July 29, 1947. W. F. HEROLD 2,424,753

TILTING CHAIR

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Fig. 1.

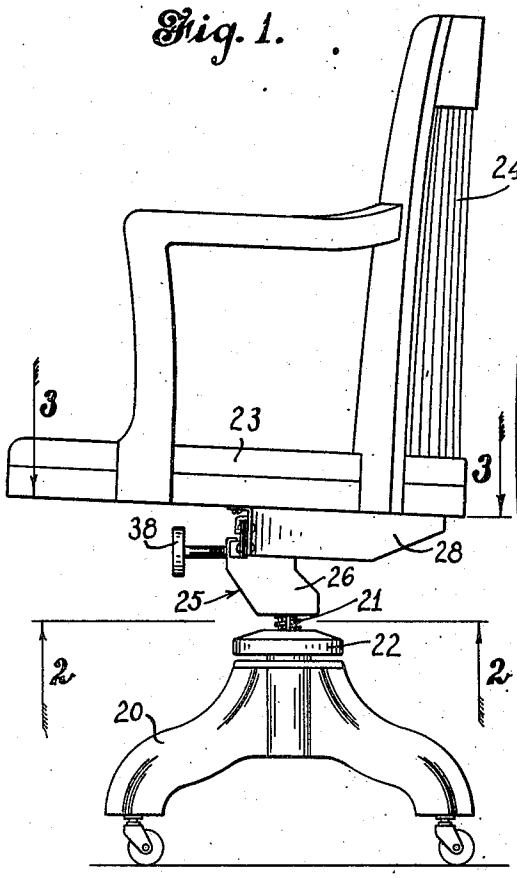



Fig. 2.

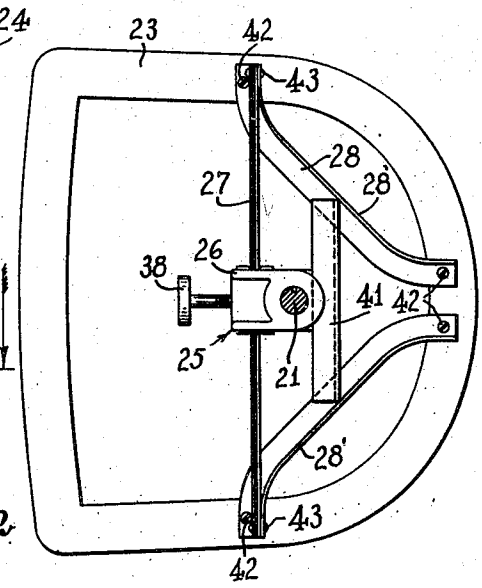



Fig. 3.

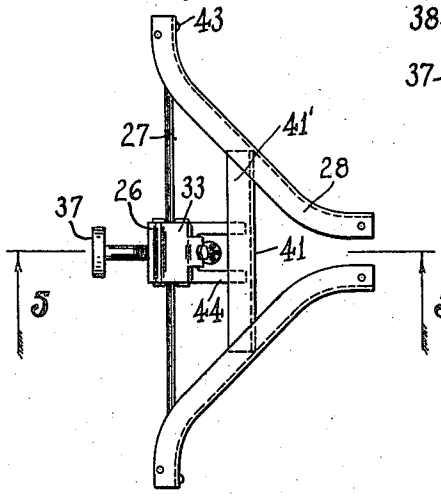
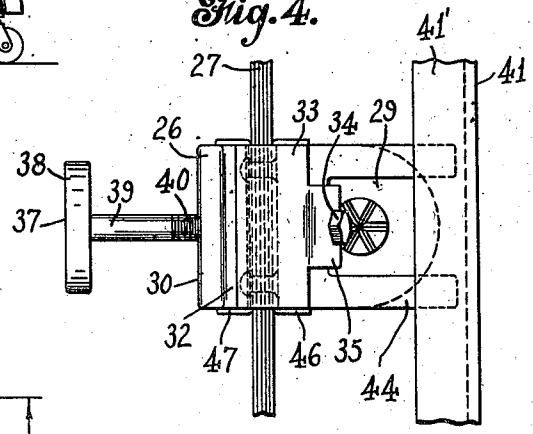



Fig. 4.




