Aug. 16, 1960 W. J. HELTON 2,948,904

FOLDING SOFA BED STRUCTURE

Original Filed March 6, 1957 3 Sheets-Sheet 1

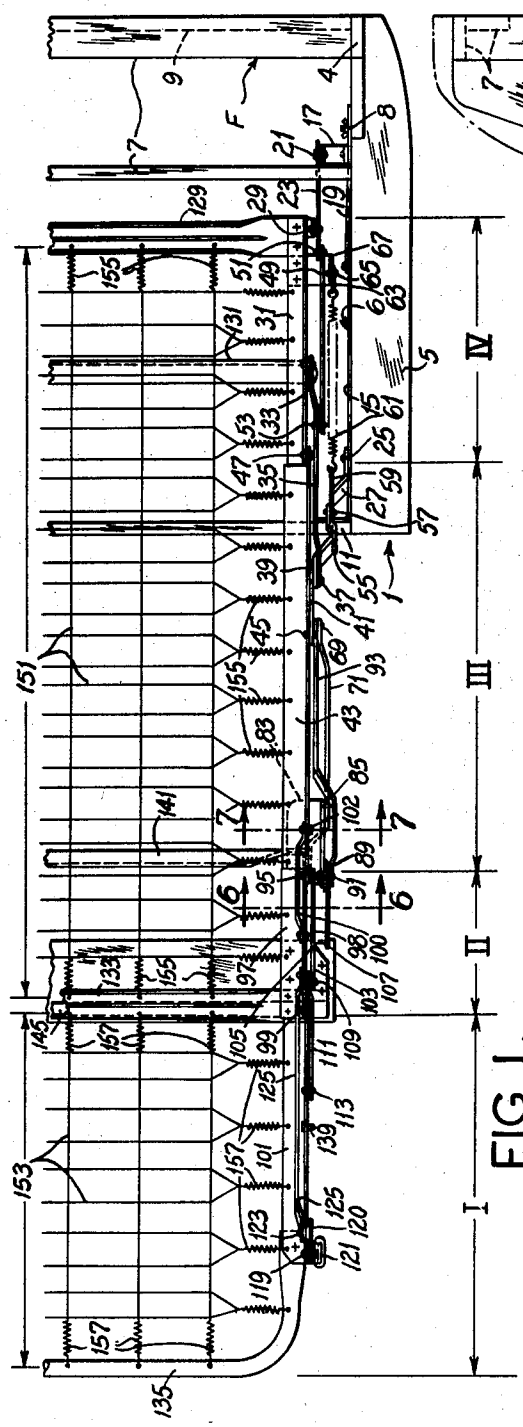


FIG. 1.

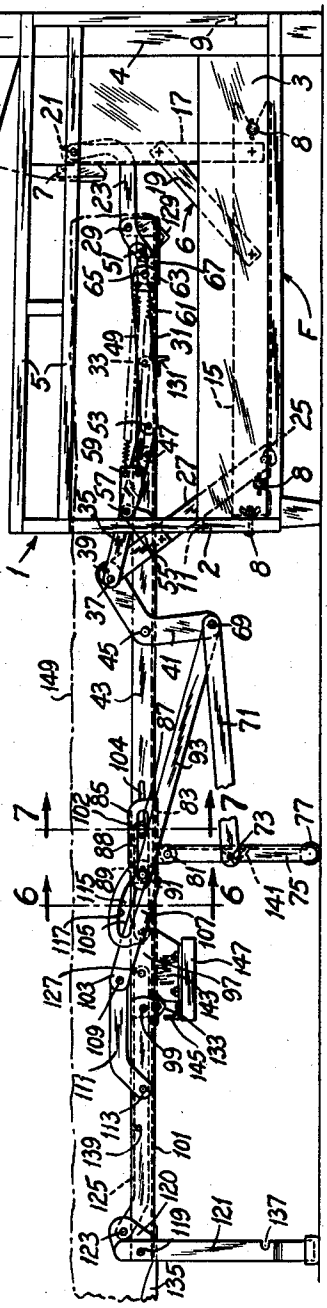


FIG. 2.

