July 7, 1953 A. LORENZ ET AL 2,644,171

COMBINED SOFA SEAT AND BED

Filed April 24, 1951 2 Sheets-Sheet 1

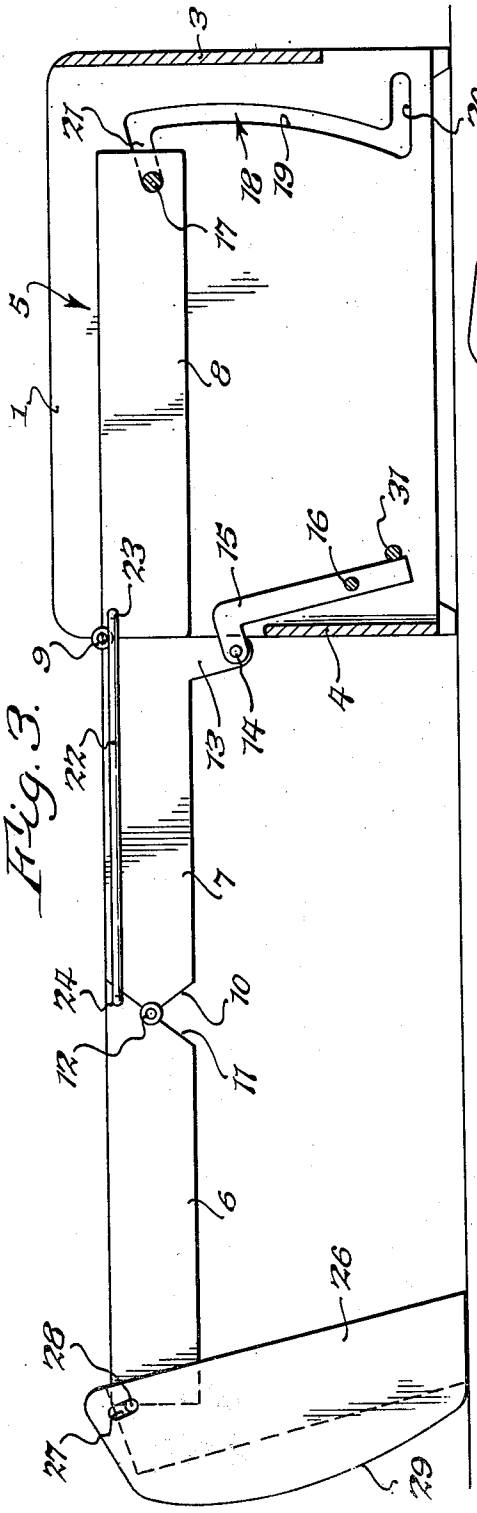


Fig. 3.

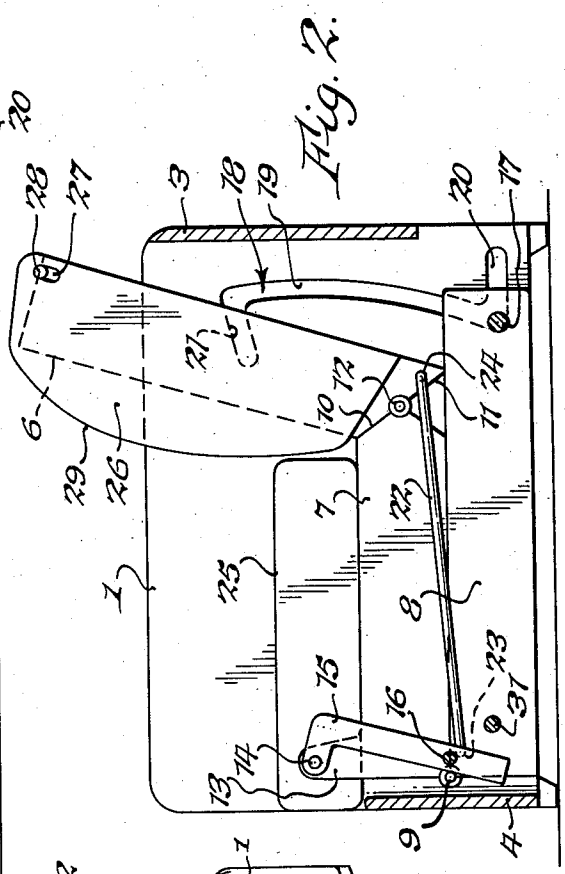


Fig. 2.

