the chair is tilted. This results in warpage of the housing, which under many circumstances is unacceptable.

In the present invention, a seat supporting means is mounted for tilting movement about a generally horizontal axis. However, the torsion means is mounted for twisting movement about a generally vertical axis, rather than horizontal, and means are provided for translating the tilting movement of the seat support to rotational movement about a vertical axis and for applying this vertical rotation to the torsion means to initiate twisting. Thus, with the torsion means being mounted vertically, the need for an elongated housing is eliminated.

Preferably, the torsion means is mounted within a hollow spindle depending downwardly from a housing on which the seat support means is rotatably mounted. In this manner, the torsion means is completely hidden from view and the chair control housing can be relatively small and compact by comparison to the elongated housing necessary in conventional torsion rod chair controls. The problem of housing warpage is completely eliminated due to the complete redistribution of torsion forces.

Two alternative means are provided for adjusting the pretension applied to the torsion rod in this invention. In one embodiment, the means for translating the tilting movement of the seat support includes an axle mounted for rotational movement in the housing. The seat support is rotatably mounted on this axle, but a lever is fixedly connected at one end to the axle and is operably connected at its other end to the seat support such that tilting movement of the seat support results in rotation of the axle. Means are provided for adjusting the angular displacement of the lever with respect to the seat support to thereby vary the pretension on the torsion rod. In the alternative embodiment, the hollow chair spindle within which the torsion rod is mounted and is fixed against rotation at one end is itself rotatably mounted within the chair control housing. Means are provided for varying the rotational angle of the spindle with respect to the housing to thereby vary the pretension on the torsion rod.

## BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and advantages of the invention will be seen and understood by reference to the specification and appended drawings in which:

FIG. 1 is a plan view of the first preferred embodiment of the chair control;

FIG. 2 is a cross-sectional view of this embodiment taken along plane II—II of FIG. 1;

FIG. 3 is a sectional view taken along plane III—III of FIG. 1;



FIG. 4 is a sectional view taken along plane IV—IV of FIG. 2;

FIG. 5 is a cross-sectional view of an alternative embodiment of the invention;

FIG. 6 is a sectional view taken along plane VI—VI of FIG. 5; and

FIG. 7 is a sectional view taken along plane VII—VII of FIG. 5.

## PREFERRED EMBODIMENT

### First Alternative

In the first alternative preferred embodiment 1, seat supports 20 are rotatably mounted on a housing 10 (FIG. 1). A hollow spindle 30 depends downwardly from the bottom of housing 10 and a torsion rod 40 is mounted within hollow spindle 30 with its bottom end fixed against rotation and with its top end freely rotatable (FIG. 2). A cam and follower means 50 is provided for translating the tilting motion of seat supports 20 about a horizontal axis to rotational movement about a vertical axis, and for imparting the vertical axis rotational movement to the free end of torsion rod 40 (FIGS. 1, 2, and 3). A pretension can be applied to torsion rod 40 by means of pretension adjustment lever 60 (FIG. 4).

Housing 10 includes a pan-shaped bottom portion 11 which is made of cast iron or an equivalent constructional material (FIGS. 1, 2 and 3). Housing 10 also includes a pair of upwardly extending sides 12 (FIGS. 2 and 3) which are welded to the sides of bottom pan 11. This provides housing 10 with a generally U-shaped cross-sectional configuration (FIG. 2).

Each side 12 includes a bent ear portion which provides a forward stop 13 for seat supports 20 (FIG. 1). For the left side 12, forward stop 13 is bent outwardly away from housing 10 while for the right side 12 the forward stop 13 is bent inwardly. The purpose of this is to accommodate pretension adjustment lever 60 as will be explained subsequently. The rear top edge of each side 12 is sloped slightly to provide a rear stop 14 for seat support 20 (FIG. 3). The forward stops 13 act to limit the forward tilting motion of seat supports 20 while rear stops 14 act to limit the rearward tilting motion of seat supports 20.