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FOLDING SOFA BED STRUCTURE

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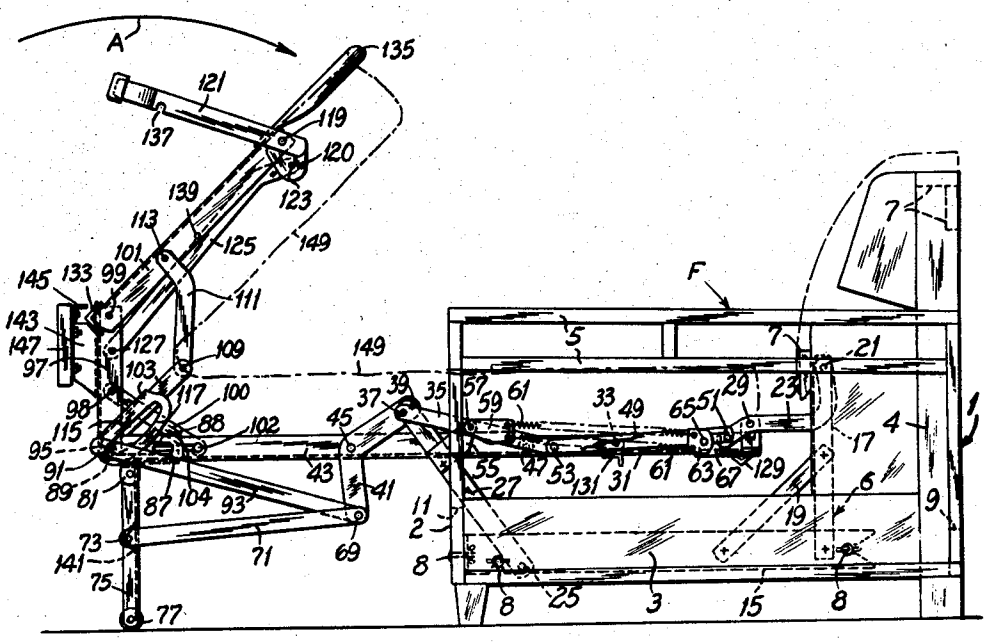


FIG. 3.

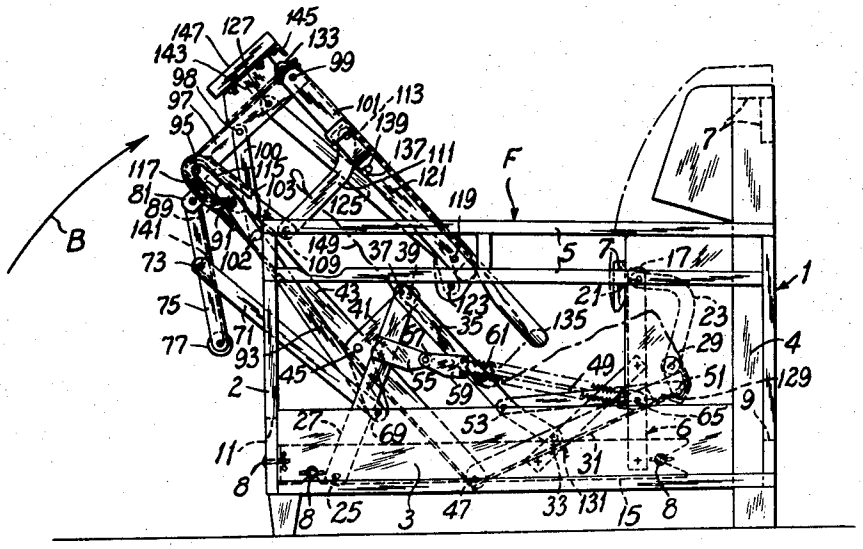


FIG. 4.

