May 19, 1953 B. F. HARBER 2,638,970

TUBULAR CHAIR CONSTRUCTION

Filed March 24, 1950

FIG. 1.

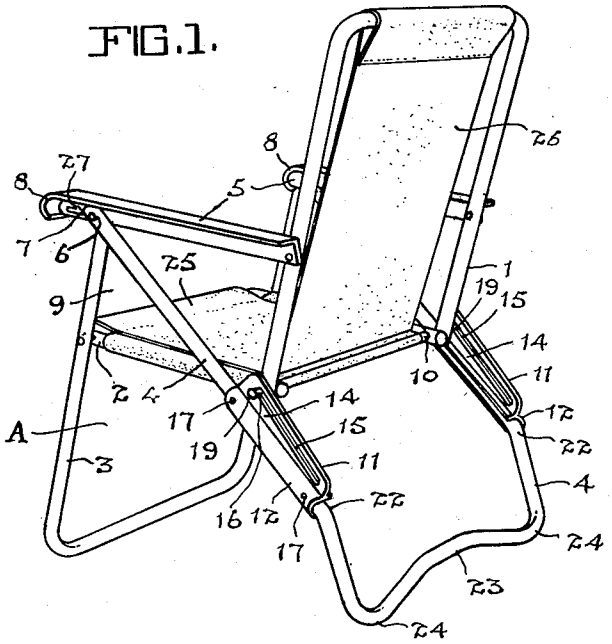


FIG. 2.

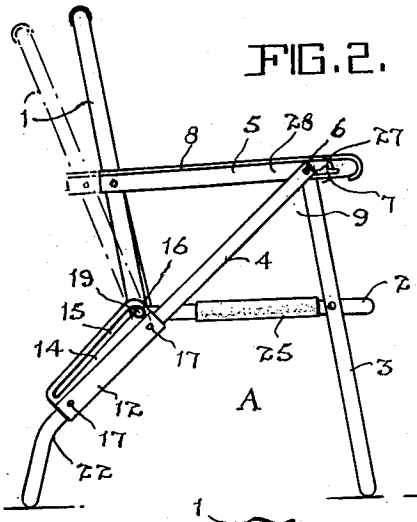


FIG. 3.

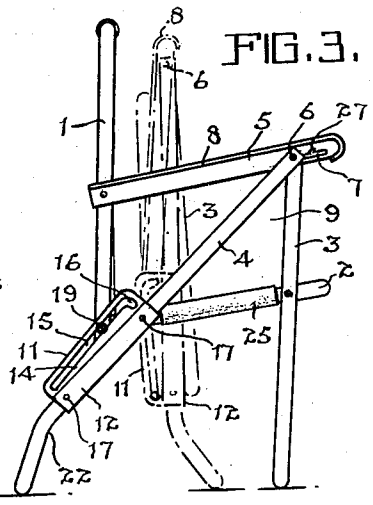


FIG. 4.

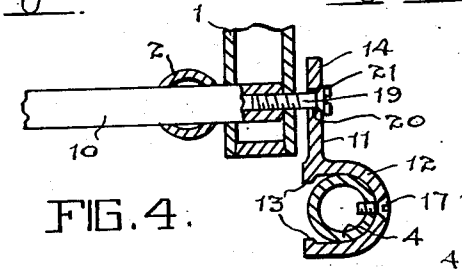
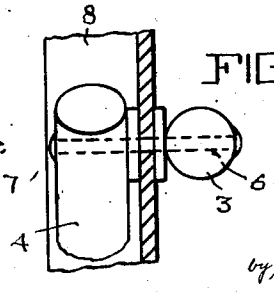


FIG. 5.



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TUBULAR CHAIR CONSTRUCTION

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9 Claims. (Cl. 155—139)

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This invention relates to improvements in chair constructions and more particularly to improvements in collapsible tubular chairs.

