Nov. 30, 1965 W. P. BAERMANN 3,220,689

RESILIENTLY-BIASED TILT MECHANISMS

Filed March 9, 1964 2 Sheets-Sheet 1

Fig. 1

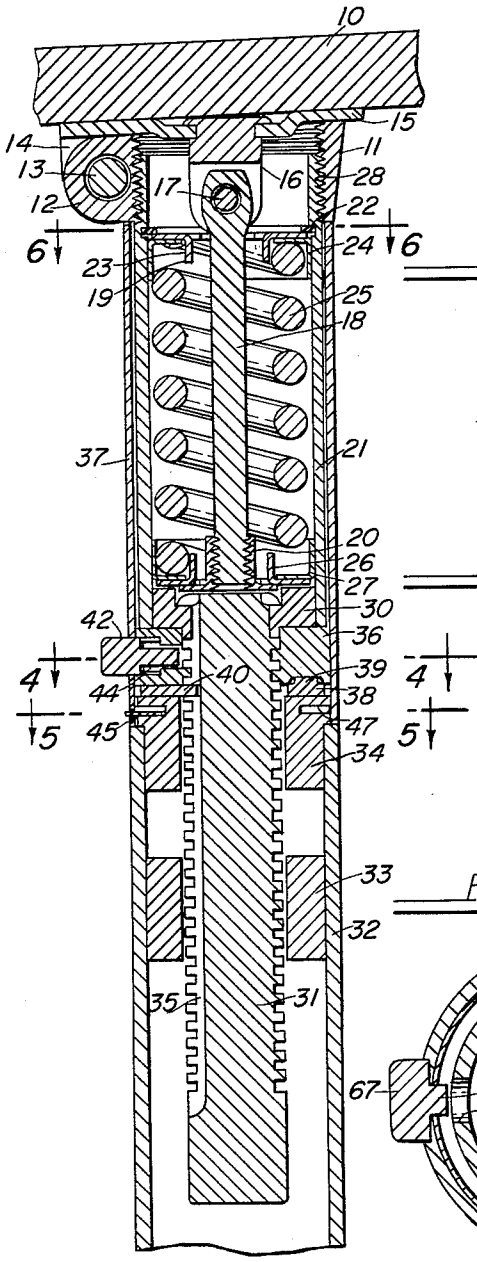


Fig. 4

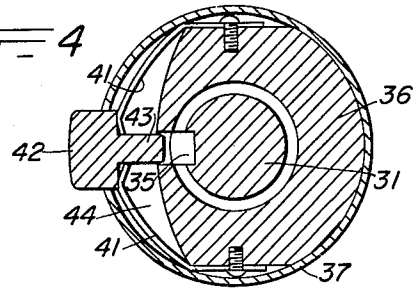


Fig. 5

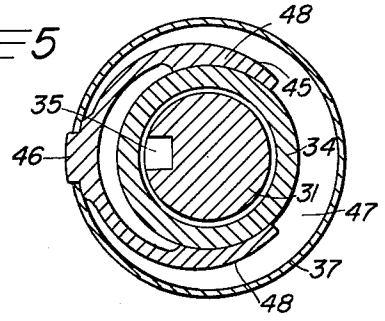


Fig. 6

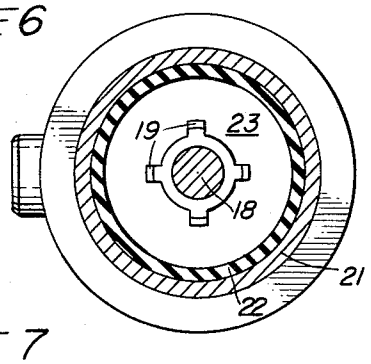
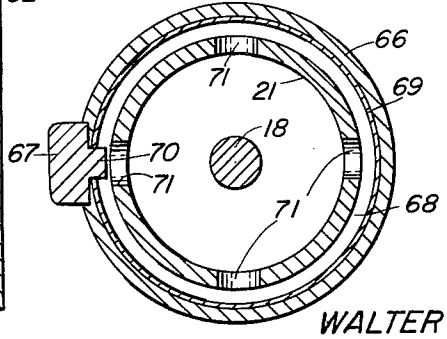


Fig. 7



INVENTOR.
WALTER P. BAERMANN
BY Marshall, Johnston, Root & Root
Attys.