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FOLDING SOFA BED STRUCTURE

Original Filed March 6, 1957 3 Sheets-Sheet 3

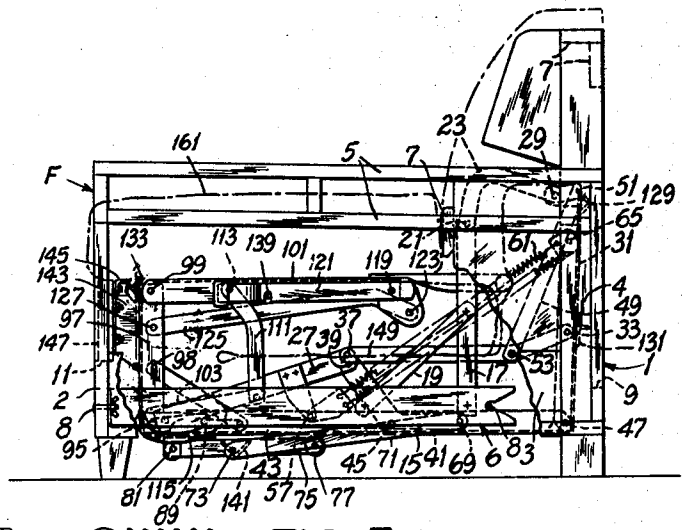


FIG. 5.

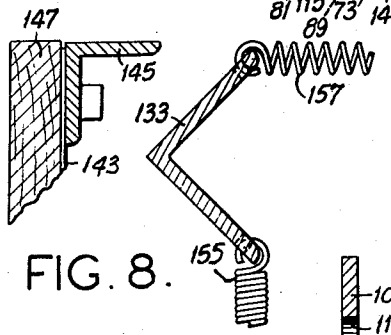


FIG. 8.

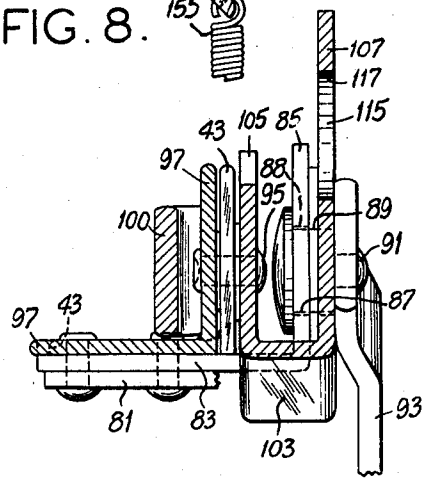


FIG. 6.

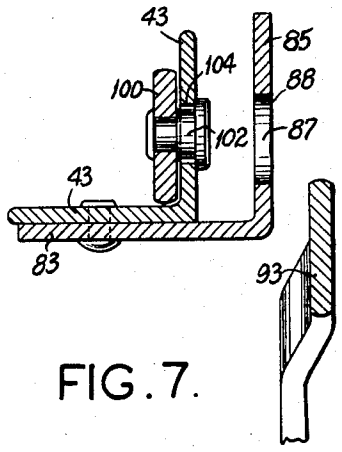


FIG. 7.

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FOLDING SOFA BED STRUCTURE

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Original application Mar. 6, 1957, Ser. No. 644,291. Divided and this application Oct. 28, 1957, Ser. No. 692,870

4 Claims. (Cl. 5—13)

This invention relates to a sofa bed of the class comprising a plurality of interconnected folding sections which, when unfolded in substantially horizontal alignment, form a bed, and which may be moved into folded position within a sofa frame to form a sofa.

This application is a division of my United States patent application Serial No. 644,291, filed March 6, 1957, for Folding Sofa Bed Structure.

Among the several objects of the invention may be noted the provision, in a folding bed structure employing a linkage connecting a first or seat section with other sections so as automatically to fold and lock a mattress in respect to simple folding movements from bed to sofa formation, of independent fabric supports for mattress support when the device is in use as a bed, and for a sofa cushion support when the device is in use as a sofa, said supports avoiding the use of an upholstery board frame for anchoring purposes and thereby minimizing unsupported marginal cushion areas. Other objects and features will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, features of construction, and arrangements of parts which will be exemplified in the structures hereinafter described, and the scope of which will be indicated in the following claims.