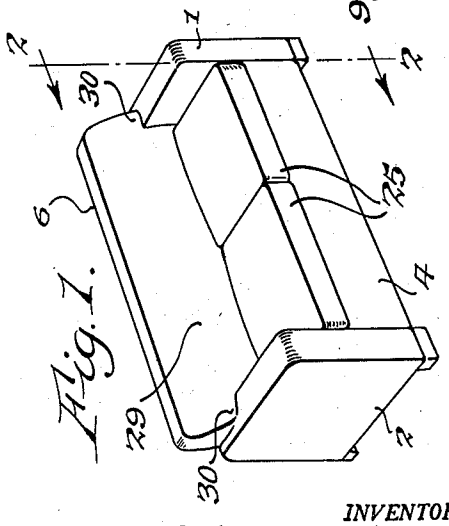


Fig. 1.

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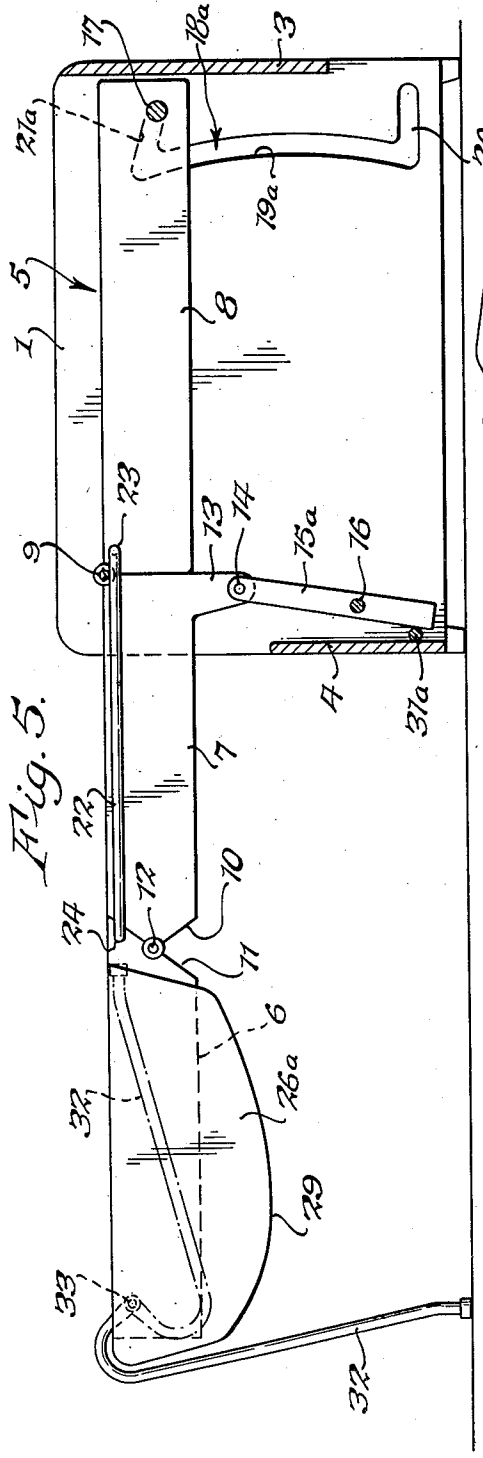


Fig. 5.

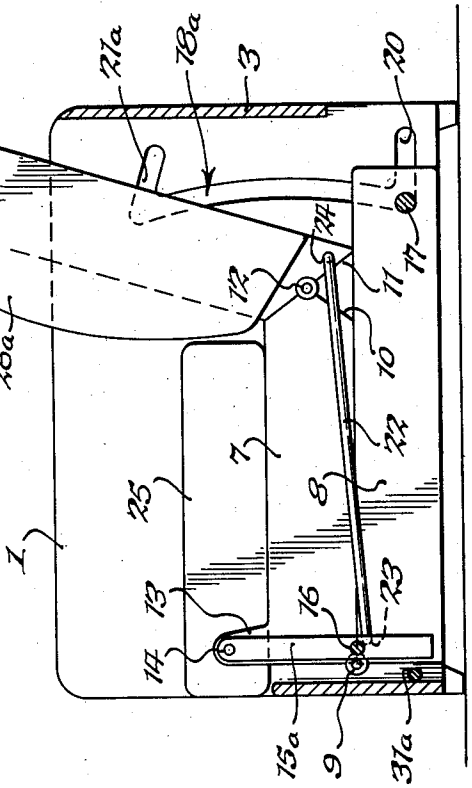


Fig. 4.

