June 27, 1972 P. J. WILLIAMS 3,672,721

RUBBER SPRING ASSEMBLY FOR CHAIR CONTROL

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FIG. 2.

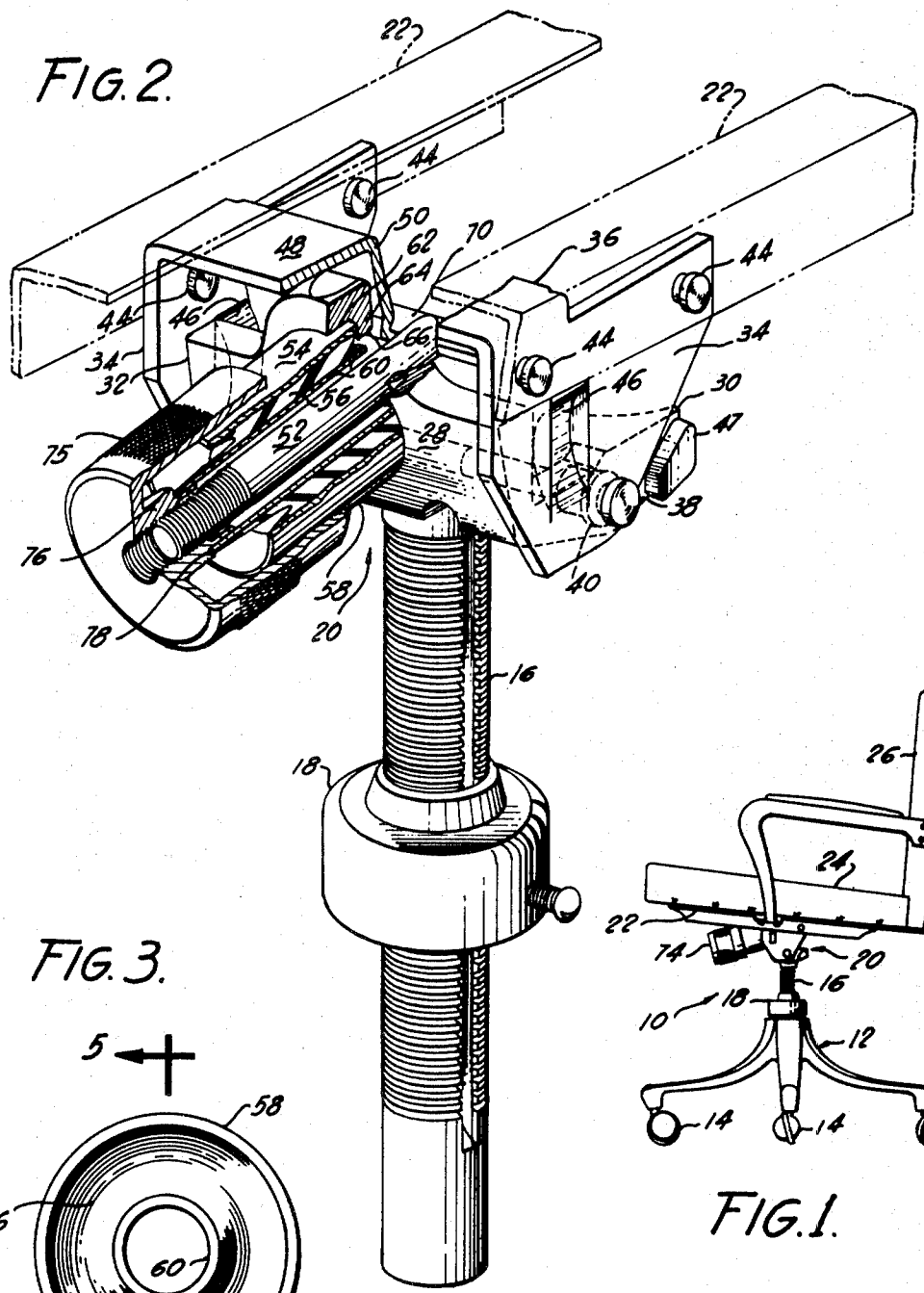


FIG. 3.

FIG. 1.