In the accompanying drawings, in which one of various possible embodiments of the invention is illustrated,

Fig. 1 is a half plan view of the improved bed in unfolded bed-forming position, the usual mattress, cushions and trim being omitted;

Fig. 2 is a fragmentary right-side elevation of Fig. 1, showing in dash lines the location of a mattress and some trim;

Fig. 3 is a complete right-side elevation similar to Fig. 2, showing an intermediate step in folding the sections from bed to sofa configuration;

Fig. 4 is a view similar to Fig. 3, showing a subsequent folding step;

Fig. 5 is a view similar to Fig. 4, showing the parts folded into sofa-forming position and showing in additional dash lines the application of a sofa cushion, parts being broken away for clarity;

Fig. 6 is an enlarged detail cross section taken on lines 6—6 of Figs. 1 and 2;

Fig. 7 is an enlarged detail cross section taken on lines 7—7 of Figs. 1 and 2; and

Fig. 8 is an enlarged detail vertical cross section on the longitudinal center line of the sofa showing the support of the front edge of a sofa cushion and the adjacent support of the spring fabric.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings. For clarity, and unless otherwise indicated, rigid connections which are formed by equivalent rivets, weldments, bolts, screws, etc., are indicated in plan by means of small right-angular crosses. Since the construction is

symmetrical, both sides of the device consisting of parts which are glove-images of one another, only one side is illustrated. It is to be understood that the description of one side serves for both.

Referring now to the drawings, there is shown in general at F the usual sofa frame, generally composed of wood and forming the foundation for the usual upholstery and trim employed. This frame F consists of side sections 1, providing supporting spans 3, uprights 2 and 4, and arm rests 5. The side sections 1 are joined by upper back-forming cross braces 7. They are also joined by lower back and front cross braces 9 and 11, respectively. The side sections 1 and the forward cross brace 11 also form the supports for two rigid metal assemblies or subframes 6. These subframes are attached to the wood frame F by means of bolts 8.

Each subframe 6 consists of angularly related bars 15 and 17, held relatively rigid by a corner brace 19. Each of these subframes supports one of a pair of lateral linkages, the linkages being transversely connected, as will appear (Fig. 1) to form folding sections I, II, III, IV, respectively. Before describing such sections, the linkages will be described. Inasmuch as the linkages on opposite sides are identical, the description of the one will suffice for both.

Referring then to the right-side linkage, a pin 21 on fixed bar 17 forms a fixed pivot for an angularly formed first double-curved swing link 23. A second pin 25 on fixed bar 15 forms a fixed pivot for a second swing link 27. The swing link 23 carries a pin 29, forming a pivot with an angle iron side bar 31 of section IV. Bar 31 carries a pin 33 forming a pivot for one end of a curved link 35. The other end of link 35 is pinned to the upper end of swing link 27 (see pivot pin 37). The upper end of swing link 27 carries another pivot pin 39, slightly offset from pin 37, forming a pivotal connection with a bell crank 41, which in turn is pivoted at 45 to an angle iron side bar 43 of section III. The rear end of bar 43 is pivoted to the forward end of bar 31 (see pivot pin 47).

A control link 49 is at one end pivoted to the outermost end of link 23 by means of a pin 51 and at its other inner end to an intermediate pivot 53 on curved link 35. Riveted to link 27 is a lug 55, to which a rocker plate 59 is pivoted at 57. Two tension springs 61 are attached to rocker plate 59. The other ends of these springs are attached to a rocker plate 63, pivoted at 65 to an angle lug 67 rigidly attached to the bar 31.

The bell crank 41 carries a third pivot pin 69, for pivoting one end of a first drag link 71. The other end of link 71 is pivoted at 73 to a mid portion of a folding leg 75. The leg 75 carries a lower caster 77 and at its upper end is pivoted to an angle lug 81 fastened by riveting to the outer end of said bar 43 section III. Riveted to the bottom of the bar 43 is the horizontal bottom side 83 of an angle iron, the vertical side of which forms a plate 85 (see Fig. 7). Thus plate 85 is held in rigid, spaced parallel relationship to the vertical side of the angle iron bar 43. The plate 85 is preferably straight slotted, as shown at 87, for the reception of a follower pin member 89, riveted on pivot point 91 to one end of another drag link 93 (Fig. 6). At its other end link 93 is pivoted to the bell crank lever 41 at said pivot pin 69.

