

Sept. 14, 1965

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3,206,153

TILT SWIVEL MECHANISM FOR CHAIRS

Filed Feb. 25, 1963

2 Sheets-Sheet 1

FIG. 1.

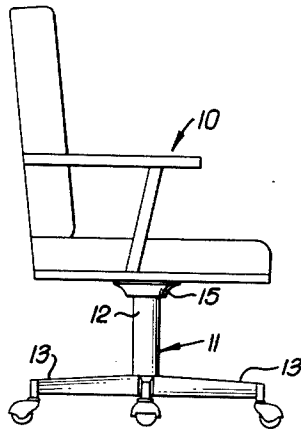


FIG. 3.

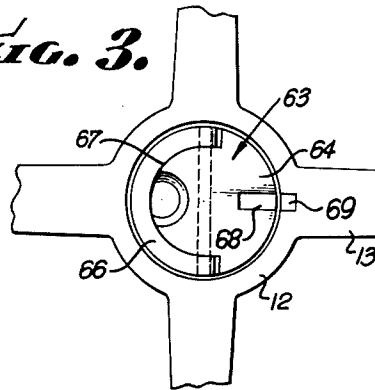
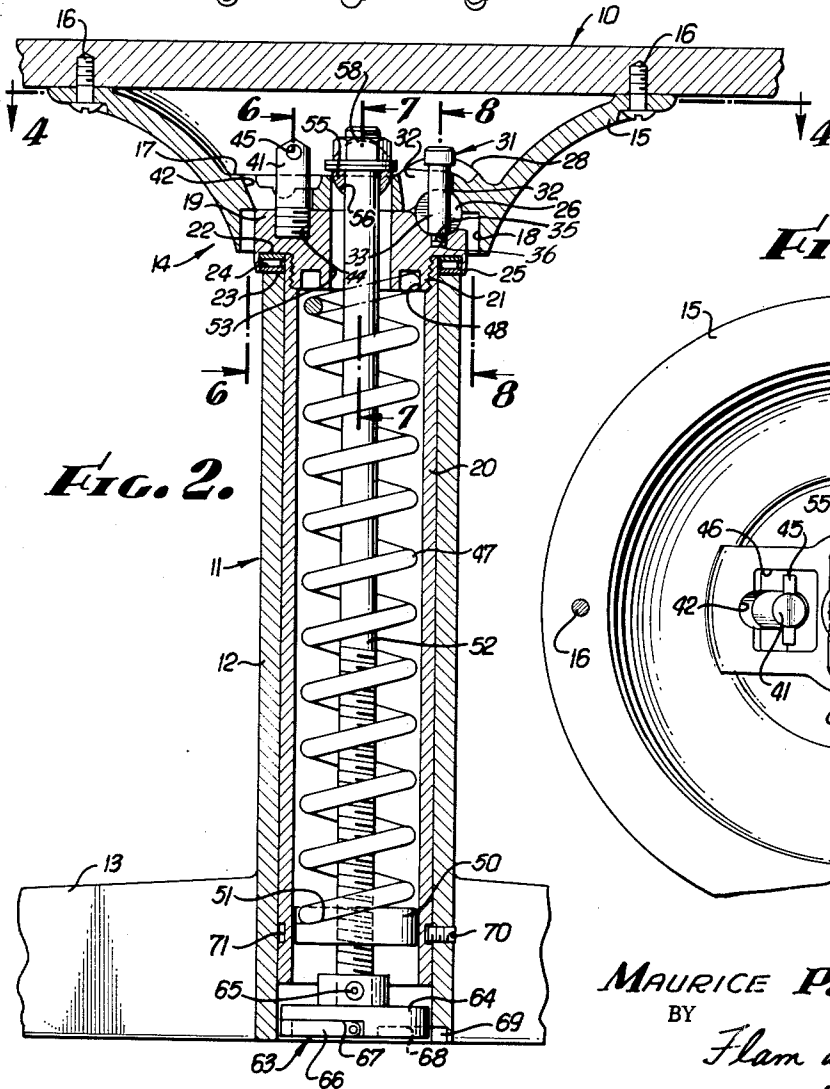
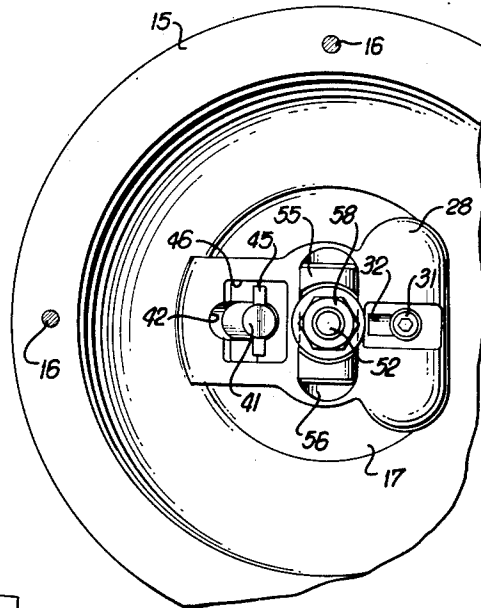


FIG. 2.

FIG. 4.



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2 Sheets-Sheet 2

FIG. 5.