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UNITED STATES PATENT OFFICE

2,644,171

COMBINED SOFA SEAT AND BED

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Application April 24, 1951, Serial No. 222,667

8 Claims. (Cl. 5—46)

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This invention relates to sofa beds which may be converted between sofa seats and beds selectively.

An object of this invention is to provide an improved sofa bed which may be converted by simple manipulations alternately into a bed and a sofa seat; which may have a length as a sofa seat approximately equal to the width of the desired bed; which will open into a full length bed; which resembles an ordinary sofa seat in appearance and size; which requires no manually operable locking mechanism to hold the various parts in either bed or sofa seat positions; with which the sofa seat cushion will have the usual desired height and the mattress may have the normal level of the mattress in standard beds; which will be stable and rigid in both bed and sofa seat positions, regardless of where one sits or lies on it in normal use, and which is relatively simple, compact, durable, practical and inexpensive in construction, convenient in manipulation and comfortable in use, and attractive in appearance.

Various other objects and advantages will be apparent from the following description of two embodiments of the invention, and the novel features will be particularly pointed out hereinafter in connection with the appended claims.

In the accompanying drawings:

Fig. 1 is a perspective of a sofa bed constructed in accordance with this invention and in condition for use as a sofa seat.

Fig. 2 is a transverse, sectional elevation of the same, the section being taken approximately along the line 2—2, Fig. 1;

Fig. 3 is sectional elevation similar to Fig. 2, but with the parts opened into bed positions;

Fig. 4 is a sectional elevation similar to Fig. 2, but illustrating a modification thereof; and

Fig. 5 is an elevation similar to Fig. 4, but with the parts opened into bed positions.

In the embodiment of the invention illustrated in Figs. 1–3, the device includes a support formed of upright end members 1 and 2 which are arranged face to face but spaced apart, and connected by intermediate cross members 3 and 4 to form a rigid supporting structure. A hollow or pan-like mattress-supporting frame 5, such as a shallow box with an open face, is disposed between the end members 1 and 2 and formed of a plurality of sections 6, 7 and 8 which, in the bed position, are disposed edge to edge, as shown in Fig. 3. The sections 7 and 8 are connected together at adjacent ends by a hinge 9 disposed at the upper, abutting corner edges when the sections are in straight-out or bed positions. The side edge 10 of section 7, opposite from the hinge 9, has the form of a dihedral angle, that is, it is V-shaped, and the adjacent edge 11 of the section 6 is oblique to the top and bottom faces of that section.

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Hinges 12 are provided at opposite ends of the sections 6 and 7 to connect the abutting edges of those sections. These hinges 12 are disposed midway of the width of the oblique face 11, that is, at a line midway between the upper and lower faces of the section 6 in the face 11, and the connection of the hinges to the V-shaped edge 10 is at the vertex of that angle. When the sections 6 and 7 are straight-out, as in bed positions (Fig. 3), the oblique face or edge 11 abuts against the upper part or side of the V-shaped edge 10, as shown in Fig. 3. The section 7 is provided at its ends and adjacent the section 8 with a depending lug 13, and each of these lugs is connected by a pivot pin 14 to one end of an adjacent link 15 which, in turn, is pivoted at 16 to one of the end members 1 or 2. There is a link 15 at each end of the support, one being pivoted to the inner face of the upright end member 1 and the other to the inner face of the other end member 2. Preferably, each link 15 is L-shaped, and the leg of the L is pivoted intermediate of its length on the pivot 16, and the pin 14, which pivotally connects it to the lug 13, is near the free end of the arm of the L.