As the bed is folded into sofa position, links 27, 35 control the position of bell crank 41 so that it turns on pivot 45 and through pin 69 forms a driving member for links 71, 93.

Pivoted at 95 to the outer end of bar 43 is an angle iron bar 97 of section II. Pivots 91 and 95 are separate. They are coaxial only when the parts are in the positions shown in Figs. 1–3, 6 and 7. Pivoted at 99 to the outer end of the bar 97 is an angle iron bar 101 of section I,

Pivoted at 98 to the bar 97 is a stop forming bar 100. Bar 100 carries a pin 102 at its other end, which slides in a slot 104 cut into the vertical side of the bar 43 (see Fig. 7). The slots 87 and 104 are in transversely spaced vertical planes. As above remarked, pivot 95 is in concentric alignment with pin 89 when the pin is in its position corresponding to the positions of it in Figs. 2 and 3. At this time pin 102 is forward in its slot 104. It moves to the other end of the slot in the Fig. 3 configuration.

At 103 is shown a link which is partly channel shaped, having spaced inner and outer sides 105 and 107, respectively. The side 105 rotates on said pivot 95 on bar 43. Its other end is pivoted at 109 to a link 111, the latter at its outer end being pivoted at 113 on the bar 101 of section I. Pivot 113 is at an intermediate point on bar 101.

In the outer side 107 of the link 103 is a slot 115 which preferably, though not necessarily, is curved on one side 117, as shown. One end of this slot has the same radius of curvature as, and is concentric with the pin 89, when the parts are in the positions shown in Figs. 2, 3 and 6.

Pivoted at 119 at the outer end of the bar 101 is a folding leg 121. The upper end of this leg is provided with a fixed lug 120, pivoted at 123 to a link 125. The other end of link 125 is pivoted at 127 to the bar 97. Motion of leg 121 is limited by engagement of a notch 137 in it with pin 139.

The upper edge 88 of slot 87 and the edge 117 of slot 115 have relative rotary action in response to clockwise rotation of link 103 (compare Figs. 2 and 3). This at first occurs while pin 89 is in retracted position at the forward ends of slots 87 and 115 (Figs. 2, 3, 6 and 7). Thereafter, for reasons which will appear, further relative angling action may be enforced by rearward movement of the pin 89 in both slots 87 and 115 (Figs. 4 and 5). This is in the sense that as the pin 89 is pulled along slot 85 by drag link 93, edges 88 and 117 are wedged from angled positions into increasingly more parallel positions. Or, in other words, the slots 115 and 87 are swept into increasingly more alignment by advance movement therein of the pin 89. The edges 88 and 117 may also be referred to as relatively angling cam surfaces fastened to the bar 43 and link 103, respectively, said cam surfaces when required being adapted to be driven apart by the follower pin 89 wedgingly moving in between them in response to pull from the drag link 93. It is to be noted that edge 117 of slot 115 is uppermost in the position of Figs. 1, 2 and 6. It becomes lowermost in the positions of Figs. 3, 4 and 5.

There is a pair of linkages such as above described, one on each side of the sofa bed. Their bars, links and levers are in pairs and operate in parallel by reason of the following cross connections between the linkages. Starting with the side bars 31, these are cross connected by means of riveted cross braces 129 and 131, thus establishing section IV as a rigid assembly. There are no cross braces connecting the bars 43 but they will be referred to as the third section III because they are sufficiently braced by adjacent sections and by reason of a cross brace 141 connecting the folding legs 75 of this section III. The short bars 97 are joined by a riveted cross brace 133. As is clear from the drawings, this cross brace is in the form of an angle iron, the legs of which are disposed diagonally of the general plane of the intermediate frame section II. The arrangement is such that when the sections are in coplanar bed-forming position the angle iron edges are disposed in the general common plane of certain wire fabrics 151, 153 (to be described below) and hold both the fabrics taut and the corner of said angle iron is beneath said plane (see Figs. 1 and 2). When the frame sections are in the sofa-forming relationship shown in Fig. 5, one of said angle iron edges is in the plane of the fabric of the upper horizontal frame section and holds that fabric taut and the remainder of the angle iron is below said plane and the fabric attached thereto is slack (see Fig. 5).