Nov. 30, 1965 W. P. BAERMANN 3,220,689

RESILIENTLY-BIASED TILT MECHANISMS

Filed March 9, 1964 2 Sheets-Sheet 2

FIG. 2

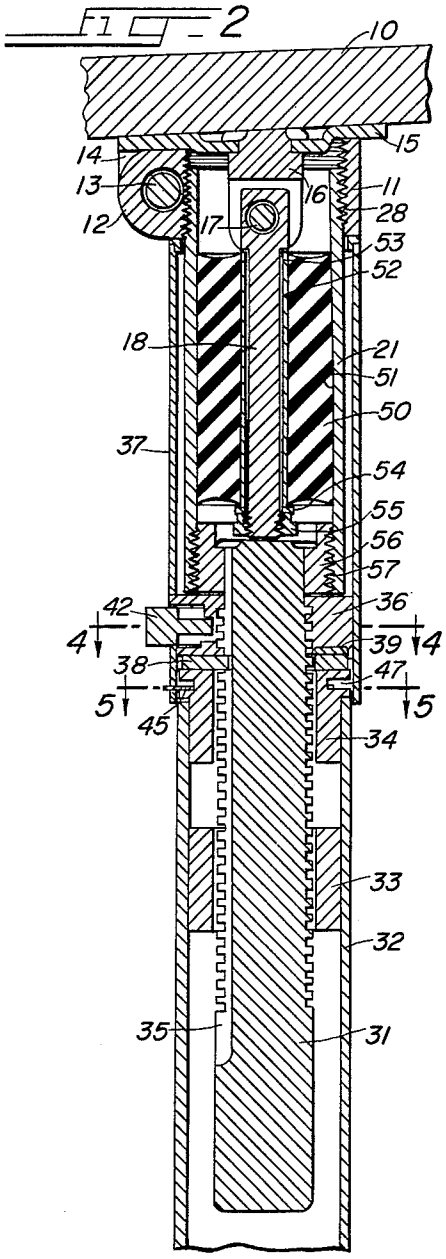


FIG. 3

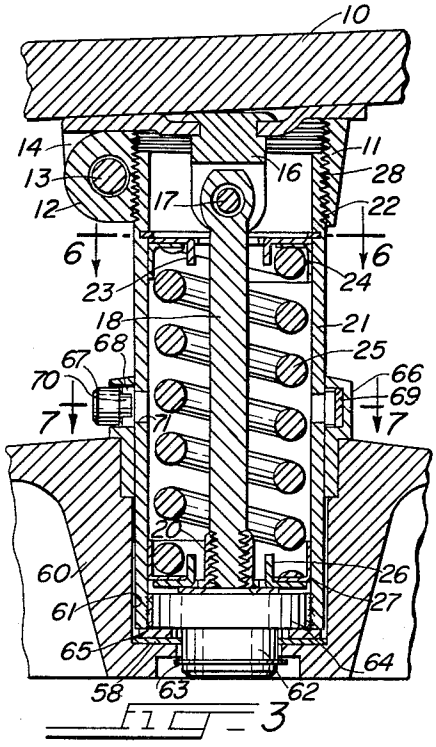
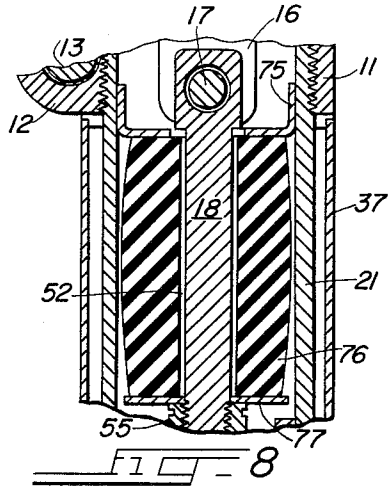


FIG. 8



INVENTOR.
WALTER P. BAERMANN
BY Maxwell, Johnston, Cook & Root
Attys.