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RUBBER SPRING ASSEMBLY FOR CHAIR CONTROL

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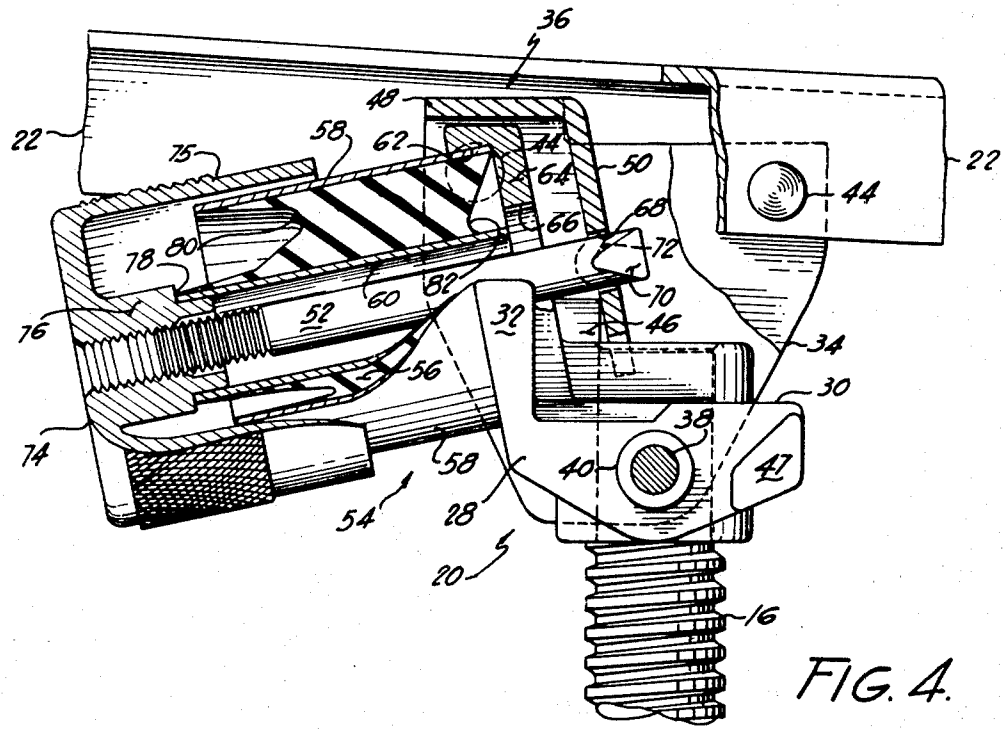


FIG. 4.

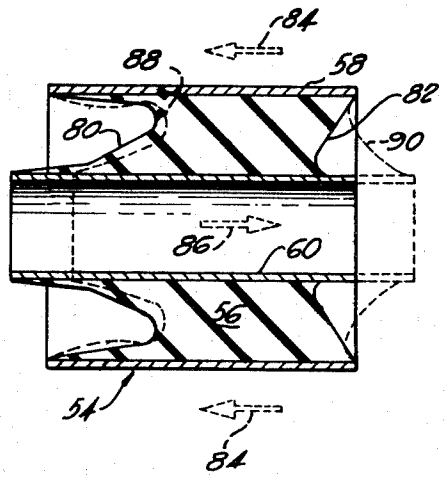


FIG. 5.

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RUBBER SPRING ASSEMBLY FOR CHAIR CONTROL

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FIG. 8.