Hereinafter the bars 97, with the cross brace 133, will be referred to as a front or upholstery board or second section II. At the outer end of the bars 101 is welded a curved cross brace 135. The bars 101 and cross brace 135 will hereinafter be referred to as the seat, cushion or first section I.

Riveted to bars 97 of section II are short Z shaped brackets 143. These brackets rigidly support an angle iron cross member 145. A front board 147, to which upholstery may be secured, is fastened at opposite ends to brackets 143 and at intermediate intervals to cross member 145. When the sections are in sofa-forming position (Figures 5, 8) the horizonal flange of member 145 acts as a space filler bar and cushion support in the gap between board 147 and cross brace 133. Member 145 and brackets 143 support board 147 independently of any connection with cross brace 133 which has its legs disposed diagonally of the general plane of section II. When the sections are in sofa-forming position (Figures 5, 8) the outer edge of the upwardly extending leg of cross brace 133, to which fabric 153 is attached, is no higher than the general plane of the fabric while the remainder of the angle depends from the fabric plane and is below the level of the horizontal leg of front board angle 145. When the sections are in co-planar bed-forming position (Figure 2) the outer corner of angle iron cross brace 133 points downwardly and the entire angle except its outer edges is below the general plane of fabrics 151, 153. At each end of cross brace 133 its legs are spread into a common-plane, flat terminal riveted to the adjacent side bar 97 of section II.

A mattress is shown in dotted lines at numeral 149 in Figs. 2–5. The mattress is supported by two separate sections of articulated flexible wire fabric. One fabric is numbered 151 and the other fabric 153 (Fig. 1). The fabric 151 is supported across the bed in sections II, III and IV. This is accomplished as to fabric 151 by helical springs, or so-called helicals 155, the outer ends of transverse helicals 155 being hooked in openings in bars 31, 43 and 97 and the outer ends of longitudinal helicals 155 being hooked in openings in cross braces 129, 133. The fabric 153 is supported in section I by coil springs or helicals 157, the outer ends of which are hooked in openings in bars 101 and into openings formed in the cross braces 133, 135. Movement of bed section I, carrying the fabric 153, upwardly from the horizontal and relative to cross brace 133 of section II causes some relative movement of the margin of the fabric 153 adjacent to brace 133. This is compensated by stretching of adjacent ones of the springs 157 (Fig. 5).

Operation is as follows, starting with the bed-forming configuration of parts shown in Figs. 1 and 2 and speaking in the plural in regard to both side linkages:

The operator grasps the endwise cross brace 135 and moves it archwise (see dart A, Fig. 3) in a direction toward the frame F, which hinges sections I and II relative to section III and brings the parts into the position shown in Fig. 3, wherein several events have occurred. First, section II has rotated on the pivots 95 connecting it with section III. The pins 102 of bars 100 have moved to the inner ends of the slots 104, thus stopping section II in the vertical position relative to section III shown in Fig. 3. During this movement section I has rotated forward relative to section II, pivoting at 99. At the same time, legs 121 have been angled partially inward toward the bars 101, because of the thrusting action of link 125 between its pivots 123 and 127. The action thus far described has only partially folded the mattress, and has involved little reaction on the hands of the operator. Any further folding action requires a substantial mattress folding force which it is preferable not to supply by further manual pressure on brace 135.