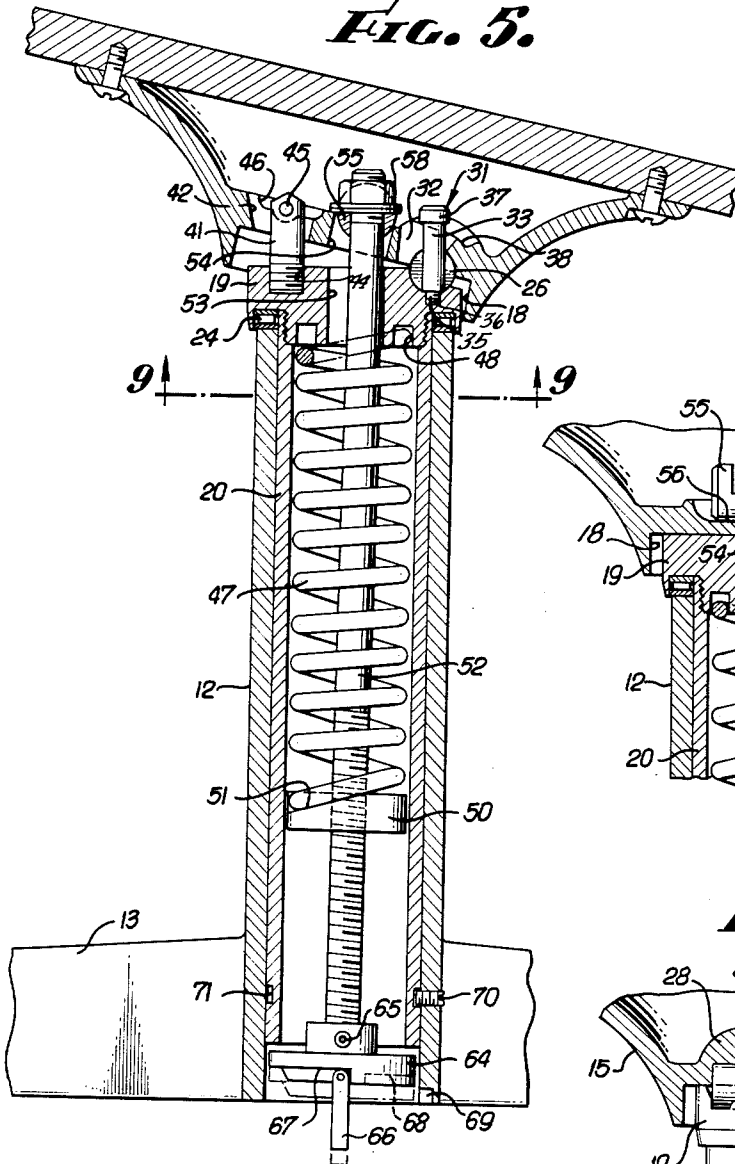


FIG. 9.

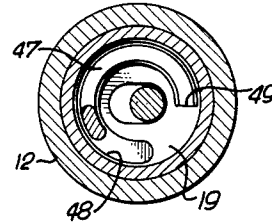


FIG. 7.

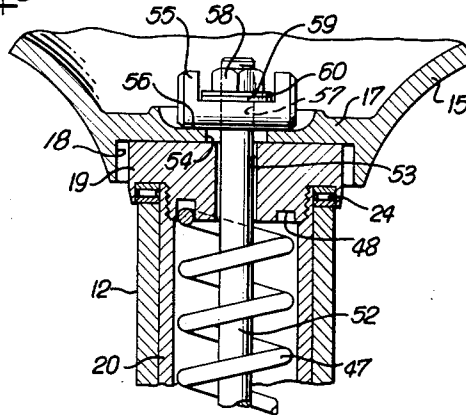


FIG. 8.

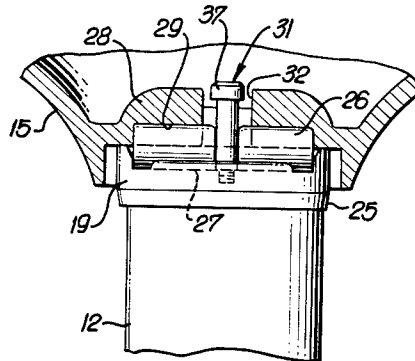
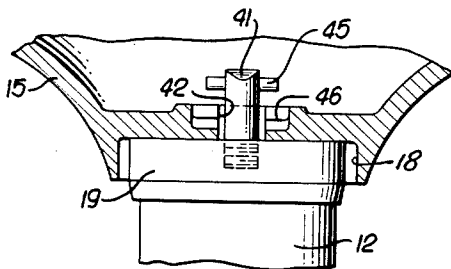


FIG. 6.



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1

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TILT SWIVEL MECHANISM FOR CHAIRS

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22 Claims. (Cl. 248—381)

This invention relates to a chair, particularly to a mechanism for allowing the chair to tilt.

Customarily, a heavy compression spring is interposed between hinged connected elements, and a hand wheel located beneath the seat for adjustment of spring tension.

The primary object of this invention is to provide an entirely new and improved tilt mechanism.

Another object of this invention is to provide a tilt mechanism that is neatly enclosed within a column pedestal and thus hidden from view.

Still another object of this invention is to provide a tilt mechanism of this character in which the spring adjusting handle is located at the bottom of the pedestal and concealed from view.

Still another object of this invention is to provide a tilt mechanism of this character in which a swivel mechanism may be incorporated, and all without detracting from the neat external appearance of the device and without affecting the access to the spring adjusting handle.