United States Patent Office 3,220,689 Patented Nov. 30, 1965

3,220,689

RESILIENTLY-BIASED TILT MECHANISMS

Walter P. Baermann, 600 Asheville Road, Waynesville, N.C.

Filed Mar. 9, 1964, Ser. No. 350,460
10 Claims. (Cl. 248—384)

This application is a continuation-in-part of my copending application Serial No. 303,643, filed August 21, 1963, the disclosure of which is incorporated herein by reference.

This invention, in general, pertains to resiliently-biased tilt mechanisms, and, more particularly, pertains to resiliently biased tilt mechanisms embodying a swivel function and particularly adapted for use in tilt-swivel articles of furniture such as tilt-swivel chairs and the like.

There are many known types of tilt-swivel mechanisms for tilt-swivel chairs. Most of these mechanisms are relatively bulky, and the component parts are arranged so as to be relatively unattractive. Furthermore, the mechanism for adjusting the tension of the resilient bias, e.g., a spring bias, is so bulky as to constitute a serious problem to the furniture designer in creating an aesthetically-pleasing chair or the like.

This invention pertains to improvements in tilt mechanisms wherein the resilient bias for the tilt mechanism is housed in the center post which supports the chair. The invention further pertains to improvements in mechanism for quickly and conveniently altering the bias of the resilient bias mechanism, such as a coil spring, a rubber sleeve, or the like, to adjust the degree of resistance to tilting to the user's desires. One aspect of the invention pertains to tilt-swivel mechanisms embodying a mechanism for raising or lowering the height of the chair seat or other structure supported by the tilt-swivel mechanism wherein the height adjustment is accomplished by a threaded post which remains hidden from view in a sleeve appropriately provided on the tilt-swivel mechanism. Furthermore, in the latter case, the invention also provides a combination wherein the sleeve is turned to provide the height adjustment as well as means for quickly detaching the sleeve, height adjustment mechanism, and resilient bias mechanism from the base of the chair for the purpose of disassembly of these mechanisms from the chair base for repair or other purposes. Still another aspect of the invention relates to tilt-swivel mechanisms which are essentially entirely housed in a vertical post constituting part of the support post for the chair seat or other structure supported by the tilt-swivel mechanism.

Briefly, the tilt-swivel mechanisms of this invention comprise a top or tilt plate adapted to be tilted with respect to a head casting. The tilt plate supports a seat frame, mounting bracket or other structure to be tiltably and swivelly supported on the mechanism. The head casting is threadedly mounted on the top of the mounting tube of the mechanism, in which mounting tube is provided an actuator rod pivotally attached at its upper end to the top or tilt plate. The actuator rod is resiliently biased by appropriate structure so that its lower end is urged resiliently downwardly to resist in a resilient manner the tilting of the top or tilt plate and the structure supported thereon. The amount or degree of tension or bias of the bias mechanism acting against the tilting action is adjusted by threading the head casting onto or off of the mounting tube to raise or lower the lower end of the actuator rod and thereby change the degree of resilient bias of the resilient bias mechanism or structure.

In mechanisms of the invention utilizing a height adjustment for changing the height of the seat or other structure supported by the tilt-swivel mechanism, this adjustment is achieved by providing a height adjustment sleeve or tube in surrounding relationship to the mounting tube. This height adjustment sleeve or tube turns a ring nut threadedly and operatively connected to a threaded height adjustment post or shaft which fixedly supports the mounting tube and the structure housed therein whereby the mounting tube and its structure, including the head casting and the tilt or top plate, is raised or lowered when the threaded shaft or post is raised or lowered via rotation of the ring nut through the rotation of the height adjustment sleeve or tube. This structure eliminates the need for bulky, knobbed handles and the like which are commonly used for adjusting the degree of bias of the resilient bias for the tilt mechanism of the chair.