Therefore, the next step of the operation is to grasp the bottom of the now raised and accessible upholstery

board 147 and lift it archwise from the Fig. 3 position toward the Fig. 4 position (see dart B, Fig. 4). During this step the following events occur automatically: First, the original straight-line relationship between the pairs of bars 31 and 43 in Fig. 3 is broken at the pivot points 47 between sections III and IV. Then, by reason of the constrained-motion relationship between pairs of bars 31, 43, upper legs of bell cranks 41, and links 35, the bell cranks 41 rotate to pull upon drag links 71 and 93. Drag links 71 then start to pull and fold in the legs 75. At this time, the drag links 93 pull the pins 89 along the slots 87 in the plates 85 which are attached to bars 43. At the beginning of this movement (as shown in Fig. 3) the slots 115 in links 103 are at an angle to the slots 87. Consequently, the pins 89 in their constrained movements forward along slots 87, tend to force the slots 115 into general alignment as the Fig. 4 position is reached. In other words the pivots 109 are drawn down toward bars 43. This action is transmitted through links 111 to bars 101, and consequently to the entire section I which presses down in a folding direction upon the mattress. This closing and mattress folding action of section I relative to section III requires no assistance by pressure on bar 135, and responds only to pressure on the upholstery board 147.

Another action that occurs between the Fig. 3 and Fig. 4 positions of parts is that the links 125 further rotate legs 121 into positions wherein the notches 137 engage the pins 139, thus limiting the infolding of said legs.

Figure 4 shows the parts in a temporary intermediate folding (or unfolding) position and this figure does not necessarily indicate a dwell in the folding operation. It does indicate a position when the outer end of link 27 is no longer rising but has moved past a point vertically above its pivot 25 and is descending. In this position the left hand two-thirds of the mattress has been doubled on itself and the overlying portions have been squeezed toward each other and framing sections I and III are locked against movement away from each other by the spacing of pin 91 in the right hand portions of slots 87 and 115 in plate 85 and link 103. The folded end of section I is so held that, with continued inward movement of the folded sections I and III, cross brace 135 will pass under the lower back cross brace 7. There remains a final folding and squeezing action as the operator pushes the footboard 147 downwardly and the sections move to the poistion shown in Figure 5, where pin 91 has shifted further toward the right hand ends of slots 87 and 115 in plate 85 and link 103.

The weight of the parts after passing the Fig. 4 position (approximately) tends to carry them toward their final Fig. 5 position, and in order partially to counterbalance this action for convenient subsequent unfolding, the springs 61 have been caused by the linkage to stretch, exerting the required partial counterbalancing action, though not enough in view of friction to return the sections from the sofa-forming configuration of Fig. 5, without some manual assistance. A final downward push on the upholstery board 147 causes the configuration of Fig. 5 to be reached which is maintained by gravity.

Unfolding is accomplished by lightly lifting up on the upholstery board 147 and drawing it forward. This action is aided by the partially counterbalancing tension in the springs 61. Then the parts are brought out through the Figs. 4 and 3 poistions to the position of Figs. 1 and 2. In passing from the Fig. 4 to the Fig. 3 position, the pins 89 return to the forward ends of the aligned slots 87, 115, thus permitting plates 85 and 107 to angle apart. Then the braces 135 are grasped to rotate sections I and II into the bed-forming configuration of Figs. 1 and 2. During this movement, pins 102 move forward along slots 104. Sections I and II are held coplanar by contact between the ends of bars 43 and 97 adjacent pivot 95.

In the Fig. 5 sofa position, the fabric 153 is uppermost and is adapted to receive a cushion 161, shown in dotted lines. Therefore, section I, which contains wire fabric 153, may be called a cushion section. The forward edge of the cushion 161 rests upon the top of the filler bar 145 of upholstery board 147. Since fabric 153 does not extend beyond cross brace 133, a space would be left between cross brace 133 and the top of the upholstery section 147, except for the fact that the space filler bar 145, carried on brackets 143, has been introduced in position in this space, so as to form said support for the marginal portions of the cushion spanning the space.

From the above it will be seen that the invention provides several advantages:

First, the mattress supporting fabric 151 and its helicals 155 is mounted independently of the other mattress supporting fabric 153 and its helicals 157. Hence the tension on either fabric is not affected by any temporary or permanent elongation of the other fabric and its helicals due to folding and unfolding of the bed or because of stretching of the other fabric by heavy loading. The cushion supporting fabric 153 of section I is tensed solely by helicals 157 secured to the relatively small rectangle 101, 133, 135 and there is little variation in the tension on this fabric due to folding and unfolding.