Housing 10 also comprises a spindle mount 15 (FIG. 2) to which spindle 30 is welded. Spindle mount 15 depends downwardly from bottom 11. A spindle cap 16 is welded to bottom pan 11, but projects upwardly into housing 10. It includes a slot 17 whose function will be explained subsequently in connection with cam and follower means 50.

Seat supports 20 are welded to mounting brackets 21 which in turn are rotatably mounted on an axle 22 (FIGS. 1 and 2). Brackets 21 are L-shaped, having a base to which seat supports 20 are welded and having legs whereby the brackets 21 can be rotatably mounted on axle 22. A washer 21*a* is welded to the inside of bracket 21, adjacent an opening therethrough such that brackets 21 can rotate on bracket bushings 23 which in turn are mounted on axle 22 (FIG. 2). Lock washers 25 are provided to hold brackets 21 and bushings 23 in place. This entire assembly, and the manner whereby brackets 21 are rotatably mounted on axle 22, is comparable to the manner in which seat supports in conventional torsion rod chair irons are rotatably mounted on a horizontal torsion rod. Axle 22 is itself rotatably mounted on housing 10. Axle 22 is carried in axle bushings 24, which allow axle 22 to rotate (FIG. 2).

Spindle 30 is hollow and is welded at its top to spindle mount 15. It includes a square-holed bottom 31 into which torsion rod 40 can be inserted. In this embodiment, torsion rod 40 is of square cross section such that its insertion into the square hole in bottom 31 of spindle 30 fixes the bottom end 40*b* of torsion rod 40 against rotation with respect to spindle 30 (FIG. 1).

Torsion rod 40 can be a conventional torsion rod mounted vertically within hollow spindle 30. While the bottom end 40*b* of torsion rod 40 is fixed against rotation with respect to spindle 30, the top end or free end 40*a* is freely rotatable. The top

end 40*a* extends upwardly through spindle mount 15, through a hole in bottom pan 11 and upwardly into spindle cap 16. Here it is carried in a bushing 41 which allows top end 40*a* to freely rotate with respect to spindle 30. Cap 16 acts to hold torsion rod 40 in proper vertical alignment.

The cam and follower means 50 includes a cam lever 51 which is welded to and depends downwardly from axle 22 (FIGS. 2 and 3). The end of lever 51 is in operable abutment with a follower lever 52 (FIG. 1). End 52*a* of follower lever 52 is secured to the top portion 40*a* of torsion rod 40 (FIG. 2). End 52*a* includes a square hole such that it can be slipped over the end of torsion rod 40 and follower lever 52 will be held against rotation with respect thereto. Follower lever 52 then extends through slot 17 in cap 16 and its opposite end 52*b* is in operable abutment with cam lever 51. At its opposite end 52*b*, follower lever 52 is enlarged and includes a slight recess which accommodates a ball bearing 53 (FIG. 3). The free end of cam lever 51 abuts ball bearing 53 to thereby minimize the friction between the abutting cam lever 51 and follower lever 52. Thus it can be seen that rotation of axle 22 will cause cam lever 51 to push against ball bearing 53 and thereby cause follower lever 52 to impart a twisting motion to torsion rod 40.

While seat supports 20 are freely rotatable on axle 22, seat supports 20 and axle 22 are operably connected for simultaneous rotation by means of pretension adjustment lever 60 (FIG. 4). Pretension adjustment lever 60 includes a square hole in one end whereby it is slipped over axle 22, the latter also being of square cross section. In this manner, pretension adjustment lever 60 is fixed against rotation with respect to axle 22. An adjustment screw 61 passes through the opposite or free end of adjustment lever 60 and engages the underside of left bracket 21 (as viewed in FIG. 1), a special abutment block 21*a* being provided. In this manner, the tilting of left seat support 20 acts against pretension adjustment lever 60 and thereby causes axle 22 to rotate. Because of pretension adjustment lever 60, the left side seat support 20 and left side bracket 21 must be spaced farther to the outside of housing 10 than is the right side bracket 21. This is the reason that forward stop 13 must be bent outwardly from housing 10 rather than inwardly. Left seat support 20 and right seat support 20 are operably joined when a chair seat is secured thereto.