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Fig. 5.

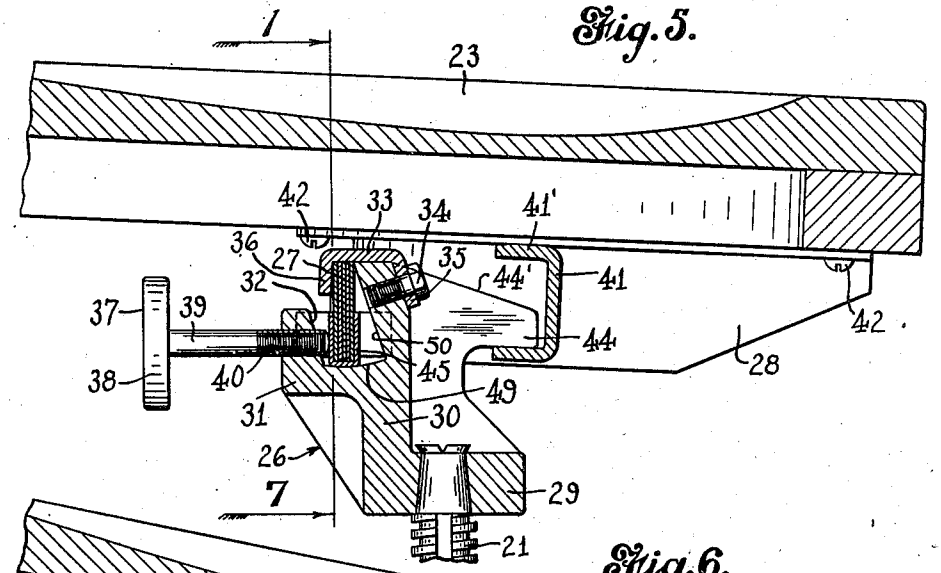



Fig. 6.

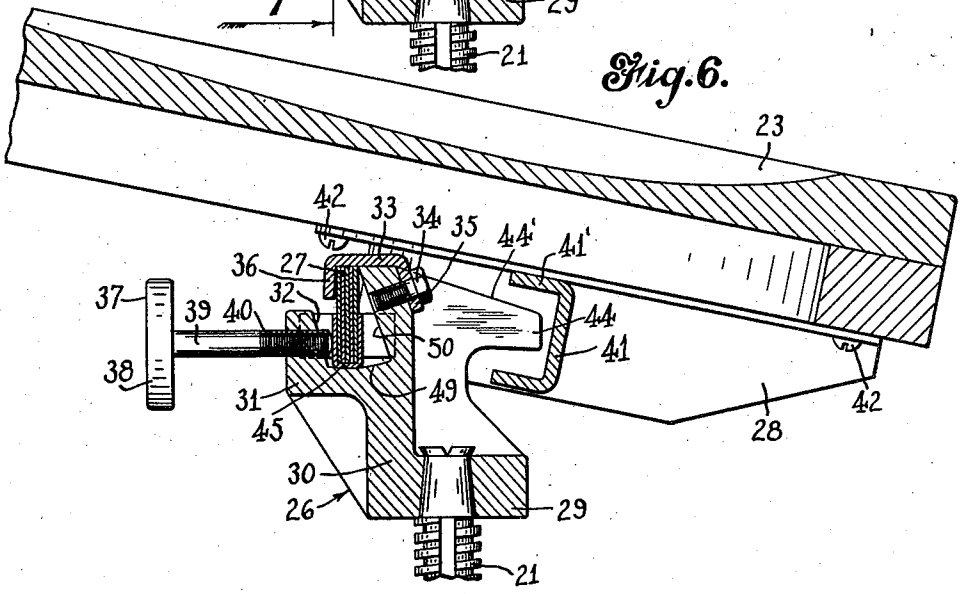
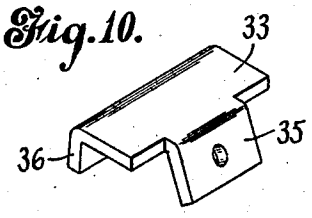



Fig. 10.




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Fig. 7.