The invention, its purposes and objectives, and advantages accuring therefrom will be more fully appreciated from the following description of several preferred embodiments of the generic invention herein disclosed. These preferred embodiments are illustrated in the accompanying drawings, wherein:

FIG. 1 is a diametric section through a tilt-swivel support structure embodying a coil spring resilient bias and a height adjustment mechanism;

FIG. 2 is a diametric section through a tilt-swivel mechanism similar to FIG. 1 but embodying an elastomer bias sleeve;

FIG. 3 is a diametric section, in fragment, of a chair structure embodying another tilt-swivel mechanism;

FIG. 4 is a section taken on plane 4—4 of FIGS. 1 and 2;

FIG. 5 is a section taken on plane 5—5 of FIGS. 1 and 2;

FIG. 6 is a section taken on plane 6—6 of FIGS. 1 and 3;

FIG. 7 is a section taken on plane 7—7 of FIG. 3; and

FIG. 8 is a fragmentary, diametric section and showing another embodiment of an elastomer bias sleeve used to bias the tilting of the chair seat or the like.

Referring to the drawings, there is shown in FIG. 1 a chair seat part **10**, e.g., a seat frame, mounting bracket, etc. tiltably and pivotally supported on a tilt-swivel mechanism embodying a seat-height adjustment mechanism. These mechanisms comprise a hollow head casting **11** having an outwardly projecting ear **12**. The ear **12** supports a transverse shaft **13** on which is pivotally mounted a pair of tabs **14**, only one of which is shown in FIGS. 1–3, depending downwardly from the bottom of the top or tilt plate **15** on opposite sides of the ear **12**. The part **10** is fixedly attached by any suitable means to the top plate **15**.

A pivot yoke **16** is fixedly attached by welding, staking, etc., to the top plate **15**. The pivot yoke **16** supports a transverse pin **17** on which is pivotally mounted the upper end of an actuator rod **18** extending downwardly. The actuator rod **18** has threaded on its lower end a weld nut **20** which preferably is fixedly secured to the lower end of the rod **18** by a tight thread fit, staking, welding, etc.

The actuator rod **18** is housed in a hollow, cylindrical mounting tube **21** having near its upper end a circumferential groove in the internal wall, in which groove is snapped a snap ring **22**. The snap ring **22** serves as seat member for the hollow ring **23**, which serves as a seat for the upper end of coil spring **25**. If desired, the ring **23** may have downwardly depending ears **19**, which function as spring seat members. The seat portion of the ring **23** has provided therein a slip or anti-friction ring **24**, in which ring is seated the upper end of coil spring **25**.

Thus, when the seat or other structure **10** is tilted to

pivot about the shaft or pin 13, the actuator rod 18 rises in the mounting tube 21. The weld nut 20, ring 26 and slip ring 27 rise with the actuator rod and cause the coil spring 25 to compress. This compressive force resists the tilting movement of the seat or other structure 10. When the tilting movement is released, the coil spring 25 drives the actuator rod 18 downwardly, causing the seat part 10 and the top or tilt plate 15 to return to normal position in which the tilt plate rests against the top of the head casting 11 (the position shown in FIG. 1). The head casting 11 and the upper end of the hollow, mounting tube 21 are threadedly connected by threads 28. These threads play an important function in adjusting the amount or degree of resilient bias of the spring 25 in its resistance to the tilting action heretofore described. This aspect of the invention will be described in greater detail hereinafter.

The lower end of the mounting tube 21 is fixedly mounted on a collar 30 provided at the lower end of the mounting tube 21. The collar 30, in turn, is fixedly supported on the upper end of a threaded, height adjustment shaft or post 31, which extends into the hollow, tubular base 32 of the chair or other structure. The threaded shaft or post 31 is journalled slidably for up and down movement and supported in the spaced, ring bushings 33 and 34 fixedly supported in base 32 but is not threadedly connected therewith. The rod or shaft 31 has an elongated, vertical slot 35 in the side thereof.