The free side edge of the section 8 is provided at each end with a projecting cam follower 17, which may be a pin with a roller on the end, or just a projecting pin that extends from each end face of the section 8. Each end piece 1 and 2 is provided on its inside face with a cam groove 18, which has an upright section 19 and laterally extending end terminals or branches 20 and 21. The lower terminal or branch 20 extends rearwardly from the lower end of the upright section 19, and the upper terminal or branch 21 extends forwardly and slightly downwardly at an incline, as shown in Fig. 3. When the sections 6, 7 and 8 are in bed-positions, as shown in Fig. 3, the cam followers 17 will be in the forward ends of the upper terminals or branches 21, but when the sections are folded into the sofa seat positions, as shown in Fig. 2, then the followers 17 will be disposed in the lower branches or extensions 20, as shown in Fig. 2.

A stabilizer rod 22 extends along each end of the section 7, and at one end is pivoted at 23 to an end wall of the section 8, closely adjacent the hinge 9 and the upper face of the section 8.

At its other end the rod 22 is pivoted at 24 to the adjacent end face of the section 6 adjacent the upper corner which the upper face of section 6 makes with its oblique edge 11. Removable seat cushions 25 are provided to rest upon the section 7 when the sections are in folded or sofa-seat positions, as shown in Fig. 2. A shell or casing 26 telescopes over the underface of the section 6 when the sections are in the Fig. 3 position, and is hinged at one end to the section 6 by providing elongated slots 27 in the ends of the shell 26, which receive short studs 28 that project from the ends of the section 6.

When the sections are in folded or sofa-seat positions, as shown in Fig. 2, the shell 26 will telescope or fit over the forward face and ends of the sections 6 and form the back rest of the sofa-seat. The forward face 29 of the shell 26, which forms the back of the sofa seat, is preferably upholstered, and the seat cushions 25, at their rear edges, abut against the lower edge portion of the upholstered face 29, as shown in Figs. 1 and 2. This shell 26, at its upper part, may be longer than the lower part so as to extend over the end pieces 1 and 2, as shown at 30 in Fig. 1, and rest upon the upper edges of the end members 1 and 2 when the section parts are in sofa-seat positions. A stop pin 31 on the inside face of each end member acts to limit the rocking movement of the link 15 in one direction at that end of the device, as shown in Fig. 3.

In the use of this embodiment of the invention, assume that the various parts will normally be in the sofa-seat positions shown in Figs. 1 and 2, at which time the section 8 will be horizontal and entirely between the cross members 3 and 4. The rear edge of the section 8 is supported by the engagement of the followers 17 in the horizontal sections 20 of the lower ends of the cam grooves, and the forward edge of the section 8 is supported through the hinges 9 from the adjacent edge of the section 7, and the latter at that same edge is supported through its lugs 13 upon the pivots 14 and the links 15, the latter being hinged to the end members 1 and 2. The section 7 rests upon the upper face of the mattress section 8, and the other section 6 extends upwardly and rearwardly at an incline, all as shown in Fig. 2. The shell 26 is telescoped over the mattress section 6, and its upholstered face 29 forms the back rest of the sofa seat. The cushions 25 rest upon the intermediate section 7, so that we have a normally appearing sofa seat, as shown in Fig. 1.

To convert this sofa seat into a sofa bed, one first removes the cushions 25, and then grasps the upper edge of the section 6 and pulls it forwardly, which would be to the left in Fig. 2. Since the section 6 abuts at its oblique face 11 against one side of the V-shaped edge 10, this forward movement of the section 6 will also swing an edge of the section 7 upwardly and forwardly about the pivot pins 14, which would be counter-clockwise in Fig. 2. As section 7 swings upwardly in this manner, the stabilizer rods 22 and the hinges 9 force the section 8 rearwardly during which the followers 17 ride along the rearward lower terminals or branches 20 of the cam grooves. When the section 7 is pulled further through upright position towards the position shown in Fig. 3, it will pull the section 8 forwardly until the cam followers 17 again reach the lower ends of the upright sections 19 of the cam grooves.