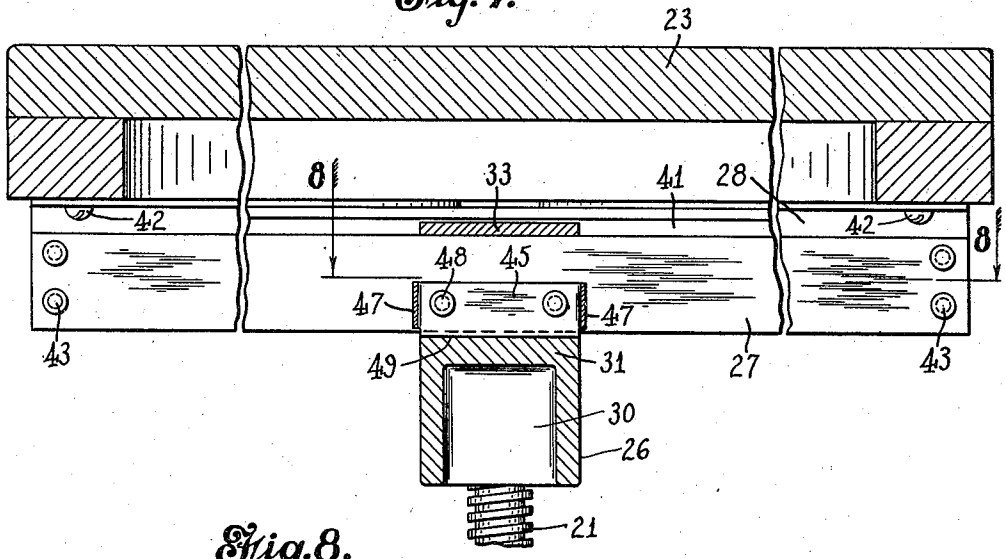



Fig. 8.

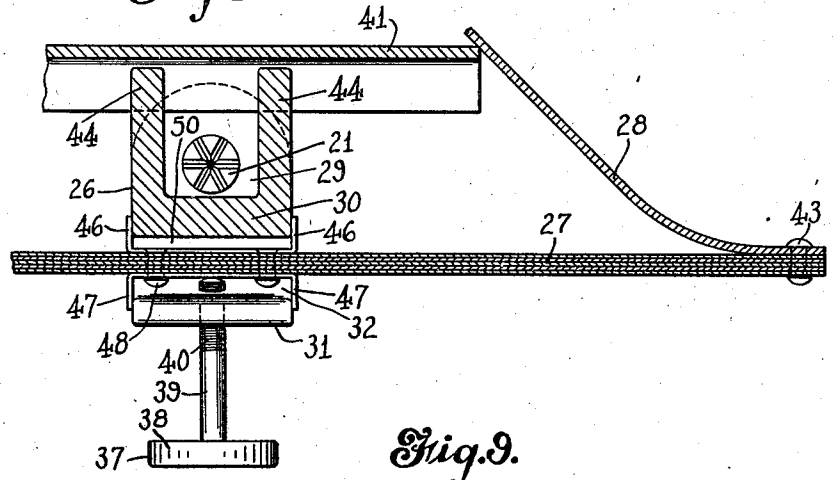
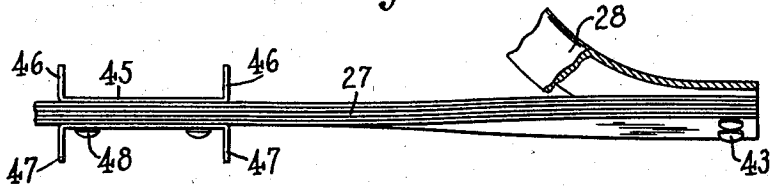



Fig. 9.




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Patented July 29, 1947 2,424,753

# UNITED STATES PATENT OFFICE

2,424,753

## TILTING CHAIR

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Application May 26, 1944, Serial No. 537,495

15 Claims. (Cl. 155—77)

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This invention relates to tilting chairs, and is applicable to office chairs of the so-called bucket type, where the seat is mounted for rearward tilting under resilient control, although the invention is also applicable to chairs of other types.

One of the objects is to simplify the chair structure and reduce its cost of production.