Still another object of this invention is to provide a combination tilt and swivel mechanism that is simple in construction, and readily assembled.

Still another object of this invention is to provide a new simple swivel structure for a chair, or the like, utilizing a pair of mutually guided telescoping parts.

Still another object of this invention is to provide a tilt mechanism for a chair in which the force of the return spring is only moderately increased as the chair is tilted, thereby promoting maximum comfort for the user.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of one embodiment of the invention. For this purpose, there is shown a form in the drawings accompanying and forming a part of the present specification, and which drawings, unless as otherwise indicated, are true scale. This form will now be described in detail, illustrating the general principles of the invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of this invention is best defined by the appended claims.

Referring to the drawings:

FIGURE 1 is a side elevational view of a chair incorporating the present invention;

FIG. 2 is an enlarged axial sectional view of the tilt mechanism, a portion of the chair and a portion of the pedestal being broken away;

FIG. 3 is a fragmentary end elevational view of the mechanism shown in FIG. 2;

FIG. 4 is a fragmentary sectional view taken along a plane corresponding to line 4—4 of FIG. 2;

FIG. 5 is a view similar to FIG. 2 but illustrating elements in alternate positions;

FIG. 6 is a fragmentary sectional view taken along the offset plane indicated by line 6—6 of FIG. 2;

FIG. 7 is a sectional view taken along the plane corresponding to line 7—7 of FIG. 2;

FIG. 8 is a fragmentary sectional view taken along the offset plane indicated by line 8—8 of FIG. 2; and

FIG. 9 is a sectional view taken on a plane corresponding to line 9—9 of FIG. 5.

In FIG. 1 there is illustrated a chair that includes the seat structure 10 and a pedestal structure 11. The seat

2

10 may be of any type or style. The pedestal 11 includes an open ended supporting post or standard 12 having a series of feet 13 radiating from its lower portion. The pedestal 11 also includes a surbase assembly 14 mounted by the post 12.

The surbase 14 includes a seat attaching member or flange 15 located beyond the upper end of the post or standard 12. The flange 15 is annular in contour, diverging outwardly and upwardly to a circular rim portion that contacts the undersurface of a part of the seat 10. Suitable fastening means such as screws 16 pass through the rim in order to attach the seat to the surbase flange 15.

The flange has a base wall 17 that is located above the bottom of the flange 15, thereby defining a downwardly opening recess 18.

The base wall 17 rests upon a thrust member 19 accommodated in the recess. The wall 17 and the thrust member 19 have flat surfaces that are normally in mutual contact.

The thrust member 19 is, in turn, mounted upon the upper end of the post 12. A sleeve 20 assists in the mounting of the thrust member 19.

The sleeve 20 is threadedly attached to a reduced extension 21 of the thrust member 19 and is guidingly and telescopically received within the post 12. The sleeve 20, when restrained from axial movement, confines the thrust member to angular movement about the common axis of the sleeve 20 and post 12. The thrust member 19 has a downwardly facing annular shoulder 22 that opposes the upper end surface 23 of the post or standard 12. Interposed between these surfaces is a bearing assembly 24 whereby the thrust member, the surbase flange 15 and seat 10 are capable of swivel movement without undue frictional restraint.

A thin flange 25 formed integrally with the thrust member 19 forms a recess in which the bearing is enclosed and concealed. The walls or skirt forming the recess 18 in the bottom of the flange 15 in turn largely conceal the thrust member 19 and the top of the post 12.

The flange 15 is capable of tilting about a horizontal axis relative to the thrust member 19. In order to provide a suitable pivotal connection, cylindrical bearing pins 26 (FIGS. 2, 5 and 8) are provided. The bearing pins 26 fit in and are seated at opposite ends of a substantially semicylindrical recess 27 formed in the top flat surface of the thrust member 19. The common axis of the bearing pins 26 and of the recess 27 is horizontal and spaced from the axis of swivel movement. Thus the axes of swivel movement and tilting movement are askew.

The upper surfaces of the bearing pins 26 are received in a companion substantially semicylindrical recess 29 formed in the undersurface of the wall 17. The recesses 27 and 29 together extend less than 360°. More particularly, the ends of the recesses are angularly spaced (FIG. 2) when the flange 15 is in its normal horizontal position determined by engagement of the wall 17 with the thrust member 19. Due to the angular separation, the flange 15 can move angularly about the horizontal axis of the pins and to the position shown in FIG. 5.

In order to prevent separation of the flange 15 and the thrust member 19 and in order to confine them for tilting movement, a locking screw 31 is provided. This screw passes through a generally arcuate slot 32 formed in an embossment 28. The embossment 28 is located on the upper surface of the wall 17 and extends about the recess 29. The slot 32 centrally intersects the semicylindrical recess 29.

The screw 31 has a cylindrical shank portion 33 that passes between the inner ends of the bearing pins 26. The screw 31 has a reduced threaded extension 35 that

3

engages a threaded recess 36 formed in the bottom of the semicylindrical recess 27 of the thrust member 19. The arcuate extent of the slot 32 about the axis of the recess 27 is such as to allow the desirable degree of tilting movement without interference. The side walls of the arcuate slot 32 have a running fit with the cylindrical shank 33 and prevent relative movement of the parts parallel to the axis of the recess 27.

In order to hold the wall recess 29 in contact with the bearing pins 26 and the bearing pins in contact with the recess 27 of the thrust member 19, the screw has a head 37. The head overlies upwardly facing shoulders 38 formed at an enlarged outer opening of the arcuate slot. The head has at least running clearance with the shoulders 38.