The adjacent edges of sections 7 and 8, which

are connected by hinges 9, will abut, and hence rocking of section 7 on pivots 14 will swing the section 8 with the section 7 in a counter-clockwise direction in Figs. 2 and 3, on the pivots 14. During this movement the cam followers 17 will move up the upstanding section 19 of the cam grooves until they reach the upper ends thereof, which will occur when the sections 6, 7 and 8 are all approximately horizontal, as shown in Fig. 3. At that time the links 15 would be vertical, and then the sections are pulled forwardly for a short movement, during which the links 15 will rock counter-clockwise and lower slightly the pins 14, and at the same time the cam followers at the rear edge portion of the section 8 will move down the forwardly and downwardly inclined branches 21 of the cam grooves. These downward movements of the cam followers 17 will be approximately the same as the downward movements of the pin 14, so that the section 8 will remain horizontal.

As the section 6 moves into the horizontal position, the shell 26 will swing downwardly into the position shown in Fig. 3, and will rest upon the floor and form an upstanding post or prop to support the free, forward edge of the section 6. The frame 5 formed of sections 6, 7 and 8, in this straight-out or bed position will be supported at its forward edge or side by the shell 26, at an intermediate point by the pivots 14, and adjacent the rear edge portion of the section 8 by the engagement of the followers 17 in the forwardly and downwardly inclined branches 26 of the cam grooves. The engagement of the lower ends of the links 15 with the stops 31 limits the rocking movement of the links 15 in one direction and thus prevents further forward lowering of the pins 14. It will be noted that downward pressure on the pins 14, such as would be caused by any weight on the mattress sections, would tend to rock the links 15 further counter-clockwise, and since this rotation is prevented by the stops 31, we have a rigid support for the section 7 at its rear edge. Any rearward horizontal pressure on the sections 6, 7 and 8, when in bed-positions shown in Fig. 3, if it is to cause a folding of these sections, must be sufficient to force the cam followers up the inclined cam groove sections 21 and to rock the links 15 rearwardly, which would elevate the pivot pins 14. This requires force, and it is unlikely that any accidental or unintentional pushing in a rearward direction on the bed would cause it to collapse or fold up.

To reconvert the device into a sofa seat, one first pushes rearwardly on the extended sections in their Fig. 3 positions until the followers 17 reach the upper ends of the upright sections 19 of the cam grooves, and then the section 6 is lifted, which rocks all of the sections 6, 7 and 8 about the pivots 14. This lowers the followers 17 to the lower ends of the cam grooves. The cam groove sections 19 are arcuate, with their centers of curvature at the related pivots 14, when the pivots 14 are in the positions shown in Fig. 2. After the followers 17 reach the lower ends of the upright cam groove sections 19, the sections 6, 7 and 8 are pushed rearwardly to a further extent, during which the followers 17 move rearwardly in the lower, horizontal branches 20 of the cam grooves, and then the section 7 is folded over upon the section 8, during which the section 8 moves forwardly. The section 6 is rocked into its upwardly and rearwardly inclined position shown in Fig. 2. When the section 6 is raised and thrown backwardly into the Fig. 2 position,

the shell 26 pivots about the studs 28 and resumes the Fig. 2 position. The cushions 25 are then placed on the section 7 to complete the sofa seat.

The sections 6, 7 and 8 are shallow boxes with an open face to receive the mattress, but with their abutting edges free of lengthwise upstanding walls between sections, so that one may place mattress sections (not shown) edge to edge in the sections 6, 7 and 8 so that they abut edge to edge, and confine them there in any suitable manner.

In the modification of the invention illustrated in Figs. 4 and 5, the construction is quite similar to that shown in Figs. 1–3, except for a few changes which will now be explained. In this modification of the invention, parts identical to those in Figs. 1 to 3 will have the same reference characters as in Figs. 1 to 3, and those similar but slightly modified have the same numerals with an "*a*" added. The shell 26*a* is fixed on the section 6, and to provide the prop at the free edge of section 6, when it is in bed position, we provide two rods 32, one at each end of the section 6 and hinged by pins 33 to the adjacent outside end walls of the section 6. Each rod 32 has a crook at its pivoted end so that it resembles somewhat a shepherd's staff or crook. The pivot pin 33 is in the free end of the crook or curved end of the staff or rod, so that when the rods 32 are folded into the dot and dash line position shown in Fig. 5, they will lie along the outside end walls of section 6. There is a small space between the end walls of section 6 and the corresponding end walls of shell 26*a* in which rods 32 may be received and secured. After the sections are swung into bed positions, one then swings these rods 32 counter-clockwise into the full line positions shown in Fig. 5. In their full line positions they are inclined rearwardly and downwardly with the foot below the pivot 33, so that any weight on the section 6 will not tend to rock the rods 32 either clockwise or counter-clockwise, further counter-clockwise rocking being prevented by engagement of the rods 32 with the free side edge of the section 6.