The threads of the shaft or post 31 are threadedly connected with a height adjustment nut 36. The height adjustment nut 36 in turn is fixedly mounted in a tubular, hollow sleeve 37 which can be rotated relative to the mounting tube 21. By turning the height adjustment sleeve 37, the height adjustment nut 36 can be turned to thread the rod or post 31 up or down, as the case may be. The structure as illustrated in FIG. 1 shows the mechanism in the lowermost position. When the sleeve 37 and nut 36 are turned in the appropriate direction, the post 31 rises, raising with it the mounting tube 21 and all of the structure supported thereby. The upper end of the mounting tube 21 moves out of the upper end of the height adjustment sleeve 37. As the threaded rod or post 31 and structure supported thereon moves upwardly, the threaded post 31 remains hidden from view inasmuch as it is screened or hidden by the height adjustment sleeve 37.

The height adjustment nut 36 is rotatably supported on a bearing washer 38 made of an anti-friction material. When the seat or other structure 10 is swiveled, the unit comprising the threaded shaft 31, collar 30, mounting tube 21, structure housed therein, head casting 11, and top plate 15 swivel together as a unit, along with the height adjustment sleeve 37. This entire unit is swivelly supported on the bearing washer 38. In order to keep the nut 36 and the height adjustment sleeve 37 rotating with the unit during normal swivel movement of the chair seat or the like, the upper surface of the bearing washer 38 is provided with at least one radially extending, rib-like boss 39 which is adapted to matingly seat in radial groove in the undersurface of the nut 36. Furthermore, the bearing washer 38 has an ear 40 which extends into the vertical slot 35 in the threaded rod 31. Thus, with the usual weight on the chair seat or the like in the normal swiveling movement of the chair, the boss 39 remains seated in the groove so that the nut rotates as a unit with the bearing washer 38. The relative motion providing the swiveling function occurs at the faces of the bearing washer 38 and the upper surface of the collar 34, which is fixedly secured in the base 32 of the chair structure or the like. When, however, the height adjustment sleeve 37 is turned to change the relative height of the seat of the chair, the boss 39 may become unseated from the groove so that the nut 36 can turn relative to the rod 31, as well as the bearing washer 38, and perform the height adjustment function.

In order to vary the resilient bias or tension of the spring 25 against tilting action heretofore described, there is provided on one side of the nut 36 a groove or recess 44. This groove or recess 44 houses a spring metal band 41 of generally U-shaped configuration attached by screws or the like to the nut 36. The center portion of the spring metal band 41 has fixed thereto a push-button 42 having a radially-inwardly extending stud or pin 43 which can project into the vertical slot 35 of the shaft or rod 31 when aligned therewith. This bias adjustment is accomplished by depressing the push-button 42 while tightly gripping the height adjustment sleeve 37 and rotating the chair seat or other structure supported on the mechanism, to which the top plate 15 is attached. Within one revolution, the pin or stud 43 of the push-botton 42 falls into the slot 35 of the shaft 31, thus locking together the height adjustment sleeve 37 and the rod or shaft 31, as well as the mounting tube 21 fixedly attached to said shaft or rod. This prevents rotation of the mounting tube 21 by virtue of the tight grip of the hand on the height adjustment sleeve 37. Continued swivel or rotational movement of the chair or other structure 10 supported on the top plate 15 causes the head casting 11 to be rotated onto or off of, as the case may be, the threaded, upper end of the mounting tube 21. If the head casting is threaded off the upper end of the mounting tube 21, this raises the actuator rod 18 relative to the mounting tube 21. This action causes the spring 25 to be compressed to a greater degree, thereby increasing the resistance of spring 25 to the tilting action of the top plate 15 and the structure supported thereon. The spring 25 thus may be compressed or decompressed, as desired, to provide the desired degree of resistance to tilting of the top plate 15 and the structure supported thereon, i.e., the seat of the chair or the like. The spring 25 does not twist during this adjustment because the ends thereof can slide relative to rings 23 and/or 26 by virtue of the sliding function provided by anti-friction rings 24 and 27.