Also, the upholstery board 147 and its supports 143, 145 are free of attachment to the fabrics 151, 153 and their helicals and is not subject to deformation by the fabric tension or loading.

Also, since angle 133 is positioned so near the forward portion of the seat section, when the bed is folded, it provides a firm supporting surface for the front edges of the cushions, thereby preventing the cushions from breaking apart. This increases the life of the cushions.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. A sofa bed structure comprising successive pivotally interconnected frame sections movable to a coplanar bed-forming relation and to a folded sofa-forming relation in which two sections are substantially parallel and spaced one above the other and an intermediate upright frame section extends between their forward edges, a fabric extending substantially throughout the intermediate frame section and one of the adjacent frame sections, another fabric extending substantially throughout the other adjacent frame section, the fabrics being secured to the sides of the corresponding frame sections, there being an angle iron cross brace between the side bars of the intermediate frame section with the legs of the angle iron cross brace disposed diagonally of the general plane of the intermediate frame section and the edges of the angle legs substantially in the plane of the fabric when the frames are in coplanar relation, each of said fabrics having an end margin independently secured to a respective leg of the angle iron cross brace and the corner of the angle iron cross brace being below the level of the fabric when the frame sections are in co-planar bed-forming relation and being at the level of and beyond the end of the fabric in the upper frame section when the frame sections are in folded sofa-forming relation.

2. A sofa bed structure according to claim 1 in which a front board is mounted on the intermediate frame section independently of the angle iron cross brace and includes a top member of angle cross section with one of its legs extending over the corner of said angle iron

cross brace, when the frame sections are in folded sofa-forming relation, and in substantially the same plane as the fabric secured to the upper leg of the angle cross bar brace.

3. A sofa bed structure comprising successive pivotally interconnected frame sections, each having side bars and adapted to be swung to an unfolded substantially co-planar bed-forming relationship and to a folded sofa-forming relationship wherein two frame sections are substantially horizontal and parallel and spaced apart vertically one above the other and an intermediate frame section is substantially upright and connected at its ends to the front edges of said horizontal frame sections, the intermediate frame section including an angle iron cross brace connecting the upper ends of the section side bars with the angle iron legs disposed diagonally of the general plane of the section, there being a fabric extending throughout the intermediate frame section and the lower horizontal frame section, another fabric extending throughout the upper horizontal frame section, the side margins of said fabrics being secured to the side bars of the corresponding frame sections and the adjacent ends of said fabrics being separately secured to respective edge portions of the legs of said angle iron cross brace, so that when the frame sections are in co-planar bed-forming relationship, said angle iron edges are disposed in the general common plane of the fabrics and the corner of said angle iron is beneath said common plane, and when the frame sections are in sofa-forming relationship, one of said angle iron edges is in the plane of the fabric of the upper horizontal frame section and the remainder of the angle iron is below said last-named plane.

4. A sofa bed structure comprising successive pivotally interconnected frame sections movable to a coplanar bed-forming relation and to a folded sofa-forming relation in which two frame sections are substantially parallel and spaced one above the other and an intermediate upright frame section extends between their forward edges, a wire fabric extending substantially continuously throughout the intermediate frame section and one of the adjacent frame sections, another wire fabric extending substantially continuously throughout the other adjacent frame section, the fabrics being secured to the sides of the corresponding frame sections, a rigid cross brace of angular cross section extending between the side bars of the intermediate frame section at the end of the latter nearer to the latter-mentioned adjacent frame section, the end portions of the cross brace being fixedly secured directly to said intermediate section side bars, said cross brace having longitudinal outer edges spaced apart transversely of its length, each of said fabrics having an end margin independently secured to a respective longitudinal outer edge of the cross brace, both longitudinal outer edges of the cross brace being at the level of said fabrics and holding said fabrics taut when the frame sections are in coplanar bed-forming relation, the cross brace having one of its longitudinal outer edges at the level of the fabrics in the upper frame section and holding taut the fabric in that section when the frame sections are in folded sofa-forming relation while the other longitudinal outer edge of the cross brace is below said latter-mentioned level and the fabric attached thereto being slack.

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