March 27, 1962 F. LIE 3,027,191

CHAIR CONSTRUCTION

Filed April 11, 1960 2 Sheets-Sheet 1

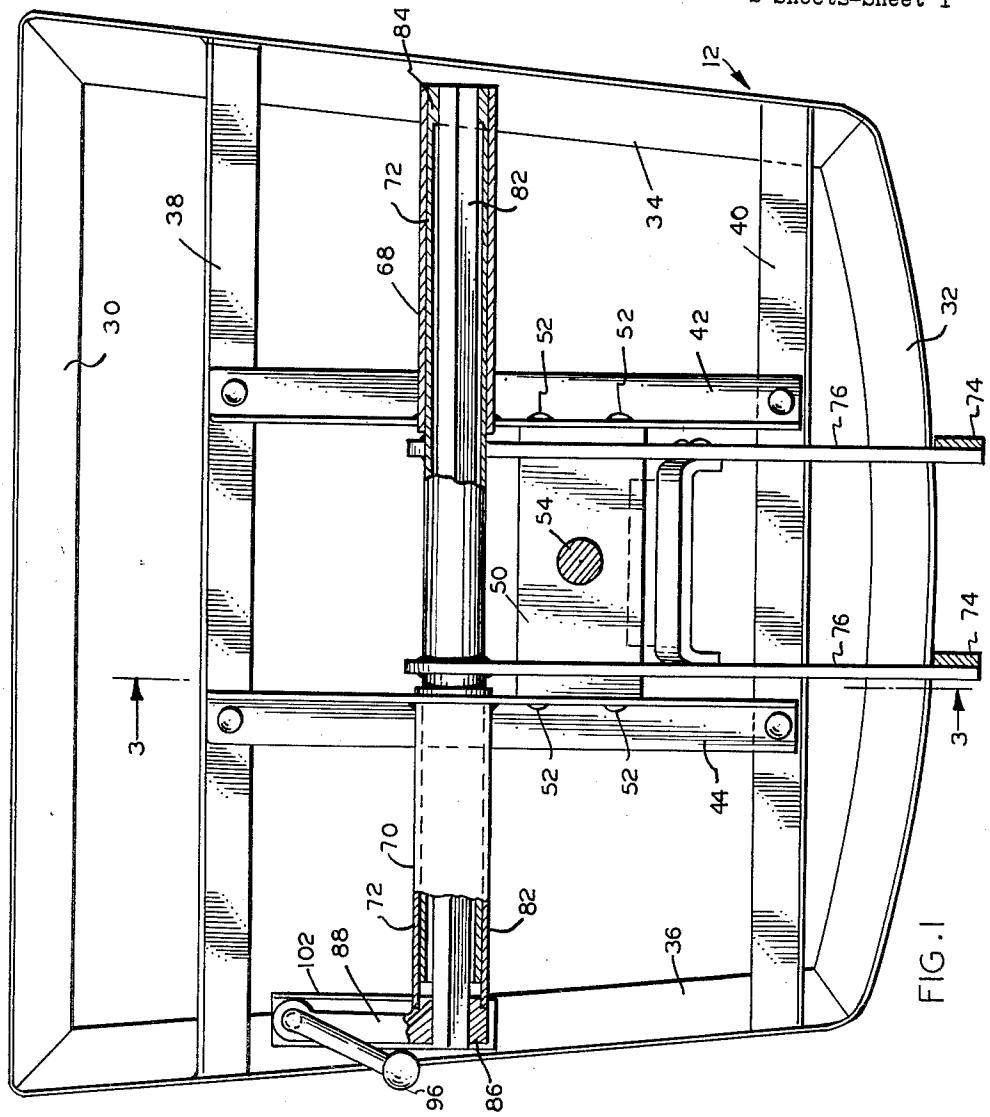

FIG. 1

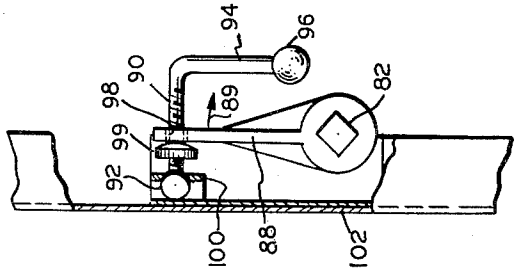

FIG. 2

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CHAIR CONSTRUCTION

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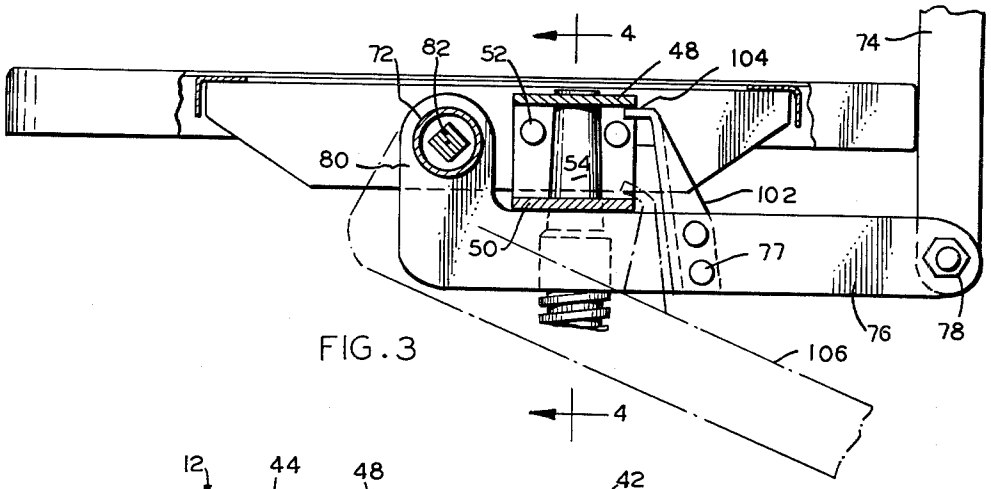

FIG. 3

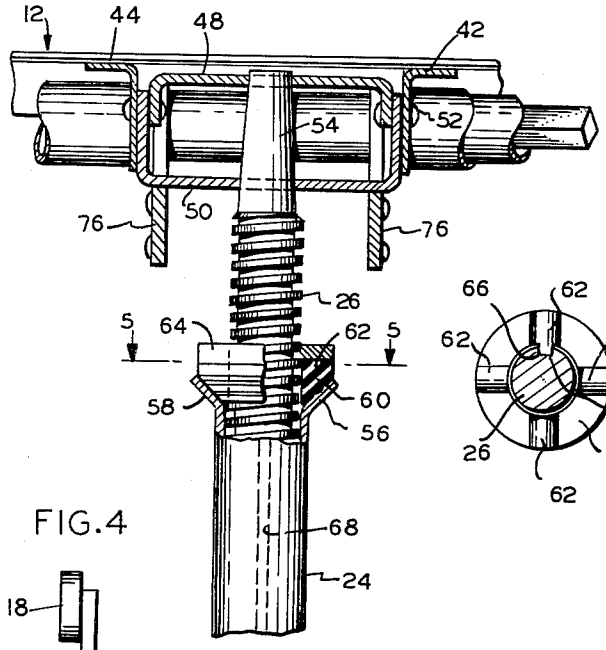

FIG. 4

FIG. 5

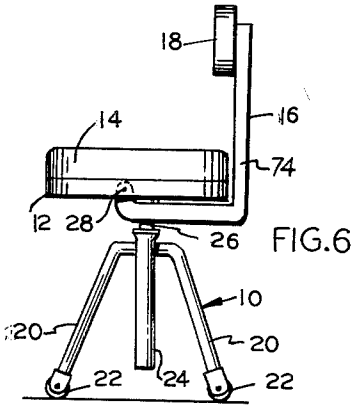

FIG. 6

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CHAIR CONSTRUCTION

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10 Claims. (Cl. 297—306)

This invention relates to a chair construction, and particularly to a chair construction having an improved means for swingably and cushionably mounting the chair back portion.