One of the principal objects of the invention is to provide a chair construction affording increased strength while permitting lighter and cheaper construction.

Another important object is to provide a chair construction having an improved collapsing action wherein the parts are accurately guided and controlled during relative movement and will move under simple and convenient manipulation between compactly folded and extended positions.

In this connection it is another principal object of the invention to provide a chair action wherein the weight of a person will act to move the chair to and hold it in an extended position to provide the important and highly desirable safety feature of eliminating chair collapse even though the chair is only partially extended at the time it receives a person's weight.

Another object is to provide a collapsing action wherein the parts automatically lock against accidental displacement at the fully folded as well as extended position.

A further object is to provide for, in a chair of the class described, adjustment to different positions of recline without in any way disturbing the collapsing action.

Still another object is to provide a chair of attractive appearance and comfortable to use.

One of the principal features of the invention resides in pivotally connecting front and rear leg and seat frames to form an A shape with the pivot connections of the leg frames forming the apex of the A, and the seat frame forming the cross bar of the A with its pivot connection with the rear leg frame constituting a sliding pivot sliding substantially on the incline of the rear leg frame, whereby loading of the chair acting down through the A acts to spread the legs and thereby move the sliding pivot upwardly to automatically extend the chair.

With regard to the collapsing action it is a feature of the invention to pivot the back frame to the seat frame on the same sliding pivot connecting the seat and rear leg frame, and to pivot the arms to the pivots of the leg frames and to the back frame.

Another important feature resides in slotting the forward ends of the arms to receive the pivot pins of the legs permitting reclining of the chair back and forming upwardly extending pin-receiving notches opening to the slots for the retention of the back in different positions of recline, the

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slots being so arranged as to permit the reclining feature without interference with the collapsing action.

Another important feature resides in the provision of novel "wrap-around" reinforcing and load-supporting structural guide members mounted in the rear leg frame, serving at the same time as a means for guiding the sliding pivot of the seat and rear leg frame and as structural members to reinforce the load-carrying rear leg frame.

In this connection the guides are arranged to encircle the rear leg frame throughout the critical area of bending stresses, permitting the use of lighter tubing in this load-supporting frame and transferring the load of pivotally connected seat and back to the rear legs through pin means operating in guide slots in the supporting guides and having a cross sectional dimension sufficient only to transfer the load in shear, permitting a minimum of metal in the guides.

Another feature of the invention resides in the formation of the guide slots to provide an effective automatic lock with the pin means when the chair is swung to the fully extended and collapsed positions.

Another feature of the invention resides in the novel construction of the rear leg frames to reduce the load-supporting span and load stresses set up under the weight of a person and to at the same time afford increased structural strength in the frames.

These and other objects and features will become apparent with reference to the accompanying drawings in which Figure 1 is a perspective view of a tubular chair construction in accordance with my invention.

Figure 2 is a side elevational view of the chair in the fully extended position.

Figure 3 is a side elevational view showing in solid lines the chair partially collapsed and in dotted lines the chair in its fully collapsed position.

Figure 4 is an enlarged fragmentary part-sectional detail of the connection between the seat, back and rear leg frame and showing the novel wrap-around guide member in end elevation.

Figure 5 is an enlarged vertical sectional detail of the pivot connection of the leg frames and arm.

With reference to the drawings, it will be seen that the chair is made up of a plurality of pivotally connected U-shaped tubular frames forming the back frame 1, seat 2, front leg frame 3 and rear leg frame 4.

The upper open ends of the front and rear legs 3 and 4 respectively are pivotally connected

to each other and to the angle arms 5 by the pivot pins or rivets 6 which engage in the slots 7 in the flanges of the arms at their forward ends in a manner to provide for different positions of recline. The angle members forming the arms 5 are formed with horizontal flange extension portions 8 rolled under to provide a curved forward edge, giving an attractive appearance and also increasing the strength of the section and providing a guard for preventing catching of the fingers between the tubes and the arms in opening and closing the chair.