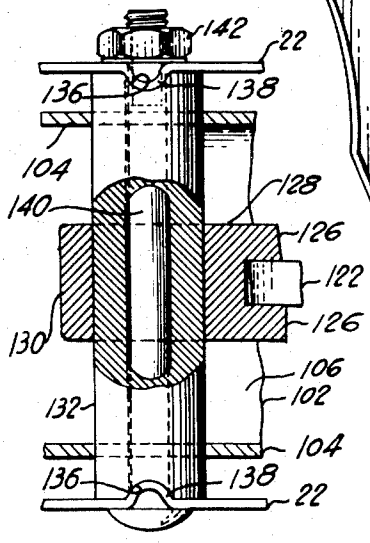
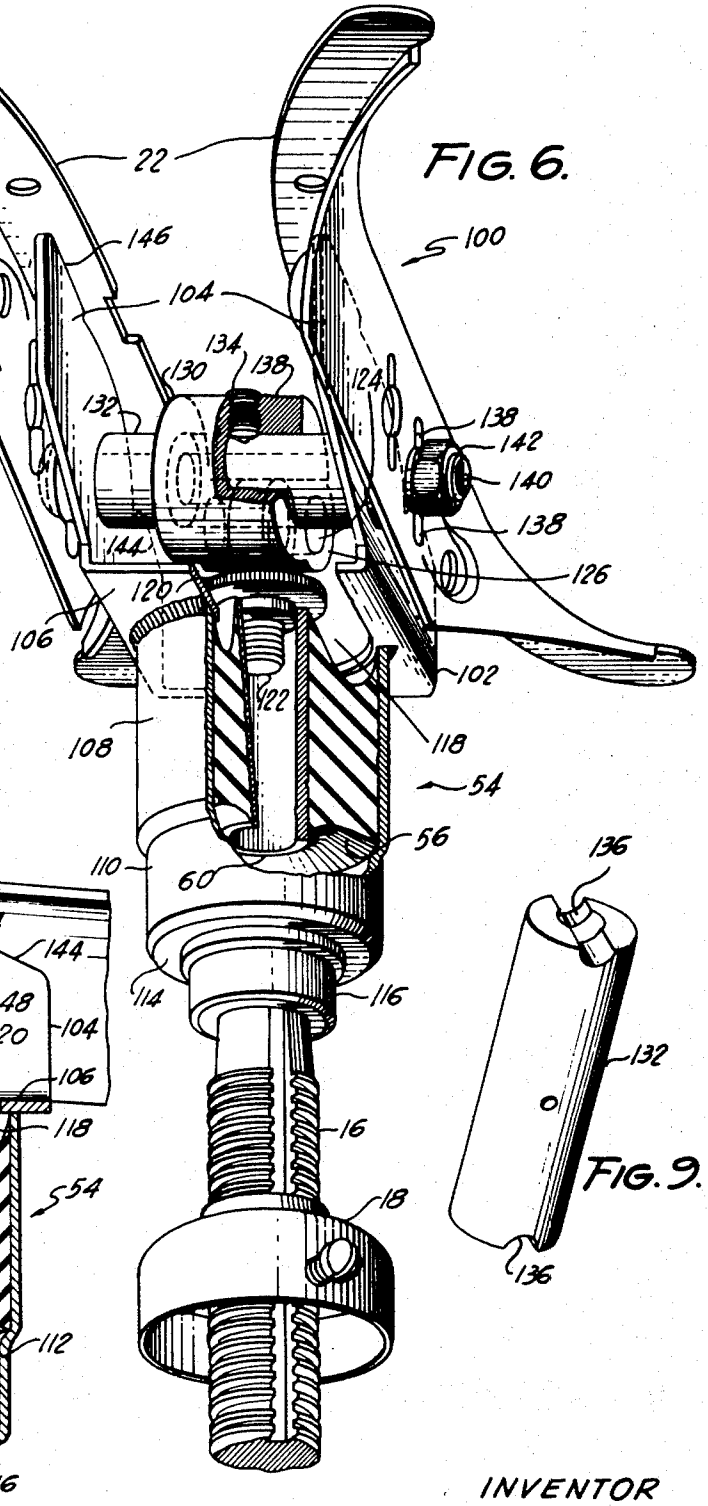


FIG. 6.



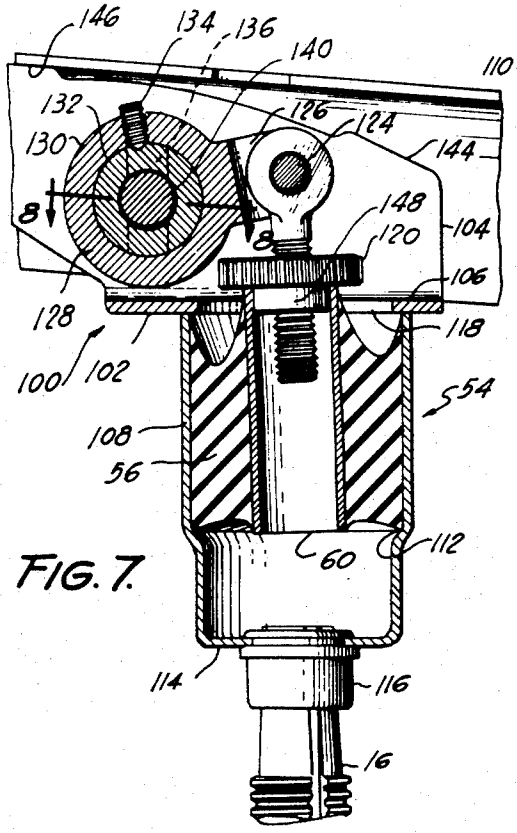


FIG. 7.

FIG. 9.

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RUBBER SPRING ASSEMBLY FOR CHAIR CONTROL