In the extreme tilted position, the thrust member 19 is substantially concealed by the skirt or peripheral walls forming the recess 18.

In order to limit the angular tilting movement of the surbase parts 19 and 15, an abutment member 41 (see FIGS. 2, 5 and 6) is provided. The abutment member 41 projects upwardly from the thrust member 19 at a place opposite the bearing pin 26. The abutment member 41 projects through an access aperture 42 that extends through the wall 17. The abutment member 41 may be formed as a cylindrical stud threadedly attached as at an aperture 44 in the upper surface of the thrust member 19. The upper end of the abutment member 41 carries a cross pin 45 the ends of which project beyond the edges of the access aperture 42, thus limiting angular movement of the flange 15. The upper edges of the aperture 42 are provided on opposite sides with semicylindrical recesses as at 46 adapted to seat against the cross pin, thus distributing the force applied thereto.

In order to return the flange 15 and the seat 10 to a normal horizontal position as shown in FIG. 2, a compression spring 47 is provided. The ends of the spring are not circularly formed, but instead are helically formed for purposes presently to appear. The spring 47 is accommodated within the sleeve 20 and the post or standard 12. The upper end of the coil spring 47 as shown particularly in FIGS. 7 and 9 is seated in a contoured recess 48 formed on the undersurface of the reduced extension 21 of the thrust member 19. The recess 48 has a shape such as to provide a stop shoulder 49 (FIG. 9) opposed to the terminus of the coil spring 47.

The other lower end of the spring 47 engages a follower nut 50. The nut 50 is generally of cylindrical configuration. Its upper surface is provided with a recess 51 contoured to fit the lower end of the spring 47 and to provide a stop shoulder opposed to the terminus of the spring.

The follower nut 50 constitutes an extension of the flange 15 such that a downward force exerted upon the nut 50 is transferred to the flange 15 tending to return the flange to the normal position of FIG. 2. A rod 52 joins the nut 50 to the flange 15. The rod 52 extends generally along the axis of the post 12 and sleeve 20, and through the spring 47. The lower end of the rod 52 is threaded for purposes of mounting the follower nut 50. The upper end of the rod passes through the central aperture 53 in the thrust member and through an access or clearance aperture 54 in the central wall 17. A large cross pin 55 serves pivotally to connect the rod 52 and the flange 15 to allow for the tilting movement.

The cross pin 55, as shown in FIG. 4 and in FIG. 7, is seated in a semicylindrical recess 56 of the wall 17 that is centrally intersected by the access aperture 54. The axis of the recess 56 is parallel to the axis of the bearing recess 29. The rod 52 passes with running clearance through a transverse aperture 57 in the cross pin. A nut 58 staked upon the upper threaded end of the rod 52 is opposed to a flat 59 milled in the cross pin 55. A bearing structure 60 is interposed between the flat 59 and the nut 58 to allow the rod 52 to rotate with minimum

4

friction about its own axis for purposes hereinafter to be described. The downward thrust of the spring 47 is transmitted to the flange 15 through the follower nut 50, rod 52, nut 58 and cross pin 55.

As the flange 15 moves angularly about the bearing pins 26, the rod 52 is cranked upwardly and slightly laterally, as indicated in FIG. 5. Suitable enlargement of the apertures 53 and 54 allows for the lateral movement of the rod 52.

By rotating the rod 52 about its own axis, with suitable restraint upon the follower nut 50, the nut 50 is raised or lowered, and the degree of compression of the spring 47 is altered, thereby changing the return force on the flange 15. In order to rotate the rod, and thus cause it to act as a lead screw, a handle assembly 63 is provided. The handle assembly includes a collar 64 threadedly mounted on the end of the post and coupled thereto by a set screw 65. A handle bar 66 is fitted in an arcuate peripheral recess 67 at the outer end of the collar 64, and is pivotally mounted for outward turning thereof by pivot pins as at 67. A ball detent (not shown) may normally hold the handle bar in the arcuate recess 67. When the handle bar 66 is rotated outwardly the rod 52 can readily be rotated. Upon rotation of the rod or lead screw 52 in one direction, the follower nut 50 tends to move so that its end shoulder firmly engages the end of the spring 47. The spring torsionally resists such movement and accordingly the rod 52 rotates while the follower nut 50 is restrained by the spring 47. The spring 47 in turn is restrained from angular movement by virtue of engagement of its other end with the end shoulder 49. The thrust member 19 on which the end shoulder 49 is formed is in turn restrained by holding the seat against movement. This direction of movement of the lead screw 52 causes the follower nut 50 to compress the spring and preferably is clockwise movement of the handle 63 as viewed from below in order to correspond to the conventional understanding that tightening is accomplished by clockwise movement. The threads of nut 50 and rod 52 in this instance will be left-handed.

Upon rotation of the rod 52 in the opposite direction, the sloping upper surface of the lead nut 50 tends to cam the coil spring upwardly and in a direction of increasing spring force. Naturally this is opposed; hence for this direction of rotation the cam action ensures against rotation of the follower nut 50 and accordingly it moves downwardly along the threaded end of the rod 52.