Another object is to simplify the chair structure by providing a chair-seat-supporting member of such character and so arranged that it has the additional function of a spring controlling the tilting movement of the seat.

A further purpose of the invention is to furnish an improved form and arrangement of spring supporting the seat of a tilting chair.

To these and other ends the invention consists in the novel features and combinations of parts to be hereinafter described and finally pointed out in the claims.

In the accompanying drawings:

Fig. 1 is a side elevation of a chair embodying my improvements;

Fig. 2 is a section on line 2—2 of Fig. 1;

Fig. 3 is a section on line 3—3 of Fig. 1;

Fig. 4 is a top plan view of a portion of the seat-supporting structure;

Fig. 5 is an enlarged section through a portion of the chair on a line corresponding to the line 5—5 of Fig. 3, showing the seat in the normal position;

Fig. 6 is a view similar to Fig. 5, showing the seat in a rearwardly tilted position;

Fig. 7 is a section on line 7—7 of Fig. 5, partially broken away;

Fig. 8 is a detail section on line 8—8 of Fig. 7;

Fig. 9 is a plan view of a portion of the spring showing the action which takes place when the seat is tilted; and

Fig. 10 is a detail perspective view of a plate which holds the spring in position in the frame on the base structure.

In the drawings, the invention is shown as applied to an office chair of the bucket type, where the seat is swiveled and is also capable of tilting movement in a vertical plane, but as above indicated, the invention is applicable to chairs of other types. The chair has any usual or preferred form of seat member, and is shown as having a base of standard type in which is upwardly adjustable a screw spindle. Attached to the upper end of the screw spindle, which in this particular case is adjustable vertically by means of a rotatable nut member, is a chair iron of a novel kind, as will hereinafter appear.

In the drawings, the base of the chair is indicated at 20, the height-adjusting spindle at 21, and the height-adjusting nut at 22. The chair seat is indicated at 23, and in this instance the same has a back 24 rigid therewith. Between the seat 23 and the spindle 21 is arranged the improved chair iron which is generally indicated at 25.

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In the particular form shown, the chair iron 25 includes as a part thereof a rigid frame member 26 carried on the upper end of the screw spindle 21. Held in place in this frame member is an elongated leaf spring member 27, which in this case is of a length approximating the width of the chair seat. This spring member is secured midway of its length to the frame 26, and at its extremities has rigid connection with the seat at the under portion of the latter, this connection preferably being provided by securing the ends of the spring to a suitable frame at the under portion of the seat and securing said frame in turn to the seat. In the particular case shown the frame just referred to is indicated at 28. This frame is applied to the under surface of the seat at the rear portion of the chair, as best shown in Fig. 2.

Referring to the details, it will be noted that the frame member 26, previously mentioned, may be a casting which in vertical section is approximately of L shape, as appears in Fig. 5, said frame member having a lower web 29 riveted to the upper end of the screw spindle 21, and having in front of its connection to the screw spindle a wall portion 30. This portion 30 has at the upper forward portion thereof an integral bracket 31 providing an upwardly facing recess 32 in which the spring 27 is accommodated. Overhanging the spring and holding the same in place in the frame is a plate member 33 attached to the upper portion of frame member 26 by means such as a screw 34. The screw 34 passes through a lug portion 35 on the rear part of plate 33. The plate 33 rests on the frame 26 and has a portion overhanging the spring 27 at the upper edge of the latter and provided with a retaining lip 36 which engages the front face of the spring and holds the latter in place. The spring is adapted to be tensioned, in the manner hereinafter described, by a tensioning screw 37, having a head 38 rigid with a shank 39 which is threaded at 40 and is screwed through the front wall of portion 31. The inner end of the screw 37 is adapted to impinge against the spring member at the lower part of the latter.