Another modification in the construction shown in Figs. 1–3, is to use straight links 15*a* instead of L-shaped links 15, and to make the upper branches 21*a* of the cam grooves 18*a* extend rearwardly and downwardly, instead of forwardly and downwardly. In view of this change in the shape of the links 15, the stops 31*a* are moved to the other side of the links 15*a*, because when the sections 6, 7 and 8 are opened outwardly, they will be given a final horizontal push rearwardly instead of forwardly, during which the cam followers 17 will ride rearwardly and downwardly in the branch grooves 21*a*, and the links 8 will move rearwardly until their lower ends engage the stop pins 31*a*, which correspond to the stop pins 31 of Figs. 1–3. The conversion of this device between sofa seat and bed positions is substantially the same as explained in connection with Figs. 1–3, except for the differences pointed out above.

Any downward pressure on the section 7 at the side having the lugs 13, will tend to rock the links 15*a* clockwise when the sections are in bed positions, and since this movement is limited by stops 31*a*, that pressure will not cause or tend to cause a folding of the sections into the sofa seat positions, nor any forward movement, such as is necessary at the start of a conversion movement.

It will be understood that various changes in the details and arrangements of parts, which have been herein described and illustrated in order to explain the nature of the invention may be made by those skilled in the art within the principle and scope of the invention as expressed in the appended claims.

We claim as our invention:

1. A sofa bed comprising a support having spaced, upright, parallel end pieces connected by cross pieces, a mattress-supporting frame disposed between said end pieces and formed of three sections, hinges connecting said sections in succession edge to edge, so that said sections together may extend forwardly of the frame in bed position but are foldable upon said hinges when in sofa seat position, to place the intermediate section upon one end section between said end pieces with the outer end section ascending from the rear edge of the intermediate section to form a back rest, each of said end pieces at its inside face and near its rear having a cam slot with an ascending, intermediate arcuate portion, a rearwardly extending branch at its lower end, and a lateral branch at its upper end which is slightly downwardly inclined away from the upper end of the intermediate portion, a cam follower carried on each end of said one section, near its rear edge, and each running in and guided by the cam slot in the adjacent end piece, the center of curvature of said arcuate portion being forwardly of the arcuate portion, a generally upright link near each end of the support, each pivoted at one point to the support and at another point to that edge portion of the intermediate section which is hinged to said one end section, to support said edge portion of said intermediate section in both folded and unfolded positions of said frame for limited forward and rearward movement as said link oscillates on its pivotal connection to said support, and a support connected to the free edge of said outer end section to engage the floor and support that free edge when the sections are in extended, bed position.

2. A sofa bed comprising a support having spaced, upright, parallel end pieces connected by cross pieces, a mattress-supporting frame disposed between said end pieces and formed of three sections, hinges connecting said sections in succession edge to edge, so that said sections together may extend forwardly of the frame in bed position but are foldable upon said hinges, when in sofa seat position, to place the intermediate section upon one end section between said end pieces, with the outer end section ascending from the rear edge of the intermediate section to form a back rest, a cam follower carried by each end of said one end section near its rear edge, each adjacent end piece having a cam slot with an ascending, arcuate intermediate portion and a rearward extension at the lower end of the arcuate portion and a lateral extension at the upper end of the arcuate portion, in which the follower runs to positively guide said rear edge of said one end section up and down when the sections are folded and unfolded, and then generally horizontally at each end of the arcuate portion, the center of curvature of said arcuate portion being forwardly of that portion, link means hingedly connecting the edge portion of the intermediate section which is hinged to said one end section, to said end pieces near the front thereof to support said edge portion of said intermediate section in both folded and unfolded positions of said frame for limited for-

ward and rearward movement, and a support connected to the free edge of said outer end section to engage the floor and support that free edge when the sections are in extended, bed position.