The tension is thus adjusted by relative movement between the seat and thrust member 19, on the one hand, and the handle or collar 64 on the other. Instead of restraining the seat and rotating the collar 64, the collar 64 can be restrained and the seat and thrust member 19 rotated. For this purpose the collar 64 has a slot 68 (FIG. 3) that is capable of alignment with the slot 69 formed in the bottom of the post 12 and adjoining portion of one of the legs 13. By inserting a locking device such as a key or other flat metal object (not shown) into the slots 68 and 69, the collar will be restrained. Thereupon, angular motion can be imparted to the thrust member 19 and the spring 47 merely by rotating the seat. When the desired adjustment is accomplished, the object inserted in the slots 68 and 69 is removed.

When the flange 15 tilts, the collar 64 is carried upwardly with the rod 52. Suitable clearance is provided between the collar and the lower end of the sleeve 20.

As the flange 15 tilts, the lower end of the rod 52 is maintained generally at the center of the sleeve 20 by virtue of a substantially fitted relationship between the cylindrical periphery of the follower nut 50 and the sleeve.

A set screw 70 passing through the post or standard 12 engages in an annular groove 71 of the sleeve 20 to prevent its normal separation from the post or standard 12 should the seat be lifted for transport of the chair.

The length of the spring 47 changes only slightly during

5

tilting movement of the flange 15. This means that the restoring force is substantially uniform for any tilted position. This materially adds to the comfort of the user.

The inventor claims:

1. In a tilt mechanism for a chair: a chair mounting having two parts, one part having provisions for attachment to a seat structure; means hingedly connecting the parts for relative angular movement about an axis; a substantially vertical support for the other of the parts and orienting said axis in a substantially horizontal plane; said other part bearing upon said support and being confined against lateral movement with respect to said support; a coil spring beneath the parts and located substantially vertically in the support; and means connecting the spring to the respective parts; said means being connected to said parts at places to locate the axis of said spring askew to the axis of hinged movement of said parts; said spring exerting a torque urging the parts towards a mutually limited normal position from which the parts are capable of relative tilting.

2. In a tilt mechanism for a chair: a chair mounting having two parts, one part having provisions for attachment to a seat structure; means hingedly connecting the parts for relative angular movement about an axis; a substantially vertical support for the other of the parts; means mounting the said other of said parts on said support for angular movement about a vertical axis, said mounting means being connected to said other of said parts at a place to space said vertical axis from the axis of said hingedly connected parts to determine an askew relationship between said axes; said mounting means orienting said axis of said hingedly connected parts substantially in a horizontal plane; means confining said other part against lateral movement with respect to said support; a coil spring beneath the parts and located substantially vertically in the support; and means connecting the spring to the respective parts for urging the parts towards a mutually limited normal position from which the parts are capable of relative tilting.

3. In a tilt mechanism for a chair: a hollow post adapted to extend vertically; a thrust member bearing upon the post adjacent the top of the post; means confining the thrust member against movement laterally of the post; a coil spring beneath the thrust member and located along the post; the upper end of said spring bearing against said thrust member; a seat attaching flange supported on the thrust member; means hingedly mounting the flange on the thrust member for movement about a substantially horizontal axis askew to the axis of the coil spring; said flange and said thrust member having a mutually limited normal position from which the flange is tiltable; and a rod extending through the thrust member and pivotally attached adjacent one end to said flange at a place spaced from said horizontal axis, said rod moving upwardly upon angular movement of said attaching flange away from said mutually limited normal position and adjacent the other end of the lower end of said spring, said rod shifting laterally upon angular movement of said flange.

4. In a tilt mechanism for a chair: a hollow post adapted to extend vertically; a thrust member mounted adjacent the top of the post for angular movement about a vertical axis; means confining the thrust member against movement laterally of the post; a coil spring beneath the thrust member and located along the post; the upper end of said spring bearing against said thrust member; a seat attaching flange supported on the thrust member; means hingedly mounting the flange on the thrust member for movement about a substantially horizontal axis askew to the axis of the coil spring; said flange and said thrust member having a mutually limited normal position from which the flange is tiltable; and a rod extending through the thrust member and pivotally attached adjacent one end to said flange at a place spaced from

6

said horizontal axis, said rod moving upwardly upon angular movement of said attaching flange away from said mutually limited normal position and adjacent the other end to the lower end of said spring, said rod shifting laterally upon angular movement of said flange.

5. In a tilt mechanism for a chair: a hollow open ended post; foot means for vertically supporting the hollow post so that its lower end is accessible by inverting the post; a thrust member having a hollow sleeve depending therefrom and telescopically and guidingly received by the post for angular movement about the vertical axis of the post; thrust bearing means between the thrust member and the post; a seat attaching member tiltably mounted on the thrust member for movement about a horizontal axis askew to said vertical axis; a coil spring located in the hollow sleeve and having an upper end bearing against the thrust member; a rod extending within the coil spring and having an upper end pivotally attached to said seat attaching member at a place spaced from said horizontal axis and so as to be capable of angular movement about its own axis; the lower end of said rod being threaded to form a lead screw; a nut threadedly mounted on the said lower end of said rod and engaged by the lower end of said coil spring; said nut having at least running clearance in said sleeve; and an operating member mounted on the lower end of said rod and accessible at the lower end of said sleeve and said post for causing rotation of the rod relative to the nut, thus raising and lowering the nut to alter the force exerted by said coil spring.