The frame 28 previously mentioned comprises two side members 28' and an intermediate mem-

ber 41, the members 28' preferably being in the form of angle bars and the member 41 preferably being of U-shaped cross section. The angle bars 28' are arranged so that they have upper plate or flange portions attached by screws 42 to the under surface of the seat, and the channel bar 41 bridges the space between the members 28' and is rigidly secured to the respective members in a suitable manner as by having the upper flange 41' of bar 41 placed against and welded to the under surfaces of the upper portions of member 28'. Each of the members 28' is attached at one end to the rear portion of the seat and at the other end to the side portion of the seat, the arrangement being such that the members 28' diverge in a forward direction, the member 41 acting as a bridge member interconnecting them in a region intermediate of their ends. The downwardly directed flange or plate portions of the members 28' have their forward end portions directed transversely of the seat, as shown in Fig. 2, so as to act as abutments against which the extremities of the spring 27 are positioned and held. In the form shown, each extremity of the spring is fastened to one of the members 28' by means of rivets 43, the extremities of the spring being abutted against the angle bars 28' at the front of the depending portions of the latter which are located at the respective sides of the seat.

The member 41 not only serves as a bridge member, as above indicated, but as a stop member for limiting the tilting movement of the seat, for which purpose said member cooperates with one or more projections on the frame member 30. In the form shown the member 26 has at the upper part thereof portions 44 projecting rearwardly therefrom at the respective sides, each of said portions 44 having a free rear end projecting into the channel of member 41, as shown in Figs. 5 and 6. The stop members 44 are in the nature of projections extending rearwardly from the upright transverse wall of member 30 at the upper part of said wall.

The spring 27 is preferably composed of a plurality of individual leaves or laminations, and these, generally speaking, are arranged in vertical or upright planes. It is preferred to interconnect the laminations at the middle portion of the spring where the same is received and held in the frame 26, and in the form shown there is employed a U-shaped clip 45 of sheet metal in which the middle portions of the laminations are received at the lower parts of such laminations, said clip in the form shown extending from the lower edge of the spring to a point about midway of the vertical dimension of the spring, as shown in Fig. 5. The length of the clip 45 is approximately the same as the width of the frame 26, and the ends of the clip are provided respectively with two flanges 46 and 47, the flanges 46 being rearwardly disposed with reference to the chair, as shown in Fig. 8, and engaging the frame to the rear of the spring while the flanges 47 engage the frame forwardly of the spring. The clip is rigidly attached to the spring by means such as rivets 48, and it will be understood that when the assembly is made and the clip, with the spring therein contained, received in the transverse recess of frame 26, and plate 33 applied to confine the spring from above, there can be no lengthwise displacement of the intermediate portion of the spring.

The tensioning screw 37 previously mentioned preferably engages the spring at the lower part thereof in the region where the clip 45 is located,



and at the front face of the spring, in order that, with reference to Fig. 5, a twist in a counterclockwise direction may be given to the spring by screwing in the tension screw. It is noted that for this purpose some clearance is provided in the frame 26, the floor of the spring recess being suitably formed or curved as shown at 49, and the surface immediately behind the spring being undercut, as shown at 50. It will also be observed that in the form shown the upper edge portion of the spring is tightly held between the lip 36 and the upper edge portion of the frame in order that there may be no lateral shifting of the upper edge portion of the spring as the screw is tightened.

When the chair seat is in the normal position of Fig. 5, in which there is usually a slight rearward tip or tilt of the seat, the leaf spring, which is connected at its middle portion to the frame 26 and at its end portions to the respective side portions of the seat, is located, generally speaking, in a single plane, this plane being upright or approximately vertical. When the seat is tilted rearwardly the parts move from the position shown in Fig. 5 to a position such as shown in Fig. 6, and the action is such as to twist or torsion the seat-connected portions of the spring about the longitudinal axis of the spring, which is directed in a horizontal plane and transversely of the chair seat. In this action the rearward tilting of the seat is resisted by the spring in an effective manner, and the spring at all times urges the seat toward the initial or untilted position. In the initial position of the seat, further forward tilting of the seat beyond the position of Fig. 5 is prevented by the lower flange of bar 41 coming into contact with the lower surfaces of the stop projections 44, which surfaces are approximately horizontal. Upon rearward tilting of the seat to a certain degree, upper inclined surfaces 44' provided on the projections 44 will be engaged by the upper flange of bar 41 so as to prevent further tilting movement.