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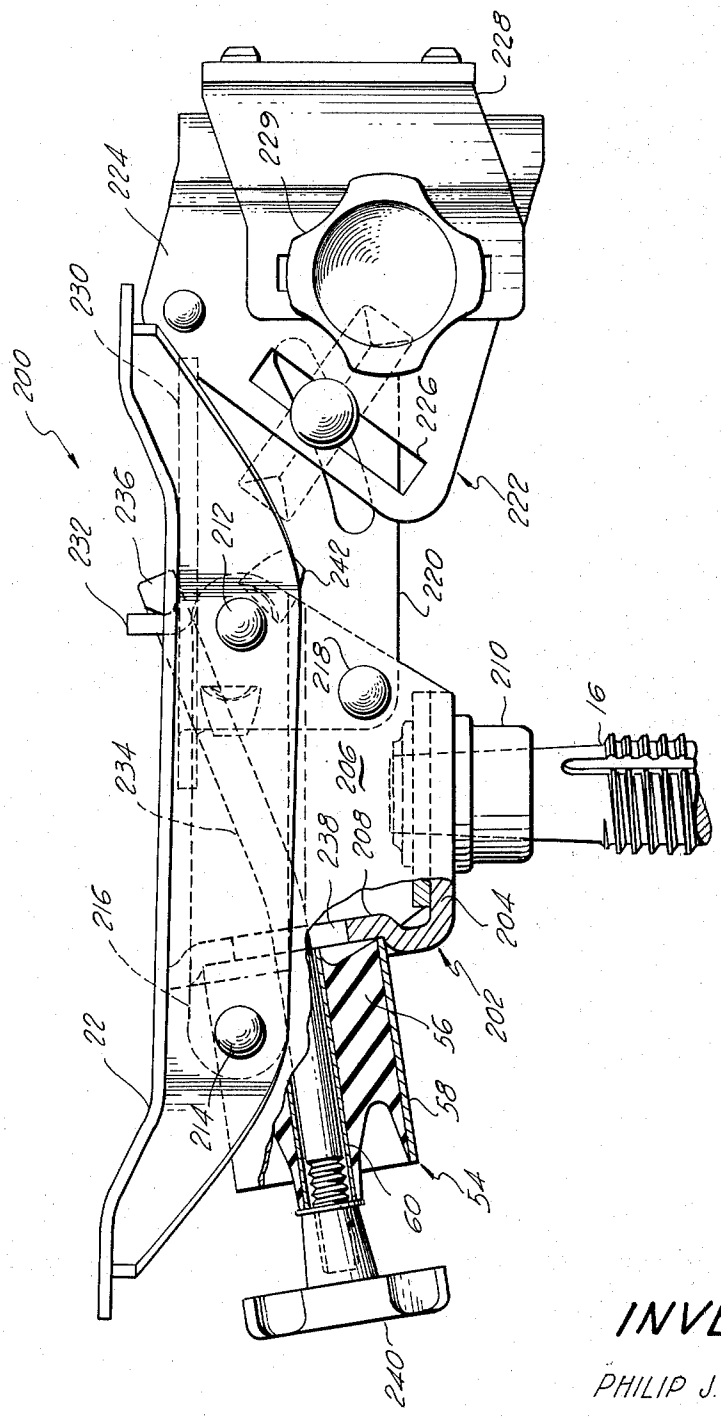


FIG. 10.

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United States Patent Office 3,672,721 Patented June 27, 1972

3,672,721

RUBBER SPRING ASSEMBLY FOR CHAIR CONTROL

Philip J. Williams, Bridgeport, Conn., assignor to Stewart-Warner Corporation, Chicago, Ill.

Continuation-in-part of application Ser. No. 862,145, Aug. 22, 1969, which is a continuation-in-part of application Ser. No. 776,673, Nov. 18, 1968. This application May 15, 1970, Ser. No. 37,754

Int. Cl. A47c 3/00

U.S. Cl. 297—302 1 Claim

ABSTRACT OF THE DISCLOSURE

The following specification describes a chair control utilizing an annular rubber spring bonded at its external surface to a shell held by the post horn and bonded at its internal surface to a tube, which is longitudinally displaced in response to rotational movement of the occupant support member. A chair control is also described in which forces created in response to pivoting movement of the chair occupant are applied in a direction corresponding to the post axis and are resisted by a spring arranged along that axis. A chair control is also disclosed for enabling movement of the chair back independently of the seat by use of an annular rubber spring placed under shear stress.

BACKGROUND OF THE INVENTION

Field of the invention

This application is a continuation-in-part of application Ser. No. 862,145, filed Aug. 22, 1969, which in turn is a continuation-in-part of application Ser. No. 776,673, filed Nov. 18, 1968 and the invention relates in general to rubber spring chair controls and more particularly to a chair control having a rubber spring placed under longitudinal shearing stress, and having improved stability and stress resistance.

Description of the prior art

Rubber springs for resisting rotational movement of a support member in a chair control have been in use for many years. Usually such springs are placed under compression or under torsional stress to resist the tilting on rotational movement of the support member. Placing the rubber under compression leads to aging and consequent hardening of the rubber so that its life is relatively short. On the other hand, placing the rubber under torsional stress requires a complicated, relatively expensive assembly in which the outer rubber surface is tightly gripped or fitted in a cylindrical type housing or the like for stressing the rubber on pivoting of the support member, since a direct bond between the rubber and metal is difficult to retain in this type of construction.

Further, in the conventional chair control pivoting movement, the chair occupant applies forces against a spring which is arranged to resist that force in a direction transverse to the post axis. This creates instability and requires relatively heavy or massive components together with elaborate fastening techniques and devices to ensure against distortion, fracture and instability in the chair.