Pivoted to the front leg frame below the arms 5 adjacent its bight 9 is the seat frame 2, and the free ends of the seat and back frames are pivotally connected remote from the front leg frame, as shown particularly in Figure 4.

The connection between the back and seat frames comprises the bar 10 spanning between and terminating within the extremities of the back frame 1 and intersecting the seat frame 2.

It will be seen that with the chair frame and arms pivotally connected as described the chair can be swung between the positions of Figures 2 and 3. It is in the control of this collapsing action that the present invention has particular merit in providing for controlled efficient and smooth chair movement, while at the same time providing increased strength and rigidity in the highly stressed load-carrying rear leg frame.

According to the invention, provided on the rear leg frame 4 at opposite sides of the chair are the "wrap-around" guide members 11, shown particularly in Figures 1 and 4. These guide members are provided with a U-shaped sleeve-like portion 12 which, as shown in Figure 4, encircles the tube of the frame 4.

The sleeve portions of the guides are shown as formed with inturned lips 13 adding to the strength of the section and providing a block for the removal of the guide members while permitting them to be sprung around the frame tubing.

Extending upwardly from the sleeve portions 12 in a substantially vertical plane are the wings 14 which taper towards the floor and which are formed with slots 15 having notches 16 in their upper end and inclining inwardly towards the rear leg frame adjacent their lower end to bring their lower ends into alignment with the notches 16 on a line parallel with the rear leg frame.

The guide members 11 are anchored to the rear leg frame by the screws 17 or other suitable means, and in surrounding or encircling the tube of the rear leg frame greatly increase the rigidity of the frame and resistance to bending at the critical section where the load of the seat and back frames are transferred thereto and where maximum bending stresses occur under load.

The transfer of the load supported by the seat and back frames is accomplished through the screws 19 threaded through the back frame 1 and into the ends of the cross tube 10, serving as projecting pivot means operating in the slots 15 of the guide members 11.

The outer face of the web of the wings 14 is preferably countersunk at 20 to increase the bearing surface between the screws 19 and their heads 21 and the slotted wings 14.

The rear leg frame 4 has the lower portion forming the floor-engaging portion and including the bight of the frame bent angularly at 22 inwardly into a substantially upright position with the chair extended, as shown in Figure 2.

The portion of the frame 4 forming the bight of the frame is preferably bent up at 23 intermediate the width of the frame to provide separate ground-engaging extremities 24.

The construction of the rear leg frame and the mounting of the brackets in the form of the guide members 11 thereon is an important concept of the present invention. It will be seen that the rear leg frame comprises a load-supporting element fixed at the ends with the chair extended, and the weight of a person sitting on the chair supported by the seat frame 2 and covering 25 carried thereby and back frame 1 and covering 26 carried thereby is transferred through the screws 19 to the rear leg frame intermediate the supported ends. Thus the bending stresses imparted to this latter frame are determined by the weight of the person and length of the unsupported rear leg section.

Normally, to withstand the high bending stresses a frame of heavy tubing would be required. Under the present invention however by employing the guide members 11 rigidly secured to the leg frame along the section of maximum bending stress these guide members serve the function of increasing the resistance of the sections to bending, permitting lighter tubing to be employed in the load-carrying rear leg frame than would be required if this frame had to bear the load without strengthening in its intermediate sections.

The result is a chair of lighter and cheaper construction is provided while an improved collapsing action is afforded, as hereinafter explained.

Additionally to the use of the guide members 11, forming the dual function of guiding the collapsing and opening movements of the chair and reinforcing the intermediate rear leg sections for bending, the deforming of the rear leg frame at 22 still further decreases the stresses in the rear leg frame and permits lighter tube construction.

This reduction in stress occurs because the unsupported span under bending stresses between the ends of the rear leg frame is decreased, and further, the actual deformation of this frame adds to the frame rigidity and strength as is well understood.