3. A sofa bed comprising a support having spaced, upright, parallel end pieces connected by cross pieces, a mattress-supporting frame disposed between said end pieces and formed of three sections, hinges connecting said sections in succession edge to edge, so that said sections together may extend forwardly of the frame in bed position but are foldable upon said hinges when in soft seat position, to place the intermediate section upon one end section between said end pieces, with the outer end section ascending from the rear edge of the intermediate section to form a back rest, a cam follower carried by each end of said one end section near its rear edge, and a cam carried by each adjacent end piece and having a cam slot in which said follower runs with an ascending arcuate intermediate portion to guide said rear edge of said one end section up and down when the sections are folded and unfolded, said cam slot having a rearwardly extending, lateral extension from the lower end of the ascending intermediate portion and a slightly downward inclined lateral portion leading from the upper end of said arcuate portion to guide said one section forwardly and rearwardly and facilitate folding and unfolding movements of said sections, link means hingedly connecting the edge portion of the intermediate section which is hinged to said one end section, to said end pieces near their front edges to support said edge portion of said intermediate section in both folded and unfolded positions of said frame for limited movement in a forward and rearward direction at the beginning and end of each folding movement, and a support connected to the free edge of said outer end section to engage the floor and support that free edge when the sections are in extended, bed position.

4. A sofa bed comprising a support having spaced, upright, parallel end pieces connected by cross pieces, a mattress-supporting frame disposed between said end pieces and formed of three sections disposed in a horizontal row and edge to edge, a hinge between adjacent side edges of one end section and the intermediate section, said hinge being approximately at the upper face of said one end section, the edge of the other end section that abuts the intermediate section being in a plane oblique to the faces of that other end section, the edge surface of said intermediate section that abuts said oblique edge being V-shaped, a hinge at the apex line of the V-shaped edge connecting that edge to said oblique edge of said other end section at approximately the longitudinal center line of that oblique edge, said oblique edge partially overlying and abutting part of the V-shaped edge when the sections are in straight out, horizontal edge to edge, relation in which they are in bed positions, a link hinged at one point to each end piece near its forward edge, and hinged at another point to said intermediate section closely adjacent its edge which is hinged to said one section but at the opposite side of the intermediate section from the hinge between the intermediate section and said one section, each end piece having a cam slot with an arcuate, ascending intermediate section, a rearward branch at the lower end of said arcuate section, and a lateral branch at the upper end of the arcuate portion which is slightly downwardly inclined away from the upper end of the arcuate portion, and a cam follower carried by each end portion of the unhinged edge of said one section, and running in and guided by the adjacent cam slot, and a prop connected to the free side edge of said other end section to rest upon the floor and support that edge when the sections are unfolded to assume a bed position, whereby the intermediate section may be folded over upon said one end section, and said other end section may be folded upon its hinge to ascend from an edge of the intermediate section, after the latter has been folded over upon said one end section, and form the back rest of the sofa seat.

5. A sofa bed comprising a support having spaced, upright end pieces, a mattress-supporting frame of three sections disposed between said end pieces, with two of the sections in horizontal, superposed, face to face relation and the third section upstanding from the rear edge of the upper one of the superposed sections to form a sofa seat, the superposed sections being hinged together at their forward corner edges and approximately at their abutting faces, the rear edge of the upper one of the superposed sections being hinged to the lower edge of the upstanding section, for movement into straight out, horizontally aligned positions when said upper one of the superposed sections is swung forwardly about its connection to the lower one of said superposed sections, the ends of said upper one of the superposed sections having adjacent its forward edge, upstanding lugs, a pair of generally upright links, one at each end of said support, and each pivoted to said support adjacent an end piece, and each also hinged at a free end to the adjacent one of said lugs, a cam follower on each end of the lower one of the superposed sections, near its rear edge, the ends of said support having on their inside faces a cam slot into which the adjacent cam followers extend and by which the followers are guided, each of said slots having a forwardly and rearwardly disposed branch, in the forward end of which the follower at that end of the lower section is engaged when the sections are in sofa seat position, an arcuate section ascending from the forward end of said branch, the center of curvature of the arcuate section being forwardly of that section, and an upper branch section extending laterally from the upper end of the arcuate section, the branches and arcuate sections of each cam slot being in a common plane, said cam slots guiding said rear edge portion of said lower one of the superposed sections first rearwardly, then forwardly and then upwardly when the hinged sections are unfolded and moved forwardly into straight-out, horizontal bed positions, and supporting it in both of its elevated and lower positions, and a prop attached to the upper edge portion of the upstanding section, when the sections are folded, to depend from that section when the sections are unfolded, to engage the floor and hold that section from descent.