In many chair constructions, as for example office chair constructions of the secretarial type, there are provided pivot structures and spring mechanisms for allowing the chair back structure to have a front-to-rear swinging motion under resilient restraining control, the arrangement being such that the secretary or other user may lean back in the chair to rest or to reach for necessary materials without encountering a rigidity in the chair back structure such as would make these operations difficult to perform.

Generally the mechanisms for swingably supporting and resiliently restraining the chair back structure have been relatively complex and have been costly to manufacture. The conventional devices have further suffered by reason of a relatively short service life and a tendency to easily lose their desired cushioning characteristics. In the usual resilient restraining arrangement wire spring constructions have been employed, and such constructions have suffered because of inability to simultaneously exert a strong but yieldable restraining force sufficient to enable the back structure to have a satisfactory movement stroke. Thus, when the wire springs are constructed of relatively heavy material the cushioning action is relatively stiff, and the stroke of the chair back structure is relatively short. Conversely, when the springs are constructed of relatively light gauge material the cushioning action is relatively weak, and the stroke is relatively long. Adjustment mechanisms have been utilized to enable the user to control the character of the resilient restraining force. However, due to the type of springs which have heretofore been employed such adjustment structures have not proven to give entirely satisfactory results.

With the above discussion in view, it is an object of the present invention to provide a chair construction, as for example a secretarial chair construction, having improved means for swingably and cushionably mounting the chair back structure.

A further object of the invention is to provide a chair construction of the above type wherein the resilient restraining force is capable of wide variation between a relatively stiff action and a relatively weak action, the arrangement being characterized by an ability to give a satisfactory movement of the chair back structure in all positions of adjustment.

In connection with the immediately above-cited objective, it is a more general object of the invention to provide a chair back structure having cushioning means therefor which will provide a desired cushioning action irrespective of the magnitude of the human force applied thereon, the arrangement being such as to adapt the construction to use by both heavyweight individuals and lightweight individuals.

A further object of the invention is to provide a chair construction of the above type wherein the chair back pivot structure and cushioning structure are incorporated directly together to form a novel pivot-cushion assembly having desired features of low cost and rugged construction.

An additional object of the invention is to provide a novel chair construction of the type which permits the seat portion to be rotated in a horizontal plane and which permits the back structure to be swingably and cushionably carried by the seat portion, whereby to enable the user to both rotate the seat portion and lean against the chair back structure to cause it to yield as occasion may require.

A further object is to provide a chair construction of the above type wherein economically manufactured mechanism may be incorporated to permit vertical adjustment of the seat portion relative to its floor-engaging base.

Other objects of this invention will appear in the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

In the drawings:

FIGURE 1 is a bottom plan view showing a seat frame and back structure having features of the invention incorporated therewith;

FIG. 2 is a left elevational view of a portion of the FIG. 1 structure, with parts thereof broken away for illustration purposes;

FIG. 3 is a view taken substantially on line 3—3 in FIG. 1;

FIG. 4 is a sectional view taken substantially on line 4—4 in FIG. 3;

FIG. 5 is a view taken substantially on line 5—5 in FIG. 4; and

FIG. 6 is a reduced elevational view of a chair construction having features of the FIG. 1 mechanism employed therein.

Before explaining the present invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

Referring to the drawings, and particularly FIG. 6, there is shown a secretarial chair including a base structure 10, a seat frame portion 12, seat cushion 14, chair back structure 16 and chair back cushion 18. The base structure 10 may take various different configurations, but as shown in FIG. 6 it comprises a plurality of outwardly radiating leg portions 20 having the floor-engaging rollers 22 thereon, said legs being connected with a vertically extending sleeve or socket structure 24 which rotatably supports and journals a spindle structure 26. This spindle structure is fixedly secured to the seat frame 12 and the seat frame carries the chair back structure 16, the arrangement being such that the assembly of frame 12 and back structure 16 can be rotated horizontally around the axis of sleeve 24. Suitable adjustment structure is provided between spindle 26 and socket 24 to permit vertical adjustment of the seat and back structure assembly.