SUMMARY OF THE INVENTION

The present invention solves the above problems through the use of an annular rubber member having its outer surface bonded or moulded to a cylindrical shell axially held by the post horn with the inner surface of the rubber bonded to a tube that shifts axially in response to pivoting action of the support member. The axial shifting action places the rubber under longitudinal shear, thereby contributing to extensive life, while the load is distributed across a large bonded surface permitting a simple economical construction.

To improve the chair construction further the rubber member or spring is arranged generally coaxially with the post axis and the pivoting movement of the chair is translated by a short lever arm to a direction corresponding to the post axis. Since the spring is held at one end by a relatively heavy post and the pivoting force is applied against the post, the interconnections between the various components is simplified and the parts reduced in size, while the application of forces through the post axis and centrally of the supporting pedestal contributes to chair stability.

The rubber spring adapted to be placed under shear for resisting leaning movements of a chair occupant is arranged for use in both a chair in which the back and seat move together and a chair in which the back moves independently of the seat.

It is, therefore, one object of the present invention to provide a chair control utilizing a rubber spring placed under longitudinal shear in response to pivoting action of the chair control support member.

It is still another object of the present invention to provide an economical chair control utilizing a rubber spring.

Other objects and features of the present invention will become apparent on examination of the following specification and claims, together with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of a typical chair utilizing a chair control incorporating the principles of the present invention;

FIG. 2 is an isometric view of a chair control utilizing the principles of the present invention;

FIG. 3 is a front elevational view of the rubber spring assembly;

FIG. 4 is a view of a portion of the chair control in partial section;

FIG. 5 is a sectional view taken generally along the line **5—5** in FIG. 3, and illustrates by broken lines the position of the rubber spring assembly in operated condition or under stress;

FIG. 6 is an isometric view of a chair control incorporating the principles of the present invention and arranged to develop a force along the post axis for resisting pivoting movement by the chair occupant;

FIG. 7 is a sectional view of the chair control shown in FIG. 6;

FIG. 8 is a sectional view taken generally along the line **8—8** in FIG. 7;

FIG. 9 is an isometric view of the tube utilized in the chair control shown in FIGS. 6 and 7; and

FIG. 10 is a side elevational view partially in section illustrating a chair control having a rubber spring placed under shear stress in response to movement of the back independently of the seat.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIG. 1 a chair is indicated by the reference character **10**. The chair comprises a pedestal **12** supported on casters **14**. A threaded post **16** projects vertically upward from the pedestal **12** and carries a hand wheel **18** for conventional adjustment of the height of a chair control **20**. The chair control **20** carries a pair of spaced L-shaped spider arms **22** attached to a seat **24** and supporting a back **26**.

The chair control **20** includes an L-shaped spider horn

28 having a bottom leg 30 for receiving the upper end of the post 16 on which the horn 28 is supported. Horn 28 has a front wall 32 extending upwardly between two side plates 34 of a U-shaped support member 36.

The support member 36 is pivotally mounted on the horn 28 by means of a pivot pin 38 and bushings 40. Pin 38 extends through the bottom leg 30 of the horn and the upper end of the post 16 adjacent the elongate axis of the post and perpendicular to the elongate axis. The support member 36 in turn carries the spider arms 22, which are each fastened to the horn by means of short pins or rivets 44 located adjacent the opposite front and rear ends and along the upper edge of the side plates. It will be understood that the pivot may be located in other positions and the post may be demountable or separable relative the spider horn so that the two may be shipped separately, for example.

An indentation 46 formed intermediate the ends of each side plate 34 is adapted to engage the back surface of the wall 32 to terminate rotation in the forward or counterclockwise direction as seen in the drawings. A projecting boss 47 adjacent the rear of the bottom leg 30 of the horn is adapted to engage respective rear edges of the side plates 34 to terminate rotation to the rear or clockwise direction, as seen in the drawings.

The spider arms 22 conventionally carry the seat 24 and both the seat and the back 26 pivot as a unit about the axis of pin 38 so that the chair is in the category commonly known as an office chair. It will be understood that the back alone can be mounted for pivoting movement, in which case the chair is commonly known as a secretarial type chair; or, if desired, the seat or back may be mounted for independent pivotal movement to provide a chair commonly known as an executive posture chair.

The U-shaped support member 36 has a back leg 48 located above the top edge of wall 32 for integrally interconnecting the two side plates 34. A depending wall 50 is formed at the rear edge of the leg 48 and it extends behind wall 32 for engagement with a rod 52 to control a rubber spring assembly 54. Support for the wall 50 to resist bending movements is provided by indentations 46.

The rubber spring assembly 54 comprises an annular rubber spring member 56 whose outer surface is moulded or bonded to the inner surface of an annular or cylindrical shell 58. The inner surface of the spring 56 is moulded or bonded to the outer surface of a tube 60.