6. In a tilt mechanism for a chair: a hollow open ended post; foot means for vertically supporting the hollow post so that its lower end is accessible by inverting the post; a thrust member having a hollow sleeve depending therefrom and telescopically and guidingly received by the post for angular movement about the vertical axis of the post; a seat attaching member tiltably mounted on the thrust member for movement about a horizontal axis; a coil spring located in the hollow sleeve and having an upper end bearing against the thrust member; a rod extending within the coil spring and having an upper end attached to said seat attaching member at a place spaced from said horizontal axis and so as to be capable of angular movement about its own axis; the lower end of said rod being threaded to form a lead screw; a nut threadedly mounted on the said lower end of said rod and engaged by the lower end of said coil spring; and an operating member mounted on the lower end of said rod and accessible at the lower end of said sleeve and said post for causing rotation of the rod relative to the nut, thus raising and lowering the nut to alter the force exerted by said coil spring; said coil spring having helically arranged ends; the lower surface of the thrust member and the upper surface of said nut each being formed to fit the respective helical ends of the coil spring whereby torsional resistance of said coil spring restrains the nut against rotation in one direction and the cam action between said surfaces and the helical ends restrains the nut against rotation in the other direction.

7. In a tilt mechanism for a chair: a hollow open ended post; foot means for vertically supporting the hollow post so that its lower end is accessible by inverting the post; a thrust member having a hollow sleeve depending therefrom and telescopically and guidingly received by the post for angular movement about the vertical axis of the post; a seat attaching member tiltably mounted on the thrust member for movement about a horizontal axis; a coil spring located in the hollow sleeve and having an upper end bearing against the thrust member; a rod extending within the coil spring and having an upper end attached to said seat attaching member at a place spaced from said horizontal axis and so as to be capable of angular movement about its own axis; the lower end of said rod being threaded to form a lead

screw; a nut threadedly mounted on the said lower end of said rod and engaged by the lower end of said coil spring; and an operating member mounted on the lower end of said rod and accessible at the lower end of said sleeve and said post for causing rotation of the rod relative to the nut, thus raising and lowering the nut to alter the force exerted by said coil spring; said coil spring having helically arranged ends; the lower surface of the thrust member and the upper surface of said nut each being formed to fit the respective helical ends of the coil spring whereby torsional resistance of said coil spring restrains the nut against rotation in one direction and the cam action between said surfaces and the helical ends restrains the nut against rotation in the other direction; the said nut having a cylindrical peripheral contour to fit within said sleeve to hold the coil spring centrally thereof.

8. In a tilt mechanism for a chair: a hollow open ended post; foot means for vertically supporting the hollow post so that its lower end is accessible by inverting the post; a thrust member having a hollow sleeve depending therefrom and telescopically and guidingly received by the post for angular movement about the vertical axis of the post; a seat attaching member tiltably mounted on the thrust member for movement about a horizontal axis; a coil spring located in the hollow sleeve and having an upper end bearing against the thrust member; a rod extending within the coil spring and having an upper end attached to said seat attaching member at a place spaced from said horizontal axis and so as to be capable of angular movement about its own axis; the lower end of said rod being threaded to form a lead screw; a nut threadedly mounted on the said lower end of said rod and engaged by the lower end of said coil spring; and an operating member mounted on the lower end of said rod and accessible at the lower end of said sleeve and said post for causing rotation of the rod relative to the nut, thus raising and lowering the nut to alter the force exerted by said coil spring; said thrust member having a part opposed to the upper end of said post; a thrust bearing interposed between the thrust member and the said upper post end for sustaining the weight of the seat.

9. In a tilt mechanism for a chair: a hollow open ended post; foot means for vertically supporting the hollow post so that its lower end is accessible by inverting the post; a thrust member having a hollow sleeve depending therefrom and telescopically and guidingly received by the post for angular movement about the vertical axis of the post; a seat attaching member tiltably mounted on the thrust member for movement about a horizontal axis; a coil spring located in the hollow sleeve and having an upper end bearing against the thrust member; a rod extending within the coil spring and having an upper end attached to said seat attaching member at a place spaced from said horizontal axis and so as to be capable of angular movement about its own axis; the lower end of said rod being threaded to form a lead screw; a nut threadedly mounted on the said lower end of said rod and engaged by the lower end of said coil spring; and an operating member mounted on the lower end of said rod and accessible at the lower end of said sleeve and said post for causing rotation of the rod relative to the nut, thus raising and lowering the nut to alter the force exerted by said coil spring; said thrust member having a part opposed to the upper end of said post; a thrust bearing interposed between the thrust member and the said upper post end for sustaining the weight of the seat; said seat attaching member having a skirt forming a recess in which the thrust member is located, said skirt substantially concealing the said thrust bearing and the upper end of said post.

10. In a tilt mechanism for a chair: a hollow open ended post; foot means for vertically supporting the hollow post so that its lower end is accessible by inverting

the post; a thrust member having a hollow sleeve depending therefrom and telescopically and guidingly received by the post for angular movement about the vertical axis of the post; thrust bearing means between the thrust member and the post; a seat attaching member tiltably mounted on the thrust member for movement about a horizontal axis askew to said vertical axis; a coil spring located in the hollow sleeve and having an upper end bearing against the thrust member; a rod extending within the coil spring and having an upper end pivotally attached to said seat attaching member at a place spaced from said horizontal axis and so as to be capable of angular movement about its own axis; the lower end of said rod being threaded to form a lead screw; a nut threadedly mounted on the said lower end of said rod and engaged by the lower end of said coil spring; said nut having at least running clearance in said sleeve; and an operating handle recessed within the post and mounted on the lower end of said rod and accessible at the lower end of said sleeve and said post for rotating the rod thus raising and lowering the nut to alter the force exerted by said coil spring.