The back structure has a pivotal connection at 28 with the seat frame 12. The arrangement being such that when a human force is applied to the back cushion 18 the entire back structure swings rearwardly and downwardly about the pivotal connection 28. A resilient cushioning mechanism, to be described hereinafter, is provided for exerting a resilient restraining force against this rearward downward tilt, the general objective of course being to provide the user with sufficient support when he assumes a normal upright position, but to enable the user to tilt the back structure rearwardly when desired.

Referring to FIG. 1 of the drawings, the seat frame 12 will be seen to comprise the front angle iron 30, the rear angle iron 32, and the two side angle irons 34 and 36,

said angle irons being suitably connected together (by integral formation, welding or the like) to form a generally rectangular rigid frame work for the seat cushion 14 shown in FIG. 6.

The seat frame further comprises the laterally extending reinforcement members 38 and 40, and the front-to-rear directed rails 42 and 44. As shown in FIG. 4 each of the rails 42 and 44 is of angular cross section to provide the vertically extending wall portions for mounting the parallel plates 48 and 50, suitable rivets 52 being provided for connecting purposes. The plates 48 and 50 are provided with aligned openings which receive the tapering portion 54 of the threaded spindle 26. The tapering nature of spindle portion 54 enables the spindle to be rigidly and firmly connected with the spaced plates 48 and 50 in an economical manner.

Spindle 26 extends into the socket or sleeve structure 24, said sleeve structure having the flaring upper end portion 56 for defining a bearing surface 58, said surface serving to receive the thrust from the thrust bearing 60. As will be seen from FIG. 5, bearing element 60 is provided with four upwardly extending lugs or detents 62 which releasably lock in mating grooves formed in the lower face of nut 64. In the illustrated embodiment bearing element 60 is formed as a collar structure and is provided with an inwardly extending key portion 66 which is slidably engaged in a keyway 68 formed in the surface of spindle 26.

In normal use of the mechanism thus far described, the occupant may freely rotate the seat frame 12 about the axis of the socket 24; during this rotational movement spindle 26, nut 64 and bearing element 60 rotate as a unit. Thus key 66 prevents any relative movement between spindle 26 and bearing element 60, and detents 62 prevent any relative movement between nut 64 and bearing element 60. During rotational movement of frame 12 bearing surface 58 receives the thrust forces occasioned by the weight of the chair occupant. When it is desired to adjust the height of the chair seat and back assembly the frame may be manually lifted so as to draw the spindle 26 upwardly relative to the base socket 24, the action being such that nut 64 is freed from its connection with collar 60 to permit the nut to be manually threaded upwardly or downwardly on the spindle for height adjustment purposes. The spindle can then be lowered into the socket 24 to cause the nut 64 to again bear on collar 60, with the detents 62 locking the nut and collar together so as to permit the chair occupant to again revolve the frame-back structure assembly about the spindle axis as previously described.

By reference to FIG. 1, it will be seen that the seat frame rails 42 and 44 carry the laterally extending steel sleeve portions 68 and 70 which constitute means for swingably mounting the chair back structure with relation to the seat frame. The sleeve portions freely receive the elongated steel tube 72 which is affixed to the chair back structure 16. In the illustrated embodiment the chair back structure is defined by two parallel uprights 74 and two forwardly extending arms 76, said arms and uprights being connected together by means of the bolts 78. Each of the arms 76 extends forwardly beneath the frame 12 and then upwardly as at 80 (FIG. 3) to a fixed connection with the tube 72. It will thus be seen that by the arrangement of bearing sleeves 68, 70 and tube 72, the chair back structure is swingably mounted for back and forth movement relative to the seat frame 12.