With the above construction explained, the operation of the first alternative preferred embodiment 1 will now be readily understood through the following explanation. In use, a seat will be mounted on seat supports 20. When a person tilts rearwardly in a chair, the brackets 21 will raise off of forward stops 13. The rotation of seat supports 20 will be imparted to axle 22 by means of pretension adjustment lever 60 and adjustment screw 61. As axle 22 is rotated, it will cause cam lever 51 to act against ball bearing 53 and thereby rotate follower lever 52 about a vertical axis. Since follower lever 52 is fixed against rotation with respect to torsion rod 40, it will cause the free end of torsion rod 40, which is carried in bushing 41, to rotate. Because the bottom end of torsion rod 40 is fixed against rotation with respect to spindle 30, and because spindle 30 is welded to spindle mount 15, this will result in a twisting of torsion rod 40 and torsion rod 40 will thereby act against the tilting motion of the chair and will bias the chair to forward position, with brackets 21 engaging forward stops 13. The extent to which the chair can be tilted rearwardly is limited by rearward stops 14 against which brackets 21 will abut as the chair is tilted rearwardly.

A pretension can be applied to torsion rod 40 and can be varied merely by threading adjustment screw 61 upwardly or downwardly in pretension adjustment lever 60. This varies the angular position of lever 60 with respect to seat supports 20. Referring to FIG. 4, it will be appreciated that as the free end of lever 60 is moved away from seat support 20, axle 22 will be rotated counterclockwise and cam lever 51 will thereby impart an initial twist to torsion rod 40. When screw 61 is rotated in the other direction, the end of lever 60 moves closer to seat support 20 and the pretension on torsion rod 40 is eased. The seat supports 20 will not be rotated by threading adjustment screw 61, since they are abutting forward stops 13 and cannot be moved forward to any greater extent.

## Second Alternative

The essential difference between the first and second alternative preferred embodiments is that an alternative means is provided for adjusting the pretension (FIGS. 5, 6 and 7). In the alternative chair control 2, spindle 130 is rotatably mounted in housing 110 (FIG. 5) and pretension adjustment lever 160 is provided for varying the rotational angular position of spindle 130 with respect to housing 110. Thus, housing 110 and its dependent components are somewhat different in construction from housing 10 of preferred embodiment 1. Spindle 130 of chair control 2 is somewhat different from spindle 30 and adjustment lever 160 is considerably different in structure and operation from adjustment lever 60 of first chair control 1. Finally, seat supports 120 of chair control 2, while identical in construction to the seat supports 20 in preferred embodiment 1, are mounted somewhat differently in chair control 2. The remaining components of chair control 2 are essentially the same as their counterparts in preferred embodiment 1.

Housing 110 is a unitary casting and includes a bottom 111 and upwardly extending sides 112 (FIG. 5). Housing 10 could similarly be a unitary casting and it is not necessary that sides 12 be welded to bottom pan 11. The sides 112 include a top edge which is sloped at two different angles. The forward sloped portion acts as a forward stop 113 and the rearward sloped portion acts as a rear stop 114.

Spindle mount 115 is cast integrally with housing 110 and includes an annular flange 116 extending around its interior. Spindle 130 is hollow, as before, and includes an exterior annular flange 137 at its top which abuts flange 116 of spindle mount 115 when the two components are assembled.

The counterpart of spindle cap 16 of preferred embodiment 1, is spindle cap 133. However, spindle cap 133 is not an integral part of nor is it welded to housing 110. Furthermore, it comprises a top portion 133*a* and a bottom portion 133*b*. The top of hollow spindle 130 is threaded, and spindle 130 can thereby be threaded into spindle cap bottom 133*b* (FIG. 5). In this manner, spindle 130 is locked vertically with respect to housing 110, but is still free to rotate with respect thereto.

Spindle cap bottom portion 133*b* and the top of spindle 130 include keyways. Once the two parts are threaded together, they are rotated until these keyways are aligned. Then, a key 132 is dropped into the keyways to thereby fix the bottom portion 133*b* of cap 133 against rotation with respect to spindle 130 (FIG. 5). These members now act as an integral unit.