By reference to Fig. 6 it will be noted that when the seat is tilted rearwardly, the end portions of the spring are twisted in a direction to impart a clockwise twist with reference to this view. This twist is opposite to that which can be imparted to the intermediate portion of the spring by the tension screw 37, and thus by tightening up on the screw the spring can be pre-tensioned to the desired extent, so that the seat requires a tilting force suited to the particular conditions of use.

It will be evident that by the invention the chair structure is considerably simplified and cheapened, owing to the fact that the member which controls or cushions the tilting movement of the seat also acts as an important or a principal structural support for supporting the seat in its tilting movement. To put the matter in another way, a member forming a primary part of the means for pivoting or hinging the seat to the chair base also has the function or capacity of maintaining the seat under resilient control, constantly urging the seat toward the normal or untilted position and effectively counterbalancing the seat. In the form shown the spring is a leaf spring, but this is not essential in all aspects of the invention. Also where a leaf spring is employed it is not essential that it be a laminated spring in all instances. Furthermore it will be understood that, while in the present instance a single spring is employed in connection with the chair, an arrangement uti-

lizing multiple springs is within the contemplation of the invention.

It will be evident from the description that the seat movement is under the control of a spring connected at one point to the chair base structure and at another point to the seat, said spring mounting the seat for tilting movement as the spring is twisted about its axis in order that the seat be effectively and strongly supported from the base by the spring, said spring having the additional function of controlling the tilting movement. In another aspect the invention is concerned with a chair structure in which the seat is supported from the base by a substantially rectilinear spring fastened at its ends to the seat and at its intermediate portion to the chair base structure, the spring being an essential part of the seat support and providing for the tilting of the seat relatively to the base structure, as well as for the resilient control of the seat.

While only one embodiment of the invention is shown, it is apparent that various modifications and changes in the arrangement of parts and in the details may be made without departing from the principles of the invention or the scope of the claims.

What I claim is:

1. In a tilting chair, the combination of a seat, a base structure having a frame at the upper part, a substantially horizontal leaf spring having an edge portion disposed under and facing upwardly toward the seat, said spring being connected at one end to a side portion of the seat for supporting the weight of the seat and connected at another point to said frame whereby said spring is anchored to said frame but subject to twisting about its longitudinal axis by the rearward tilting of the seat, and pre-tensioning means associated with said spring comprising a pressure member carried by said frame.

2. In a tilting chair, the combination of a base structure, a seat, means for tiltably connecting the seat with the base structure including a spring extending transversely of the seat which supports the weight of the seat and is twisted by the rearward tilting of the seat, said spring being anchored intermediate of its ends to the base structure, and pre-tensioning means associated with the middle portion of the spring.

3. In a tilting chair, the combination of a base structure having a frame member at the upper part thereof, said frame member having an upwardly facing recess, an elongated leaf spring substantially horizontally disposed with its middle portion in said recess and with one edge facing upwardly, means for holding said spring in said recess, a chair seat relatively to which said spring extends transversely and to the side portions of which the respective ends of the spring are fastened, said spring being twisted from the ends by the rearward tilting of the seat, and means in association with said frame for giving said spring an initial twist at its intermediate portion.

4. In a tilting chair, the combination of a base structure having a frame at its upper part, a seat, a frame applied to the under portion of the seat at the sides of the latter, and an elongated leaf spring received edgewise and held at its middle portion within said first frame and having its respective ends fastened to said second frame so that said spring is twisted from its ends when the seat is rearwardly tilted, said frames being separate from each other so that the weight of the seat is borne by said spring.



5. In a tilting chair, the combination of a base structure having a frame at its upper part, a seat, a frame applied to the under portion of the seat at the sides of the latter, and an elongated leaf spring received edgewise and held at its middle portion within said first frame and having its respective ends fastened to said second frame so that said spring is twisted from its ends when the seat is rearwardly tilted, said frames cooperating with each other to limit the tilting movement of the seat in opposite directions.

6. In a tilting chair, the combination of a base structure having a frame at its upper part, a seat, a frame applied to the under portion of the seat at the sides of the latter, an elongated leaf spring received edgewise and held at its middle portion within said first frame and having its respective ends fastened to said second frame so that said spring is twisted from its ends when the seat is rearwardly tilted, said frames cooperating with each other to limit the tilting movement of the seat in opposite directions, and a tensioning screw in association with said first frame for imparting a twist to the middle portion of the spring for tensioning the spring.