As previously noted, it is an object of the present invention to provide an improved arrangement for cushioning the back structure during its rearward movement. For this purpose the illustrated embodiment includes a rectangular cross section torsion bar 82, said bar extending substantially the full width of the seat frame as shown in FIG. 1 so as to permit desired "stiffness-yieldableness" adjustment and satisfactory angular movement. The torsion bar as shown in the drawings is anchored at its right end by means of an enlargement 84 formed on tube 72, said enlargement having a rectangular cross sectioned opening therein to anchoringly receive the torsion bar. The left end of the torsion bar extends through a rectangularly cross sectioned opening in the enlargement 86 of the arm 88 which is rotatably mounted in sleeve portion 70 and which extends forwardly in the space beneath frame rail 36. The purpose of arm 88 is to provide a variation and control of the preset tension in the torsion bar whereby to provide a soft or stiff cushioning action, depending on the weight of the user and his particular desires or requirements.

The preset tension adjustment may, for the purposes of the present invention, be of various different arrangements and locations. However, for illustration purposes the adjustment structure as shown in the drawings comprises a threaded stem 90 having a spherically shaped enlargement 92 and a horizontally extending handle portion 94 provided with a knob 96. Threaded stem 90 freely extends through an opening 98 in the arm 88, said stem however meshing with a nut 99 which bears against the upper face of arm 88. Spherical portion 92 of the stem seats freely within a seat formed by the wall 100, said wall being suitably carried on the seat frame by forming it as part of a frame carried angle member 102.

It will be seen that in using the FIG. 2 adjustment structure the user can rotate the stem 90 so as to draw the nut 99 downward sufficiently to move arm 88 a desired distance in the arrow 89 direction. As arm 88 is moved in the arrow 89 direction it twists the left end portion of torsion bar 82. The right end portion of bar 82 is connected with the seat back structure via the tube 72, and thus movement of arm 88 in the arrow 89 direction is effective to apply a resilient force on the back structure tending to move it upwardly and forwardly relative to the pivot axis 28 defined by the sleeve portions 68 and 70. The chair back structure is provided with stop means which prevent it from moving upwardly above its FIG. 3 full line position, and the twisting of the torsion bar 82 is therefore effective to build up a preset resilient restraining force which is later utilized to provide a resilient cushioning action when the user leans against the chair back structure.

The stop structure for limiting upward forward motion of the chair back structure takes the form of a flanged bracket 102 which is secured to the back structure arms 76 by means of the rivets 77 as shown in FIG. 3. The upper end portion of bracket 102 is turned to provide a stop portion 104. In the FIG. 3 full line position the stop portion 104 abuts against the underside of the frame-carried plate 48 so as to limit upward, forward movement of the back structure. As the occupant leans against the back structure the back structure arms 76 move toward the FIG. 3 dotted line position 106, and the stop portion 104 thereby moves toward a position abutting against frame carried plate 50. By this arrangement a positive stopping action is obtained. However, in normal operation the back structure may not move sufficiently to cause engagement of portion 104 with plate 50, since during such movement the preset tennsion in torsion bar 82 is effective to provide a resilient cushioning and restraining action.

The employment of the illustrated torsion bar-pivot assembly has been found to be advantageous because of an improved cushioning action which is attained. It will be appreciated that the elongated character of the torsion bar enables it to be pretwisted through a very small angular movement or through a much larger angular movement. Thus the bar can be adjusted to give a very soft cushioning action or a very stiff cushioning action, depending on the weight of the user and his particular desires. This large variation in restraining force character is in contrast to the conventional coil spring

arrangements wherein substantially lesser ranges of adjustment are possible.

The illustrated arrangement is further advantageous in that the pivot for the chair back and the mounting for the torsion bar are incorporated together so as to provide desired features of sturdy construction and anti-wobble operation.

The drawings show the pretwist adjustment structure as located between the frame and the torsion bar, with no adjustment between the bar and the back structure. However, it will be appreciated that the frame and bar can be immovably locked together, with the adjustment structure being located between the frame and the chair back structure. In this connection, the drawings necessarily show various specific structural arrangements necessary to form one embodiment of the invention, but it will be appreciated that variations in arrangement and construction can be employed without departing from the spirit of the invention as set forth in the appended claims.