6. A sofa bed comprising a support having spaced, upright end pieces, a mattress-supporting frame of three sections disposed between said end pieces, with two of the sections in horizontal, superposed, face to face relation and the third section upstanding from the rear edge of the upper one of the superposed sections, the superposed sections being hinged together at their forward edges and approximately at their abutting faces, the face of the rear edge of the upper

one of the superposed sections being V-shaped with the apex of the V extending lengthwise of the side edge, the lower edge of the upstanding section being downwardly and rearwardly inclined in a plane which is oblique to both faces of that upstanding section, the oblique edge of said upstanding section, midway between the main faces of that section, being hinged to the rear edge of said upper one of the superposed sections at said apex, the ends of said upper one of the superposed sections having adjacent its forward edge, upstanding lugs, a generally upright link pivoted to said support adjacent said end pieces and hinged at a free end to the adjacent one of said lugs, said support having a stop for engagement by said link to limit rocking movement of said link beyond a selected position in which the link is oblique to a perpendicular, a cam and follower connection between the rear side portion of the lower one of the superposed sections and the end portions of the support to guide that rear side portion upwardly and downwardly as its forward side is elevated or lowered, and also guide it forwardly and rearwardly when at the limits of its upward and downward movement, and a prop attached to the upper edge portion of the upstanding section, when the sections are folded, to depend from that section when the sections are unfolded, to engage the floor, and hold that section from descent.

7. A sofa bed comprising a support having spaced, upright end pieces, a mattress-supporting frame of three sections disposed between said end pieces, with two of the sections in horizontal, superposed, face to face relation and the third section upstanding from the rear edge of the upper one of the superposed sections, the superposed sections being hinged together at their forward edges and approximately at their abutting faces, the rear edge of the upper one of the superposed sections being hinged to the lower edge of the upstanding section, for movement into straight out, horizontally aligned positions when said upper one of the superposed sections is swung forwardly about its connection to the lower one of said superposed sections, the ends of said upper one of the superposed sections having adjacent its forward edge, upstanding lugs, a generally upright link pivoted to said support adjacent said end pieces and hinged at a free end to the adjacent one of said lugs, a cam follower on an end of said lower one of the superposed sections, adjacent its rear edge, a cam on the adjacent end piece for guiding said follower, said cam having an upstanding guide portion with generally horizontal extensions at its upper and lower limits to guide the section with the follower forwardly or rearwardly when at its upper and lower limits, and a prop attached to the upper edge portion of the upstanding section, when the sections are folded, to depend from that section when the sections are unfolded, to engage the floor, and hold that section from descent.

8. A sofa bed comprising a support having spaced, upright end pieces, a mattress-supporting frame of three sections disposed between said end pieces, with two of the sections in horizontal, superposed, face to face relation and the third section upstanding from the rear edge of the upper one of the superposed sections, the superposed sections being hinged together at their forward edges and approximately at their abutting faces, the rear edge of the upper one of the superposed sections being hinged to the lower edge of the upstanding section, for movement into straight out, horizontally aligned positions when said upper one of the superposed sections is swung forwardly about its connection to the lower one of said superposed sections, the ends of said upper one of the superposed sections having adjacent its forward edge, upstanding lugs, a pair of generally upright links pivoted to said support, one adjacent to each of said end pieces and each hinged at a free end to the adjacent one of said lugs, a cam follower on each end of said lower one of the superposed sections, adjacent its rear edge, a cam on the adjacent end piece having a slot in which said follower runs, said cam slot having an ascending guide portion with generally horizontal extensions at its upper and lower ends to guide the section with the follower forwardly and rearwardly when at its upper and lower limits, the extension at the lower end of the ascending portion of the slot being rearward only, the upper one of the extensions of said guide portion being downwardly inclined somewhat from the upper end of the ascending guide portion, and a prop attached to the upper edge portion of the upstanding section, when the sections are folded, to depend from that section when the sections are unfolded, to engage the floor, to hold that section from descent.

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