The entire tilt-swivel-height adjustment mechanism heretofore described is detachably held on the tubular base portion 32 by a quick detach mechanism. The latter structure comprises a generally U-shaped, spring lock clip 45 having a head portion 46 extending through a slot in the lower end of the height adjustment sleeve 37. The spring lock clip 45 is seated in an annular groove around the outer wall of the upper bushing 34, which is fixedly held in the tubular base portion 32. The lips 48 at the ends of the springable arms of the spring lock clip 45 matingly seat against the cylindrical side wall of the groove 47. With the head 46 projecting through the slot in the tubular, height adjustment sleeve 37 as shown in FIGS. 1 and 5, the tilt-swivel-height adjustment mechanism is held on the base portion 32. When the head portion 46 is pushed inwardly to unseat it from the groove in the sleeve 37, the arms of the spring lock clip 45 spread apart and allow the head portion 46 to be pushed inside the sleeve 37. This allows the tilt-swivel-height adjustment mechanism, including the threaded rod or post 31, to be lifted out of the tubular base portion 32. In the locking orientation as shown in FIGS. 1 and 5, the lips 48 slide on the wall of the groove 47 when the sleeve 37 rotates relative to the base 32 either during normal swiveling action or during the height adjustment function.

The mechanism illustrated in FIG. 2 is like in many respects to he mechanism heretofore described and illustrated with reference to FIG. 1. Where applicable, like numerals have been used to designate like parts. The essential difference between the mechanism of FIG. 2 and the mechanism of FIG. 1 is that the coil spring 25 in the mechanism of FIG. 1 is replaced by a cylindrical, elastomeric sleeve 50. The sleeve 50 is vulcanized or otherwise suitably securely bonded to the inner wall 51 of the mounting tube 21, and is vulcanized or otherwise suitably bonded to an elongated tube or sleeve 52 loosely fitted around the actuator rod 18. In the illustrated case,

the tube or sleeve **52** is mounted on the actuator rod **18** in surrounding relationship therewith between an annular shoulder **53** at the upper end of the actuator rod **18** and the washer **55** at the lower end of the actuator rod, which washer **55** is held on the actuator rod by means of the nut **56** threaded on the lower end thereof. Thus, when the member **10** and the top plate **15** are tilted about the tilt axis of the shaft **13**, the elastomeric sleeve **50** is stretched by virtue of the fact that the inner portion attached to the sleeve **52** moves upwardly while the outer portion attached to the inner wall **51** of the mounting tube **21** remains fixed. This stretching action provides the resilient bias in resisting tilting action and bias in returning the plate **15** and the member **10** to normal position, the position shown in FIG. 2, when the tilting force is released.

In the embodiment illustrated in FIG. 2, the collar **56** is fixedly attached to the upper end of the threaded post **31** and has external threads **57** used to secure the internally-threaded, lower end of the mounting tube **21** on the upper end of the shaft or rod **31**.

The adjustment of the axial position of head **11** relative to post **21** through threads **28** raises or lowers the sleeve **52** with rod **18** to provide greater or lesser stretch tension in the elastomer sleeve. Rod **18** rotates with head **11** and plate **15** during the bias adjustment, but loose-fitted sleeve **52** does not rotate.