I claim:

1. The combination comprising a generally horizontal seat frame, including two front-to-rear directed rails located inwardly of its lateral side portions; a pair of horizontal sleeves extending outwardly from the rails to the lateral side portions of the frame; an elongated tube rotatably extending through both of the sleeves and the space between the rails; a torsion bar extending within and for the full length of the tube; one end of said torsion bar having an anchorage connection with a portion of the tube; tension-adjusting means connected between the other end of the torsion bar and a portion of the seat frame; and arm means affixed to portions of the tube located between the aforementioned rails and extending rearwardly from the tube beneath the frame and thence upwardly therepast to define a chair back structure, whereby human force on the chair back structure is effective to swing the arm means rearwardly and downwardly about the axis of the torsion bar so as to act through the tube and twist the bar from its initial condition, said twisting being effective to cause the torsion bar to build up a resilient restraining force opposing the rearward swinging of the chair back structure.

2. The combination of claim 1 and further comprising a stop structure carried by the horizontally extending portions of the arm means, and a cooperating abutment means carried by the seat frame in registry with said stop means to limit upward forward movement of the chair back structure.

3. The combination of claim 1 and further comprising two vertically spaced plates extending horizontally between the frame rails in locations rearwardly of the torsion bar-tube assembly; a vertical spindle connected with said plates and extending therebelow; a chair base positioned beneath the seat frame; and means rotatably supporting the spindle on said base to thereby permit the seat frame-chair back structure to have rotary motion in a horizontal plane about the spindle axis.

4. The combination of claim 3 and further comprising an adjustable connection between the spindle and base for enabling the spindle and connected frame to be vertically adjusted to different heights in accordance with desires of the user.

5. The combination of claim 4 wherein the base comprises a vertically extending sleeve structure, and the spindle is threaded; the aforementioned support means comprising a bearing element rotatably bearing against

a portion of the sleeve structure, and a nut positioned atop the bearing element and having meshing engagement with the spindle threads; said nut and bearing element having cooperating detent portions releasably locking them together, and said bearing element having key means slidably axially keyed to the spindle; the arrangement being such that during use of the chair construction the assembly of the spindle, nut, and bearing element rotate as a unit on and within the base sleeve structure, and whereby adjustment of the seat frame vertically may be effected by lifting the frame so as to disengage the nut from the bearing element and thereby permit the nut to be threaded vertically on the spindle to establish a new position of the spindle relative to the base sleeve structure.

6. In a chair structure of the secretarial type having a leg assembly and a seat assembly supported by said leg assembly, with a back assembly pivotally supported upon said seat assembly, the improvements comprising an elongated torsion member interposed between said seat assembly and said back assembly, said torsion member having two ends, one of said ends being fixedly connected to said back assembly and the second of said ends being restrainingly engageable with said seat assembly, whereby a force against the back assembly is effective to cause it to be resiliently pivoted with respect to said seat assembly.

7. The chair structure of claim 6 including means between the second end of said torsion member and said seat assembly for exerting variable preset twist to the torsion member.

8. In a chair structure of the secretarial type having a leg assembly and a seat assembly supported by said leg assembly, with a back assembly pivotally supported upon said seat assembly, the improvement comprising a sleeve fixedly mounted on said seat assembly, a tube rotatable within said fixedly mounted sleeve, an elongated torsion member within said tube and said torsion member having two ends, one of said ends being fixedly connected to said back assembly through said sleeve and the second of said ends being restrainingly engageable with said seat assembly, whereby a force against the back assembly is effective to cause it to be resiliently pivoted with respect to said seat assembly.

9. A chair structure of the secretarial type, including a leg assembly and a seat assembly supported on said leg assembly, said seat assembly including a support rail, located inwardly of its periphery, a sleeve fixedly secured to said support rail, a tube rotatable within said sleeve, an elongated torsion bar extending within said tube, said torsion bar having two ends, with one of said ends being fixedly connected to said tube and the second of said ends being restrainingly engageable with said seat assembly, whereby a force against the back assembly is effective to cause it to be resiliently pivoted with respect to said seat assembly.

10. The chair structure of claim 9 including means between the second end of said torsion member and said seat assembly for exerting variable preset twist to said torsion bar.

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