With the cross bar 10 seating within the tubing of the back frame 1 the back frame is maintained in correctly spaced relation under loading. This bar 10 is of a cross section to withstand bending under load, and by having it terminate within the back frame the pivot projection means in the form of the screws 19 can be of reduced cross section as they are substantially entirely under shear in transferring the load from the seat and back frames to the rear leg frame through the guide members 11.

These screws 19 are co-axial with the cross bar 10 which forms the pivotal connection between the seat and back frames, and in affording reduced cross section from the tubing 10 permits a reduction in the amount of metal required in the web of the wings 14 of the guide members, adding further to the economy and lightness of the chair.

Collapsing action

Referring now particularly to Figure 2, it will be seen that the seat, front and rear leg frames 2, 3 and 4 form an A-shape with the pivots connecting the leg frames being at the apex of the A and the pivot connecting the seat (and also the back) and rear leg frame forming the cross bar of the A being the sliding pivot.

Under loading of the chair it will be seen that the load can be considered as acting downwardly through the apex of the A to therefore spread the leg frames and as the leg frames spread the seat frame forming the cross bar of the A will be urged upwardly to accommodate the leg spread so that the pivot screws 19 will ride upwardly under loading in the slots 15 and will move into the notches 16.

This is an extremely important safety feature for, contrary to conventional chair constructions which collapse under load unless fully extended and locked, the present chair is moved or urged to a fully extended position by loading and in the event it is only partially extended at the time of loading will automatically move to the fully extended position with the pivot projecting means 19 firmly seated in the notches 16.

In the collapsing action the chair operates much in the manner of an umbrella with the movement of the screws 19 in the slots 15 governing the movement of all pivotal parts.

To move the chair to the collapsed position, as shown in Figure 3, the back and seat frames are grasped and the chair is lifted clear of the floor as these frames are swung together. Any tendency to lift the chair will move the screws 19 which connect or tie the back and seat to the rear legs out of the notches 16, and the simple closing together of the back and seat frames forces the screws to travel along their predetermined linear path formed by the slots 15 and all parts move in controlled and co-ordinated movement to to the finalized position shown in dotted line, eliminating any uncontrolled frame swinging which might occasion damage to nearby furniture or inconvenience in handling.

As the chair slides to the fully collapsed position, due to the incline of the slots 15, the pivot screws 19 move inwardly towards the rear leg frame to hold the frames of the chair in collapsed position against accidental opening movement until the back and seat frames are grasped and pulled outwardly as pull is applied to lift the chair in an upward direction.

In the collapsing action it will be noted that the arms 5 are somewhat inclined rearwardly and the notches 27 and 28 formed in the upper longitudinal edges of the slots 7 are inclined forwardly and upwardly, permitting and ensuring movement of the arms forwardly without obstruction until pins 6 enter notches 28.

The slots 7 are so formed that with the pivot pins 6 entered in notches 28 the arm and seat pivot spacings are equal as are the spacings of the front and back frames to provide a pivotal parallelogram as shown in Figure 3. This parallelogram can then fold by extending its increasing length along the slots 15 of the leg members 11, Figure 3.

With the chair extended the notches 27 and 28 block rearward movement of the arms with the weight of the arms automatically causing entry of the pins into the notches. Thus the back frame 1 is adjustable to different positions of recline about the pivot rod 10 forming the sliding seat and back pivot in the slides 11 and is locked in adjusted recline position against rearward movement.

While I have shown the preferred form of my invention, it will be understood that modifications may be made in the precise form of guide member and guiding action without departing from the spirit of the invention wherein guiding of the chair and controlling of the chair movement is accomplished through the use of structural members reinforcing the main load-carrying chair frame, permitting lighter overall chair construction.