The mechanism illustrated in FIG. 3 is an embodiment of the invention for use on chairs or like structures wherein a tilt-swivel function is desired, but the height adjustment feature is omitted. The resiliently-biased tilt mechanism is essentially the same as the tilt mechanism described and illustrated with relation to the embodiment of FIG. 1, and, where applicable, like figures have been used to designate like parts. The mounting post **21** is supported swivelly in the hub of the base member **60** in a stepped hole **61** provided in the base member. The swivel mechanism used in this embodiment comprises a swivel bearing stem **62** extending through the bottom of the base member **60**. The swivel bearing stem has mounted thereon a removable, snap ring **63** which holds the stem **62** in the base member. The base stem **63** has a hub **64** which is welded or otherwise fixedly secured to the lower end of the mounting tube **21** so that the swivel bearing and hub are rotatable with the mounting tube. The lower edge of the mounting tube **21** and the lower surface of the hub **64** rests against an anti-friction washer **65** supported at the base of the hole **61** in any suitable manner, i.e., by a washer **58** or the like.

At the upper end of the hole **61**, a tension lock bushing **66** is fixedly mounted in the hub of the base **60**. This tension lock bushing provides the function of locking the swivel mechanism from turning in the base **60** when it is desired to thread the head casting **11** onto or off of the upper end of the mounting post **21** for the purpose of changing the bias of the spring **25** to adjust the resistance to the swivel motion of the seat or other member **10**. This locking function is accomplished by pushing push-button **67** which is mounted in an appropriately provided hole communicating with an inner, annular groove **68** in the tension lock bushing **66**. The push button **67** is urged outwardly by its mounting on a circular, leaf-spring **69** mounted in the groove **68**. The button **67** is pushed inwardly and the seat is rotated to rotate the mounting tube to a position wherein the stud **70** on the button **67** enters one of the holes **71** provided in the side wall of the mounting tube **21**. This locks the mounting post **21** from swivel movement relative to the base **60** so that the turning of the chair seat or other structure supported on the mechanism heretofore described causes the head casting **11** to thread in or out, as the case may be, on the threads **28** at the upper end of the mounting post. This raises or lowers the actuator rod **18** to compress or decompress the spring **25** to adjust the bias thereof to the desired value.

The embodiment of FIG. 8 is similar in most respects to the embodiment of FIG. 2 and, where applicable, like numerals have been used to designate like parts. In the embodiment of FIG. 8, the mounting tube **21** has fixed to the inner wall thereof an upper seat ring **75**, which functions as a bearing surface for the upper end of a tubular, elastomeric sleeve **76**. The elastomeric sleeve **76** provides the resilient bias which acts against the actuator rod **18** to resist the pivoting of seat or other structure supported on the tilt-swivel mechanism. The elastomeric sleeve **76** is mounted on a tubular sleeve **52**, which in turn is mounted about the post or rod **18** and held thereon by virtue of the washer **77** and nut **55** threaded on the lower end of the rod **18**. This embodiment differs from the embodiment of FIG. 2 in that the elastomeric sleeve **76** is not fixedly attached to the inner wall of the mounting tube **21**, but rather is preferably spaced therefrom. When the actuator rod **18** moves upwardly as the mechanism tilts, the upper and lower ends of the sleeve **76** are squeezed together. If the elastomeric sleeve **76** is made of a porous, foam rubber, the sleeve **76** actually compresses and thereby provides the resilient biasing function. Suitable porous, foam materials are commercially available for this purpose. If, however, the sleeve **76** is made of an essentially solid and essentially incompressible elastomer, such as natural or synthetic rubbers, the sleeve **76** does not compress in volume but rather distorts and expands outwardly as the washer **77** is drawn upwardly by upward movement of the actuator rod **18**. In this case, the outer wall of the sleeve **76**, in its normal, downmost position, is spaced from the inner wall of the mounting tube **21** so that there is some room for the outward expansion of the sleeve **76** as the washer **77** is drawn upwardly toward the mounting ring **75**. In this manner, a resilient, biasing function is provided by the sleeve **76** when the actuator rod **18** is moved upwardly under the tilting action of the chair seat or other structural member attached to the mechanism. Similarly, sleeve **76** compresses or decompresses in the case of a compressible sleeve or expands or contracts in the case of an essentially incompressible sleeve when the post **18** is raised or lowered, respectively, by threading head **11** relative to post **21** during adjustment of the degree of bias of sleeve **76** against tilting of the plate **15** and member **10**.