One end of the shell 58 engages in a recess 62 formed in wall 32 and butts against an end wall 64 of the recess so that movement of the shell to the right as seen in FIGS. 2 and 4 is prevented. An aperture 66 is formed in the end wall 64 coaxial with the axis of the rubber spring 56, shell 58 and tube 60. The aperture 66 is large enough to permit tube 60 to move into the aperture and one end of the rod 52 passes through the aperture 66 and an aligned aperture 68 in wall 50. A cross head 70 is provided at the respective end of rod 52, and the cross head 70 has a pivot edge for engagement in a correspondingly shaped recess 72 located in the rear surface of wall 50. This arrangement permits some pivotal movement of the rod while preventing independent axial movement of the rod to the left as seen in FIG. 4. The other end of the rod 52 is threaded for adjustable engagement with a threaded hand wheel 74.

The hand wheel 74 is generally cup-shaped with its outer wall 75 being knurled for ease in turning and overlaps the end of shell 58. A boss 76 projects from the rear wall of the cup 74 and it is apertured to receive the end of rod 52 opposite head 70. Threads are formed on the corresponding end of rod 52 and in the boss aperture for threaded engagement to permit axial adjustment of the hand wheel on rod 52. A shoulder 78 is formed intermediate the ends of the boss 76 for engagement against one end of tube 60, which overlaps the reduced end of boss 76. The hand wheel 74 may of course be varied in many ways and instead of cup-shaped it may, for example, be T-shaped or of many other designs.

It will be noted that the rubber spring member 56 has an outer diameter of approximately 1¾ inches and its outer surface is moulded or bonded to the inner surface of shell 58 throughout their entire coincident length of 2 inches for shell 58. The inner diameter of the rubber spring is approximately ¾ inch and the inner surface of the spring defined by the diameter is moulded or bonded to the tube over the tube length of 2¼ inches with the tube 60 protruding at the left beyond the end of shell 58. It will be appreciated that variations in dimension and location may be introduced depending on the chair type and location of the assembly 54. The bonded surfaces of the tube and shell are appropriately treated, if necessary.

The rubber spring member is dished inwardly at opposite ends intermediate the tube and shell as indicated by lines 80 and 82 shown in FIGS. 4 and 5. The inward dishing at the end of the rubber spring adjacent the protruding end of tube 60 is about ¾ inch deep from the adjacent end of shell 58 and about ¼ inch deep at the opposite end.

In assembling the rubber spring assembly to the chair, the tube 60 is simply slipped over the threaded end of rod 52, while the outer shell 58 is placed in abutment with wall 64. The threaded hand wheel 74 is engaged with the threaded end of rod 52 and as the wheel 74 is threaded on the rod, the shoulder 78 engages with the tube 60 to apply an axial force on the tube 60. Since the tube 60 is bonded to the rubber spring 56, which is in turn bonded to the shell 58 and the shell is held by wall 64, this force tends to pull the rod 52 to the left and pivot the side plates 34, spider arms 22 and back 26 clockwise about the axis of pin 38. This force is used for adjusting the back and seat commonly called pretensioning the chair for holding the back in a generally upright position and it counteracts the weight of the seat and back, which acts through the center of mass at the right of the axis of pin 38. In substance, the threading of the hand wheel 74, therefore, pivots the back and seat counterclockwise until the indentation 46 engages wall 32 and prevents further movement of the support member 36 in the corresponding direction. The force holding the back in the upright position is stored in spring 56 by some movement of tube 60 to the right relative shell 58 as seen in FIGS. 4 and 5 to set up a longitudinal shear stress in the rubber.

An occupant sitting in the chair on leaning backwards exerts a force against the back 26 and rear of the seat 24 to pivot the side plates 34 clockwise about the axis of pin 38 as seen in FIG. 4. This force pulls the bolt head 70 and rod 52 to the right, thereby pulling the hand wheel 74 and tube 60 in the same direction. Since the outer shell 58 is held by the post and cannot move, a force additional to the pretensioning force is exerted on the rubber for resisting the tilting or pivoting action, as indicated by the arrows 84 and 86 in FIG. 5.

It will be noted that as the support member 36 pivots, the tube 60 and rubber spring 56 move, for example, to a position shown by the dotted lines 88 and 90 in FIG. 5 with the dished contour at one end becoming deeper relative the corresponding end of shell 58 as indicated by line 88 and the other contour becoming relatively straight as shown by line 90. A force of 180 pounds is required to deflect or move the tube 60 axially about ⅛ inch so that force of 800 to 1000 pounds, for example, exerted adjacent the pivot axis from the chair back deflects the tube 60 approximately 1 inch. The full deflection of tube 60 causes the dished ends 80 and 82 of the rubber spring 56 to assume the contour indicated generally at broken lines 88 and 90.