11. In a tilt mechanism for a chair: a seat attaching member; a thrust member; means connecting said members together for tilting movement about an axis; said members having a mutually limited angular position from which the seat attaching member is tiltable; means supporting the thrust member so that the axis of tilting movement is substantially horizontal; a compression coil spring located beneath and bearing against the thrust member at a place spaced from said axis of tilting movement; a rod extending in the coil spring and pivotally connected at its upper end to said seat attaching member for relative movement about a horizontal axis spaced from and parallel to the axis of tilting movement of said seat attaching member as well as for angular movement about a longitudinal axis of the rod; a nut threadedly mounted on the lower end of said rod and engaged by the lower end of said spring; means restricting movement of the nut laterally of the rod and locating the axis of the spring askew to the said axis of tilting movement; said spring exerting a torque urging the members toward their said normal position; abutment means operative to limit the tilting movement of said members; and a handle attached to the lower end of said rod for moving the nut along the rod.

12. In a tilt mechanism for a chair: a seat attaching member; a thrust member; means tiltably connecting said members together; said members having a mutually limited angular position from which the seat attaching member is tiltable; means supporting the thrust member so that the axis of tilting movement is substantially horizontal; a compression coil spring located beneath and bearing against the thrust member with its axis substantially vertical and askew to the axis of tilting movement; a rod extending in the coil spring and pivotally connected at its upper end to said seat attaching member for relative movement about a horizontal axis spaced from the horizontal axis of tilting movement of said seat attaching member as well as for angular movement about a longitudinal axis of the rod; a nut threadedly mounted on the lower end of said rod and engaged by the lower end of said spring for urging the members toward their said normal position; abutment means operative to limit the tilting movement of said members; and a handle attached to the lower end of said rod for moving the nut along the rod; the upper end of said rod projecting through the bottom of a recess formed in the upper surface of a wall of said seat attaching member, and through an aperture in a cross pin seated in the recess and angularly movable therein, said rod having a part bearing against the edges at the aperture of the cross pin, there being bearing means between the said part and said cross pin to reduce restraint against angular movement of the rod about its own axis.

9

13. In a tilt mechanism for a chair: a seat attaching member; a thrust member; means tiltably connecting said members together; said members having a mutually limited angular position from which the seat attaching member is tiltable; means supporting the thrust member so that the axis of tilting movement is substantially horizontal; a compression coil spring located beneath and bearing against the thrust member with its axis substantially vertical and askew to the axis of tilting movement; a rod extending in the coil spring and pivotally connected at its upper end to said seat attaching member for relative movement about a horizontal axis spaced from the horizontal axis of tilting movement of said seat attaching member as well as for angular movement about a longitudinal axis of the rod; a nut threadedly mounted on the lower end of said rod and engaged by the lower end of said spring for urging the members toward their said normal position; abutment means operative to limit the tilting movement of said members; and a handle attached to the lower end of said rod for moving the nut along the rod; said seat attaching members and said thrust member each having opposed substantially semicylindrical recesses, there being cylindrical elements seated in the recesses, thereby forming the means for tiltably connecting the said members.

14. In a tilt mechanism for a chair: a seat attaching member; a thrust member; means tiltably connecting said members together; said members having a mutually limited angular position from which the seat attaching member is tiltable; means supporting the thrust member so that the axis of tilting movement is substantially horizontal; a compression coil spring located beneath and bearing against the thrust member with its axis substantially vertical and askew to the axis of tilting movement; a rod extending in the coil spring and pivotally connected at its upper end to said seat attaching member for relative movement about a horizontal axis spaced from the horizontal axis of tilting movement of said seat attaching member as well as for angular movement about a longitudinal axis of the rod; a nut threadedly mounted on the lower end of said rod and engaged by the lower end of said spring for urging the members toward their said normal position; abutment means operative to limit the tilting movement of said members; and a handle attached to the lower end of said rod for moving the nut along the rod; said seat attaching members and said thrust member each having opposed substantially semicylindrical recesses, there being cylindrical elements seated in the recesses thereby forming the means for tiltably connecting the said members; a screw passing transversely between the cylindrical elements and attached to said thrust member, there being an arcuate recess intersecting the semicylindrical recess of said seat attaching recess and guidingly receiving the shank of said screw to prevent relative lateral movement of said members; said screw also having a head for preventing separation of said members.

15. In a tilt mechanism for a chair: a seat attaching member; a thrust member; means tiltably connecting said members together; said members having a mutually limited angular position from which the seat attaching member is tiltable; means supporting the thrust member so that the axis of tilting movement is substantially horizontal; a compression coil spring located beneath and bearing against the thrust member with its axis substantially vertical and askew to the axis of tilting movement; a rod extending in the coil spring and pivotally connected at its upper end to said seat attaching member for relative movement about a horizontal axis spaced from the horizontal axis of tilting movement of said seat attaching member as well as for angular movement about a longitudinal axis of the rod; a nut threadedly mounted on the lower end of said rod and engaged by the lower end of said spring for urging the members toward their said normal position; abutment means operative to limit

10

the tilting movement of said members; and a handle attached to the lower end of said rod for moving the nut along the rod; said seat attaching members and said thrust member each having opposed substantially semicylindrical recesses, there being cylindrical elements seated in the recesses thereby forming the means for tiltably connecting the said members; a screw passing transversely between the cylindrical elements and attached to said thrust member, there being an arcuate recess intersecting the semicylindrical recess of said seat attaching recess and guidingly receiving the shank of said screw to prevent relative lateral movement of said members; said screw also having a head for preventing separation of said members and in which the upper end of said rod projects through the bottom of a recess formed in the upper surface of a wall of said member, and through an aperture in a cross pin seated in the recess and angularly movable therein, said rod having a part bearing against the edges at the aperture of the cross pin, there being bearing means between the said part and said cross pin to reduce restraint against angular movement of the rod about its own axis.