It is thought that the invention and its numerous attendant advantages will be fully understood from the foregoing description, and it is obvious that numerous changes may be made in the form, construction and arrangement of the several parts without departing from the spirit or scope of the invention, or sacrificing any of its attendant advantages, the forms herein disclosed being preferred embodiments for the purpose of illustrating the invention.

The invention is hereby claimed as follows:

1. A resiliently biased tilt mechanism comprising a hollow mounting post, a hollow head mounted by threads on one end of said post, the axial positioning of said head relative to said post adapted to be varied by rotating said head relative to said post on said threads, a tiltable member pivotally supported on said head, resilient bias means in said mounting post and operatively connected to said tiltable member for biasing the tilting movement of said tiltable member, and means for varying the amount of bias of said bias means in response to rotation of said head relative to said post to provide a relative threading action of said threads.

2. A tilt mechanism as claimed in claim **1**, a base member, means supporting said mounting post for swivel movement relative to said base member, and means for locking said base member and said mounting post against relative swivel movement when rotating said head relative to said mounting post to activate said means for varying said amount of bias.

3. A tilt mechanism as claimed in claim **2**, a hollow

base member, a threaded post axially slidably supported in said base member, said threaded post being fixed to and supporting said mounting post, a threaded ring nut threadedly engaging the threads of said threaded post, means supporting said ring nut on said base member, and a hollow sleeve surrounding said mounting post and secured to said ring nut whereby rotation of said nut relative to said threaded post by manually rotating said hollow sleeve provides a height adjustment for said mechanism.

4. A tilt mechanism as claimed in claim 3, and releasable means for locking said sleeve and said mounting post against relative rotation when said head is rotated relative to said mounting post to adjust the bias of said bias means.

5. A tilt mechanism as claimed in claim 4 wherein said releasable means is a spring-biased button mounted in said sleeve, said threaded post has a longitudinal groove, and said button has a stud adapted to extend into said longitudinal groove when said button is depressed to lock said sleeve, said threaded post and said mounting post thereon against relative rotation.

6. A tilt mechanism as claimed in claim 5 wherein said means supporting said ring nut on said base member is a bearing washer between said ring nut and a support surface on said base member adapted to allow said threaded post, mounting post, ring nut, and hollow sleeve to swivel relative to said base member.

7. A tilt mechanism as claimed in claim 6, and means adapted to interlock said washer and said nut against relative rotation during normal swivel movement of said threaded post, mounting post, ring nut and hollow sleeve relative to said base member.

8. A support mechanism embodying a height adjustment mechanism and comprising a mounting post, a hollow base member, a threaded post axailly slidably supported in said base member, said threaded post being fixed to and supporting said mounting post, a threaded ring nut threadedly engaging the threads of said threaded post, means supporting said ring nut on said base member, and a hollow sleeve surrounding said mounting post and secured to said ring nut whereby rotation of said nut relative to said threaded post by manually rotating said hollow sleeve provides a height adjustment for said mechanism.

9. A support mechanism as claimed in claim 8 wherein said means supporting said ring nut on said base member is a bearing washer between said ring nut and a support surface on said base member adapted to allow said threaded post, mounting post, ring nut, and hollow sleeve to swivel relative to said base member.

10. A support mechanism as claimed in claim 9 and means adapted to interlock said washer and said nut against relative rotation during normal swivel movement of said threaded post, mounting post, ring nut and hollow sleeve relative to said base member.

References Cited by the Examiner

UNITED STATES PATENTS

434,743	8/1890	Trapp	248—406
607,283	7/1898	Schaffner	297—205
805,522	11/1905	Bethke	248—402
1,344,092	6/1920	Shaw	108—141
1,589,847	6/1926	Hansen	248—381
2,106,174	1/1938	Herold	248—375

CLAUDE A. LE ROY, *Primary Examiner.*