What I claim as my invention is:

1. In a collapsible tubular chair construction having pivotally connected back, seat, front and rear leg frames with said seat frame pivoted at the rear to the lower end of said back frame, a pair of guide members having sleeve portions encircling portions of said rear leg frame intermediate the top and bottom and at opposite sides of the chair to reinforce said rear leg frame in bending and having wing portions projecting from said sleeves and formed with elongated slots therein, pivot means forming an extension of the pivotal connection of said back and seat frames and entered in said slots affording a linear sliding pivotal control connection tying the pivot of said back and seat frames to said rear leg frame and constraining the pivots of said back and seat frames to move in guided linear sliding motion along said rear leg frame while permitting free pivotal movement of said back and seat frames, said slots terminating at their upper ends in notches seating said pivot means against movement in said slots under load upon said chair being extended.

2. A device as claimed in claim 1 in which the slots in said wing portions of said guide members incline inwardly towards the bottom of said rear leg frame.

3. In a collapsible tubular chair, U-shaped front and rear leg frames pivotally connected at their upper open ends, U-shaped back and seat frames pivotally connected at their open ends, said seat frame being pivoted to said front leg frame, arms pivoted to said back frame and to said leg frames, a pair of wraparound guide members encircling said rear leg frame and strengthening same in bending intermediate the length thereof at opposite sides of the chair and formed with longitudinal substantially linear slots, pivotal projection means extending from said back and seat frames and engaging in the slots in said guide members and forming a sliding pivotal connection tying the pivot of said back and seat frames to said rear leg frame permitting collapsing and extending of the chair while constraining the pivot of said back and seat frame to move in guided linear sliding motion along said rear leg frame while permitting free pivotal movement of said back and seat frames.

4. A device as claimed in claim 3 in which said U-shaped rear leg frame is bent angularly inwardly adjacent the bottom to present a substantially upright floor-engaging lower portion.

5. A device as claimed in claim 3 in which said U-shaped rear leg frame is bent angularly inwardly to define a substantially upright floor-engaging bight portion, said bight portion being bent upwardly intermediate the width thereof.

6. A device as claimed in claim 5 in which the pivot connecting said seat and back frames comprises a tubular bar intersecting the seat frame tubing and terminating within the back frame tubing and spacing said back frame, and the pivot means entered in said slots is of a lesser cross section than said bar and comprise screws screws threaded into the ends of said tubular bar and riding in said slots.

7. A device as claimed in claim 6 in which said guide members are countersunk in their outer surfaces along said slots and said screws having

their heads riding on surfaces formed by countersinking.

8. In a collapsible tubular chair construction including a front leg frame, an inclined rear leg frame pivotally connected to said front leg frame, a seat frame and arms pivotally connected to said front leg frame and a back frame pivotally connected to said arms and seat frame in which means are provided to tie said back and seat frames to said rear leg frame to constrain the point of pivotal connection of said back and seat frames to linear sliding movement along said rear leg frame while permitting free pivotal movement of said back and seat frames, said means comprising a pair of guide members carried by and reinforcing said rear leg frame, one at each side of the chair, substantially linear slots in said members, and projection means extending coaxially with the pivotal connection of said back and seat frames engaging in said slots and transferring load on said seat to said rear leg frame through said guide members.

9. In a collapsible chair having pivotally connected back, seat, front and rear leg frames with said seat frame pivoted at the rear to the lower end of said back frame, a pair of guide members encircling portions of said rear leg frame intermediate the top and bottom thereof and at opposite sides of the chair, means forming an extension of the pivot connection of said back and seat frames non-removably and slidably engaged in said guide members and affording a pivotal sliding control connection tying the pivot of said back and seat frames to said rear leg frame and constraining the pivot of said back and seat frames to move in guided linear sliding motion along said rear leg frame while permitting free pivotal movement of said back and seat frames, said guide members including stop means to bar movement of the aforesaid connecting means along said rear leg frame under loading to maintain said back, seat and rear leg frames against relative movement with the chair in extended position.

BLAIR FOWLER HARBER.

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