16. In a tilt mechanism for a chair: a seat attaching member; a thrust member; means tiltably connecting said members together; said members having a mutually limited angular position from which the seat attaching member is tiltable; means supporting the thrust member so that the axis of tilting movement is substantially horizontal; a compression coil spring located beneath and bearing against the thrust member with its axis substantially vertical and askew to the axis of tilting movement; a rod extending in the coil spring and pivotally connected at its upper end to said seat attaching member for relative movement about a horizontal axis spaced from the horizontal axis of tilting movement of said seat attaching member as well as for angular movement about a longitudinal axis of the rod; a nut threadedly mounted on the lower end of said rod and engaged by the lower end of said spring for urging the members toward their said normal position; abutment means operative to limit the tilting movement of said members; and a handle attached to the lower end of said rod for moving the nut along the rod; said supporting means comprising a hollow post in which said spring is enclosed and in the lower end of which said handle is located.

17. The combination as set forth in claim 16 in which said thrust member is supported by said post for angular movement about the axis of the post.

18. In a tilt mechanism for a chair: a hollow vertical post; a thrust member supported on the post for swivel movement about the axis of the post; seat attaching means; means carried by the thrust member at a place spaced laterally of said post axis for mounting the seat attaching means on the thrust member for movement about a horizontal axis askew to the post axis; a coil spring extending in the post and having an upper end bearing against the thrust member; a connecting member extending within the post and having an end attached to said seat attaching means at a place spaced from said horizontal axis and supported for angular movement about the said horizontal axis with respect to said attaching means; an element threadedly engaging the connecting member and engaged by the lower end of said spring; and means causing rotation of said element upon relative angular movement between the thrust member and said connecting member.

19. In a tilt mechanism for a chair: a hollow vertical post; a thrust member supported on the post for swivel movement about the axis of the post; seat attaching means; means carried by the thrust member at a place spaced laterally of said post axis for mounting the seat attaching means on the thrust member for movement about a horizontal axis askew to the post axis; a coil spring extending in the post and having an upper end

11

bearing against the thrust member; a connecting member extending within the post and having an end attached to said seat attaching means at a place spaced from said horizontal axis and supported for angular movement about the said horizontal axis with respect to said attaching means; an element threadedly engaging the connecting member and engaged by the lower end of said spring; means causing rotation of said element upon relative angular movement between the thrust member and said connecting member; and selectively operable means for causing relative angular movement between said members upon angular movement of one of them for effecting axial movement of said element to adjust the force of said spring.

20. In a tilt mechanism for a chair: a hollow vertical post; a thrust member supported on the post for swivel movement about the axis of the post; seat attaching means; means carried by the thrust member at a place spaced laterally of said post axis for mounting the seat attaching means on the thrust member for movement about a horizontal axis askew to the post axis; a coil spring extending in the post and having an upper end bearing against the thrust member; a connecting member extending within the post and having an end attached to said seat attaching means at a place spaced from said horizontal axis and supported for angular movement about the said horizontal axis with respect to said attaching means; an element threadedly engaging the connecting member and engaged by the lower end of said spring; means causing rotation of said element upon relative angular movement between the thrust member and said connecting member; and selectively operable means for causing relative angular movement between said members upon angular movement of one of them for effecting axial movement of said element to adjust the force of said spring comprising a handle coupled to said connecting member and accessible at the lower end of said post.

21. In a tilt mechanism for a chair: a hollow vertical post; a thrust member supported on the post for swivel movement about the axis of the post; seat attaching means; means carried by the thrust member at a place spaced laterally of said post axis for mounting the seat

12

attaching means on the thrust member for movement about a horizontal axis askew to the post axis; a coil spring extending in the post and having an upper end bearing against the thrust member; a connecting member extending within the post and having an end attached to said seat attaching means at a place spaced from said horizontal axis and supported for angular movement about the said horizontal axis with respect to said attaching means; an element threadedly engaging the connecting member and engaged by the lower end of said spring; means causing rotation of said element upon relative angular movement between the thrust member and said connecting member; and selectively operable means for causing relative angular movement between said members upon angular movement of one of them for effecting axial movement of said element to adjust the force of said spring comprising a part coupled to said connecting member and accessible at the lower end of said post, said part and post having companion surfaces capable of releasably receiving a locking device between them.

22. In a tilt mechanism for a chair: a chair mounting having two parts, one part having provisions for attachment to a seat structure; said one part having a downwardly extending skirt substantially encompassing said other part; means located within the skirt tiltably attaching said one part to the other of said parts; a substantially vertical support for the other of said parts and extending downwardly beneath the skirt; and a spring located in the support and connected to the respective parts for urging the parts toward a mutually limited normal position from which the parts are capable of relative tilting.

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