At this point in the assembly, torsion rod bushing 141 is slipped over torsion rod 140. In chair control 2, follower lever 152 is welded to torsion rod bushing 141, rather than being secured directly to torsion rod 140, as follower lever 52 of chair control 1 is secured to torsion rod 40. Also in chair control 2, torsion rod 140 is round, having a keyed top portion 140*a* and a keyed bottom portion 140*b* to key into bushing 141 and into bottom 131 of spindle 130 respectively. In this manner, torsion rod 140 is fixed against rotation at its bottom with respect to spindle 130, but its upper end 140*a* is freely rotatable. However, its upper or free end 140*a* is fixed against rotation with respect to follower lever 152 by means of keyed bushing 141 to which follower lever 152 is rigidly secured.

Once this assembly is completed, the top portion 133*a* of cap 133 is secured to the bottom portion 133*b* by means of screws 134. As with cap 16 in embodiment 1, spindle cap 133 includes a slotted portion, 135, which accommodates follower lever 152.

The bottom portion 133*b* of cap 133 includes a pretension adjustment lever 160 integrally secured thereto and extending laterally therefrom (FIGS. 5 & 7). An adjustment screw 161 threads through housing 110 (FIG. 6) and its end abuts the end of adjustment lever 160. It should be noted that adjustment screw 161 is positioned on that side of lever 160 which

will cause it to act as a force in opposition to cam lever **151** (FIG. 7). In this manner, adjustment screw **161** prevents spindle **130** from rotating when a force is applied to follower lever **152** by means of cam **151**. This results in a twisting motion being applied to torsion rod **140** in a manner similar to that described above in connection with chair control **1**. Pretension can be varied merely by threading screw **161** in either direction to thereby vary the angular rotational position of spindle **130** with respect to housing **110**. As spindle **130** is rotated counterclockwise, pretension on torsion rod **140** will increase. As spindle **130** is rotated clockwise, pretension will decrease.

Seat supports **120** include bracket portions **121**, just as in preferred embodiment **1**. However, brackets **121** are not freely rotatable on axle **122**, but rather are fixed against rotation with respect thereto. This can be accomplished by providing square holes in brackets **121** to correspond to the square cross section of axle **122**. Thus, bracket bushings **23** which are found in preferred embodiment **1** have no counterpart in preferred embodiment chair control **2**. It is merely necessary to provide axle bushings **124** and lock washers **125**.

While the configurations of cam lever **151** and follower lever **152** vary somewhat from the configurations shown for preferred embodiment **1**, the basic construction and operation is identical. Cam lever **151**, rather than being welded to axle **122**, includes a square hole **151***a* in one end thereof, whereby cam lever **151** can be slipped over axle **122**. In this manner, cam lever **151** is fixed against rotation with respect to axle **122**. Otherwise, it acts against ball **153** and follower lever **152** just as cam lever **51** acts against ball **53** and follower lever **52**. Accordingly, the description of the operation of these elements as set forth above will suffice.

It will be understood that the above are merely preferred embodiments of the invention and that many changes and alterations can be made thereof without departing from the spirit and broader aspects of the invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows.

**1**. A chair control comprising: means for supporting a seat, for operable, rotatable mounting on a chair base, for tilting about a generally horizontal axis; torsion means mounted for twisting movement about a generally vertical axis; means for translating the horizontal axis tilting movement of said seat support means to rotational movement about a generally vertical axis, and for applying said vertical axis rotation to said torsion means to initiate said twisting movement.

**2**. The chair control of claim **1** in which said means for translating said tilting movement comprises: a cam operably connected to said seat supporting means; a follower lever operably connected at one end to said torsion means and at the other end, operably abutting said cam, whereby tilting of said seat support means causes said cam to move said follower lever and thereby twist said torsion means.

**3**. The chair control of claim **2** which comprises: a ball bearing positioned between said cam and said follower lever for minimizing friction therebetween; means being provided for holding said ball bearing in position between said cam and said follower lever.