7. A tilting chair comprising a base, an upstanding spindle, a frame carried by the spindle, a seat, and an elongated torsion spring in the form of a bar having upper and lower edges, said bar being received at its middle portion in said frame and being connected terminally to the side portions of the seat, said frame being spaced from the seat so that the weight of the seat is borne by said spring.

8. A tilting chair comprising a base, an upstanding screw spindle, a frame fixed to the upper end of the screw spindle and having an upwardly facing recess, a seat, and an elongated bar torsion spring anchored intermediate of its ends to said frame by being engaged and fixed in said recess and having its terminals connected to the side portions of the seat, said spring being the weight-carrying element for the seat, and said frame except for the spring connection being free from said seat.

9. A tilting chair comprising a base, an upstanding screw spindle, a frame carried at the upper end of the screw spindle, a seat, an elongated bar torsion spring anchored intermediate of its ends to said frame by being engaged in a recess formed in the frame and having its terminals connected to the side portions of the seat, said spring being the weight-carrying element for the seat, and means associated with the recessed portion of the frame for pre-tensioning the spring by engaging it in an off-center location and twisting it with reference to its longitudinal axis.

10. A tilting chair comprising a base, an upstanding screw spindle, a seat, a frame fixed to the upper end of the screw spindle, a second frame fixed to the side portions of the seat and also fixed to the rear portion of the seat, and an elongated torsion spring anchored intermediate of its ends in said first frame and fixed at its terminals to said second frame adjacent the sides of the seat, said spring being the weight-carrying element of the seat, and said frames except for the spring connection being free from each other.

11. In a tilting chair, the combination of a base, a frame in fixed position above the base and having an upwardly facing recess, a chair seat, a frame fixed to the sides and rear of the

chair seat, a torsion spring having its middle portion engaged and fixed in said recess with one of the side edges of the spring uppermost and having its terminals connected to the other frame adjacent the sides of the seat, said spring supporting the weight of the seat and adapted to be twisted as the seat is tilted, and a pressure screw engaging a threaded socket in said first frame adjacent said recess, said screw bearing against a portion of said spring in said recess and being nearer one edge than the other so as to be operable to pre-tension the spring by twisting the same.

12. In a tilting chair, the combination of a base structure, a seat, and means for tiltably connecting the seat with the base structure, including a spring extending transversely of the seat which supports the weight of the seat and is twisted by the rearward tilting of the seat, said spring comprising an elongated leaf connected at its ends to the seat and at its middle portion to the base structure and disposed normally in a substantially upright plane.

13. In a tilting chair, the combination of a base, a post rising from the base, a frame fixed to the upper end of the post, a substantially horizontal regulating screw screwing into the frame and adapted to be disposed at the front of the chair and to regulate the tension of a spring controlling the tilting movement of a seat, a tilting seat above said frame adapted to be tilted rearwardly from an approximately horizontal position, and a spring comprising an elongated spring bar attached at its ends to said seat and at its middle to said frame for supporting the weight of said seat from said frame and adapted to be twisted as the seat is tilted rearwardly and having its tension controlled by said regulating screw, said screw having off-center engagement with a face of said bar.

14. In a tilting chair, the combination of a base structure carrying a frame at the upper end thereof, a seat located above the frame and spaced therefrom, and a bar spring extending transversely of the seat at the under portion of



the seat and connected at its ends to the seat to support the entire weight of the seat by being anchored to said frame, said spring being anchored intermediate of its ends to said frame by being received edgewise and fastened in a recess provided in said frame and having portions between its middle and its ends which are flexed when and as the seat is tilted.

15. In a tilting chair, the combination of a seat, a bar spring extending crosswise of the seat at the under portion thereof and connected at its ends to the seat to carry the entire weight thereof and having its middle portion free of the seat, a frame located substantially centrally of the seat and spaced downwardly therefrom and free of engagement with the seat but engaged with the middle portion of said spring to anchor the same and thereby carry the weight of the seat, said spring being capable of flexing in portions thereof between the ends and said frame and being so flexed as the seat is tipped in a vertical plane, and a base supporting said frame.

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