A longitudinal shearing stress is created in the rubber spring by the deflection force, but since the shearing stress is distributed over the large coplanar cylindrical bonded

areas of engagement between the rubber spring **56** and the shell **58** and between the spring **56** and tube **60**, the load per unit area is relatively low and the bond is easily retained. The longitudinal shearing stress also permits extremely long rubber life, while the dished or concave surfaces **80** and **82** at respective ends of the rubber spring **56** accommodate displacement of the rubber to axial movement of tube **60** and mitigates the effect of any slight compressive forces that may be exerted on the rubber between the tube and shell.

On relief of the backward pivoting force created by the occupant, the rubber spring member **56** restores to its original position, thereby drawing the tube **60**, hand wheel **74** and rod **52** to the left for pivoting the support member **36**, seat **24** and back **26** into their normal position.

DESCRIPTION OF ANOTHER PREFERRED EMBODIMENT

In FIGS. 6 and 7 a chair control employing the principles of the present invention is illustrated by the reference character **100**. Parts shown in FIGS. 6 and 7 generally similar to those shown in FIGS. 1–5 are indicated by corresponding reference numbers.

The chair control **100** includes a U-shaped horn or support body **102** having generally vertical side legs **104** spaced approximately 2″ apart and a horizontal back wall **106**. Fixed to and depending from the back wall **106** is a rubber spring assembly **54** including an annular outer shell or wall **108**, annular rubber spring **56** moulded to the inner periphery of shell **108** and an inner tube **60** moulded to the inner periphery of spring **56**.

Shell **108** is fixed at its upper end to the bottom surface of wall **106**, for example, by welding and is generally the same as wall **58** with the exception of an annular extension **110** at the lower end thereof of slightly smaller radius than wall **108** to form a small shoulder **112** for the lower edge of the outer periphery of rubber spring **56**. The extension **110** terminates in a radial wall **114** to which is staked an annular post support member **116** that receives the post **16**. The post **16** and member **116** may have corresponding Morse taper to provide a locking fit therebetween and are supported on a pedestal such as **12**.

The upper end of tube **60**, as seen in FIGS. 6 and 7, projects through an aperture **118** in wall **106** having a diameter somewhat smaller than wall **108** and is engaged by a knurled nut or hand wheel **120** which is pressed upwardly by the normal tension of the rubber spring **56** held between wall **108** and tube **60**. A stud **122** threaded through the nut **118** is therefore also pressed upwardly. The stud **122** has a ring at its upper end pivotally engaged with a pin **124**.

Pin **124** passes through bifurcations **126** of a yoke or crank arm **128** having an annular portion **130** encircling a support member or tube **132**. A set screw **134** extending through annular portion **130** secures the crank arm **128** to the tube **132** so that the crank arm **128** applies pressure to the stud **122** in response to rotation of the tube **132** with the stud being less than 1½ inches to the rear of the tube axis.

The tube **132** passes rotatably through openings in the vertical legs **104** of the horn **102** and is provided with recesses **136** at opposite ends. The tube terminates in abutment with spider arms **22** spaced about 3⅜ inches apart with the recesses **136** engaging respective bosses **138** formed on the vertical legs of the spider arms. Spider arms **22** in turn carry the seat and back. A bolt **140** having a head at one end passes through openings in both spider arms **22** intermediate the respective bosses **138** and through the tube **132**. A nut **142** fastened to the stud end opposite the head secures the spider arms **22** to the tube **132** so that movement of the spider arms is transmitted through the bosses **138** and respective recesses **136** to the tube **132** and through the set screw **134** to the crank arm **128** to move the stud **122** about the axis of stud **140**.

Thus, a chair occupant on leaning backwards or in a clockwise direction as seen in FIGS. 6 and 7 pivots the spider arms **22**, tube **132** and crank arm **128** about the axis of stud **140** to move the pin **124** downward together with the stud **122**, which in turn carries the nut **120** downward against the tube **60** to place the rubber in longitudinal shear as previously explained. Backward pivoting movement continues until the spider arms engage against the top rear surfaces **142** of the legs **104**, which serves as a stop for the spider arms **22**. In the backward pivoting movement, it will be noted that the pivoting force is translated into a vertical axis generally coincident with the post axis so that advantage is taken of the relatively heavy post in resisting the tilting force and the chair is stabilized against tilting of the pedestal.

When the backward tilting force is relieved, the rubber spring **56** resumes its normal position and forces the nut **120** and stud **122** upward to pivot the spider arms forwardly or counterclockwise, as seen in FIGS. 6 and 7, until the spiders engage the forward top surfaces **144** of the legs **104** to terminate further forward tilting.

It will be noted that the nut **120** is adjusted on stud **122** to properly pretension the chair by applying pressure against the tube **60** to bring the chair seat and back into the desired horizontal and vertical positions respectively. A boss **148** on the nut **120** maintains the nut and stud **122** properly centered relative the tube **60**.

