Jan. 31, 1967 M. P. SPITZ 3,300,792

FOLDING SOFA-BED CONSTRUCTION

Filed Feb. 1, 1965 5 Sheets-Sheet 1

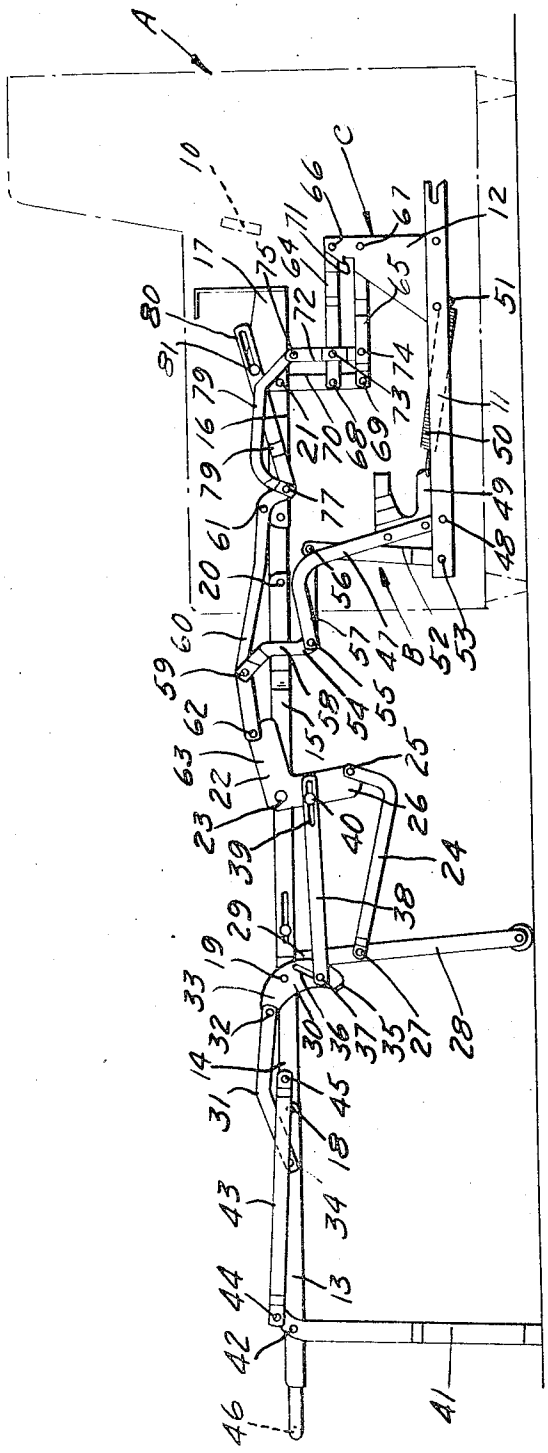


Fig. 1.

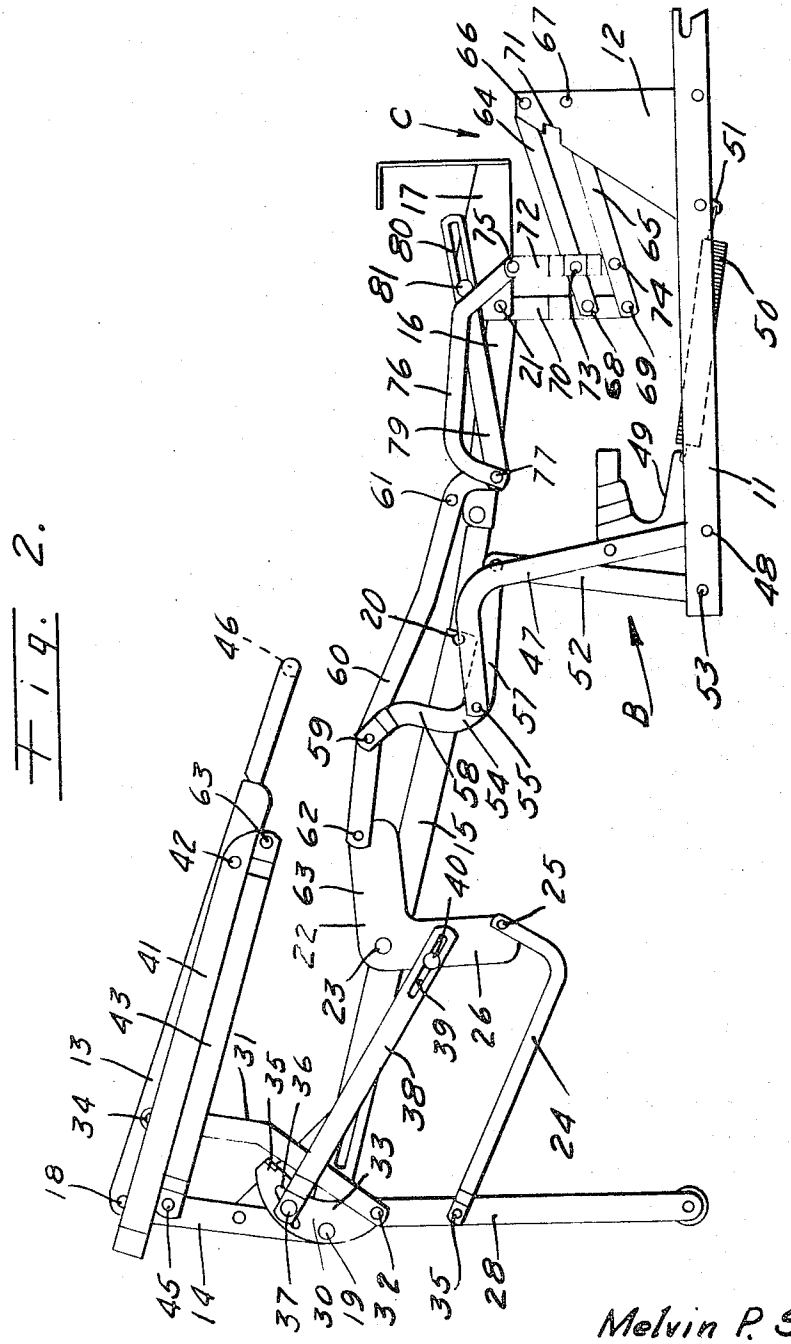
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FOLDING SOFA-BED CONSTRUCTION