**4**. A chair control comprising: a housing for operably mounting on a chair base; means for supporting a seat, mounted on said housing for tilting movement about a generally horizontal axis; a spindle operably connected to said housing and depending downwardly therefrom; a torsion rod mounted in said spindle for twisting movement about a generally vertical axis, one end of said torsion rod being fixed against rotation with respect to said spindle and the other end being free to rotate with respect to said spindle; means for translating tilting movement about a horizontal axis to rotational movement about a vertical axis, said means operably connecting said seat supporting means to said torsion rod whereby tilting of said seat supporting means causes twisting of said torsion rod.

**5**. The chair control of claim **4** in which said translating means operably connecting said seat supporting means to said torsion rod comprises: a cam operably connected to said seat supporting means; a follower lever operably connected at one end to said torsion rod and operably abutting said cam at its other end, whereby tilting of said seat supporting means causes said cam to move said follower lever and thereby twist said torsion rod.

**6**. The chair control of claim **5** in which said free end of said torsion rod is positioned at the top of said spindle, said free end being mounted in a rotatable bushing and being fixed against rotation with respect thereto; said follower lever being connected to said rotatable bushing and thereby being operably connected to said torsion rod.

**7**. The chair control of claim **5** in which a ball bearing is positioned between said cam and said follower lever for minimizing the friction therebetween; said ball bearing being positioned within a recess in one of said cam and said follower lever whereby its position therebetween is maintained.

**8**. The chair control of claim **4** in which said spindle is rotatably mounted in said housing and which comprises: means for adjusting the angular rotational position of said spindle with respect to said housing whereby a pretension can be applied to said torsion rod before said seat is tilted.

**9**. The chair control of claim **5** in which said spindle is rotatably mounted in said housing and which comprises: means for adjusting the angular rotational position of said spindle with respect to said housing whereby a pretension can be applied to said torsion rod before said seat is tilted.

**10**. The chair control of claim **9** in which said means for adjusting the angular rotational position of said spindle comprises: a pretension adjustment lever operably connected to said spindle and extending laterally therefrom within said housing; a screw threadably mounted within said housing with its end in abutment with the end of said lever; said screw being mounted with respect to said lever and said cam being mounted with respect to said follower lever such that said screw and said cam act as opposing forces with respect to the twisting of said torsion rod.

**11**. The apparatus of claim **10** in which said pretension adjustment lever is connected to a cap which is rotatably mounted within said housing; said cap being keyed to said spindle whereby rotation of said cap causes corresponding rotation of said spindle; said free end of said torsion rod being mounted within a bushing and being fixed against rotation with respect to said bushing; said bushing being rotatably mounted within said cap; said follower lever being connected to said bushing whereby said follower lever is operably connected to said torsion rod.

**12**. A chair control comprising: a housing of generally U-shaped cross section having sides and a bottom; an axle being rotatably mounted between said sides; means for supporting a seat being operably connected to said axle; a hollow spindle being operably connected to said bottom of said housing and depending downwardly therefrom; a torsion rod mounted within said spindle and having one end fixed against rotation with respect to said spindle and having a free end extending from the top of said spindle, being rotatable with respect thereto; a cam lever connected to said axle and depending downwardly therefrom; a follower lever being operably connected to said free end of said torsion rod and extending laterally therefrom; said ends of said cam lever and said follower lever operably abutting whereby rotation of said axle causes said cam lever to initiate rotation of said follower lever and imparts a twisting motion to said torsion rod.

**13**. The chair control of claim **12** in which said seat supporting means is mounted to be freely rotatable on said axle; said seat supporting means and said axle being operably connected by means of a lever being connected at one end to said axle and being fixed against rotation with respect thereto and being operably connected at its other end to said seat supporting means whereby tilting of said seat supporting means causes rotation of said axle; means being provided for adjusting the

angular orientation of said lever with respect to said seat supporting means whereby the pretension on said torsion rod can be adjusted.

**14**. The chair control of claim **12** in which a ball bearing is positioned between said cam and said follower lever for minimizing the friction therebetween; said ball bearing being positioned within a recess in one of said cam and said follower lever whereby its position therebetween is maintained.

* * * * *