In FIG. 10 a chair control in which the back moves independently of the seat, commonly called a steno type chair control, is indicated by the reference character **200**. Parts in the chair control basically similar to parts shown in the previous drawings will be identified by similar reference characters.

The chair control **200** comprises a generally U-shaped body support **202** having a back wall **204** and side legs **206** together with a front wall **208** between the side legs **206**. A post support member **210** is fixed to the back wall **204** for receiving a post **16**. A pair of spaced spider arms **22** are fixed to the side legs **206** by means of pin **212** and rivets **214** in lugs **216** at the front end of legs **206** for the purpose of supporting a chair seat.

A pivot pin **218** extending through side legs **206** carries a pair of spaced side arms **220** of a back support **222** for pivotal movement about the pin axis. A U-shaped adjustment bracket **224** is adjustably fixed to the rear end of side arms **220** by means of hand wheel **226** and associated slots and a backplate **228** is clamped to bracket **224** by means of clamp wheel **229** for the purpose of carrying a chair back at a desired height and angular position in a conventional manner.

A top wall **230** is provided between side arms **220** of the back support and an upstanding lug **232** is formed thereon intermediate the spaced arms **220**. A tension adjustment rod **234** passes freely through lug **232** and a cross head **236** at one end of the rod pivotally butts the lugs **232**. The rod **234** passes through a relatively large opening **238** in front wall **208** of body support **202** and then through tube **60** of a rubber spring assembly **54**.

The rubber spring assembly **54** shown in FIG. 10 is basically similar to the spring assembly shown in FIG. 5 and the end of rod **232** extending therethrough is threaded for receiving an adjustment wheel **240**.

Wheel **240** is threaded against tube **60** to engage the tube **60** and draw the rod **234** through the tube, since the annular outer shell **58** of spring **54** seats against the front wall **208**. This pivots the back support **222** about the axis of pivot pin **218** into a position for holding the back upright. A stop **242** engaging pin **212** limits the pivoting movement of the back support **222** and chair back into the upright position.

A chair occupant on leaning back causes the back support **222** including side arms **220** to pivot clockwise as seen in FIG. 10 about the axis of pin **218** and thereby pull rod **234** towards the right as seen in FIG. 10. This places the rubber spring assembly **54** under shear as the

tube **60** moves to the right under pressure of wheel **240** until stop **244** engages pin **212** to limit the movement. Thereafter, release of the backward leaning pressure enables the rubber spring **56** to return the back to normal as the rubber spring **56** causes tube **60** to force wheel **238** and rod **234** to the left as seen in FIG. 10 for pivoting the back upright about pin **218.**

The foregoing description pertains to a rubber spring assembly of novel design whose inventive concepts are believed set forth in the accompanying claim.

What is claimed is:

1. A spring assembly for use in a chair control having a support member pivotable by a chair occupant about an axis extending perpendicularly through the elongate axis of a post carrying said support member, the improvement comprising a rod, means coupling one end of said rod pivotally to said pivotable support member for enabling axial movement of said rod in response to pivotal movement of said support member, the other end of said rod being threaded, a tube having an outer diameter of ¾ inch encircling said rod, an annular rubber spring encircling said tube with the inner surface of said annular spring bonded to the external surface of said tube for a distance of substantially 2¼ inches, an annular shell encircling said rubber spring with the internal surface of said shell having a diameter of substantially 1¾ inches and bonded to the external surface of said rubber spring for a distance of substantially 2 inches whereby one end of said tube and rubber spring project beyond one end of said shell, means located adjacent the other end of said shell, rubber spring and tube for preventing movement of said shell axially of said rod in one direction relative said post while permitting axial movement of said rod, tube and rubber spring in said one direction, said rubber spring having an inward annular dish at each end with the dish at the end adjacent said one end and threaded rod end being at least ¾ inch deep and the dish at the other end of said spring being substantially ¼ inch deep, and means in threaded engagement with said opposite rod end to engage said projecting tube end for moving said tube in said one axial direction to thereby apply a shear stress of substantially 180 pounds to said rubber member for each ⅛ inch movement of said tube relative said shell in response to the pivoting movement of said support member to move said rod in said one axial direction with said inward dish at each spring end accommodating displacement of said rubber spring, and the ¾ inch inward dish adjacent said spring one end accommodating the volume of said rubber spring between said shell and tube resulting from the bonded length of said rubber spring to said tube exceeding the bonded length of said rubber spring to said shell.

References Cited

UNITED STATES PATENTS

2,756,807	7/1956	McKinley	297—305
3,034,828	5/1962	Kurihara	297—306
3,220,689	11/1965	Baermann	248—375 X
3,356,414	12/1967	Doerner	297—305 X

FOREIGN PATENTS

370,582	4/1939	Italy	248—375

FRANCIS K. ZUGEL, Primary Examiner

U.S. Cl. X.R.

248—375; 297—304, 306