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Fig. 2.



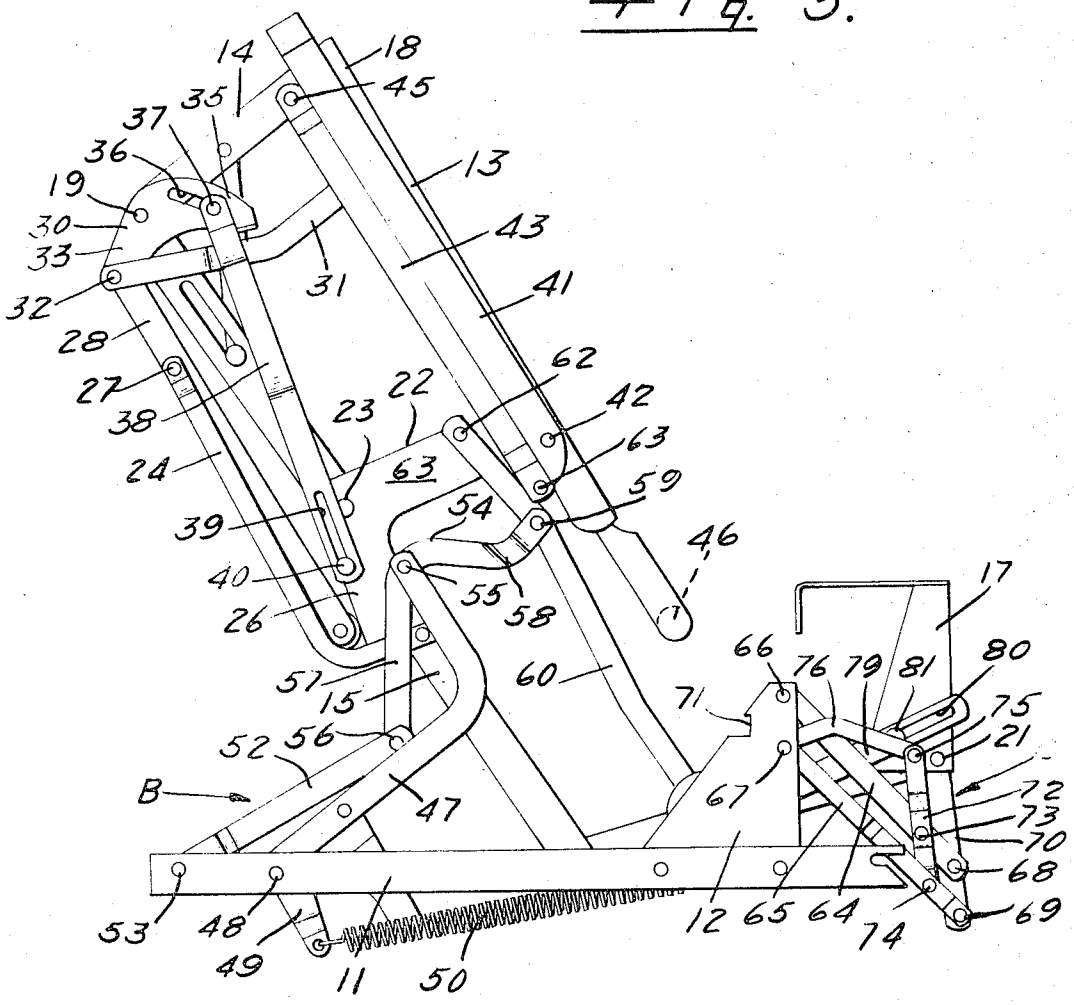
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FOLDING SOFA-BED CONSTRUCTION

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Fig. 3.



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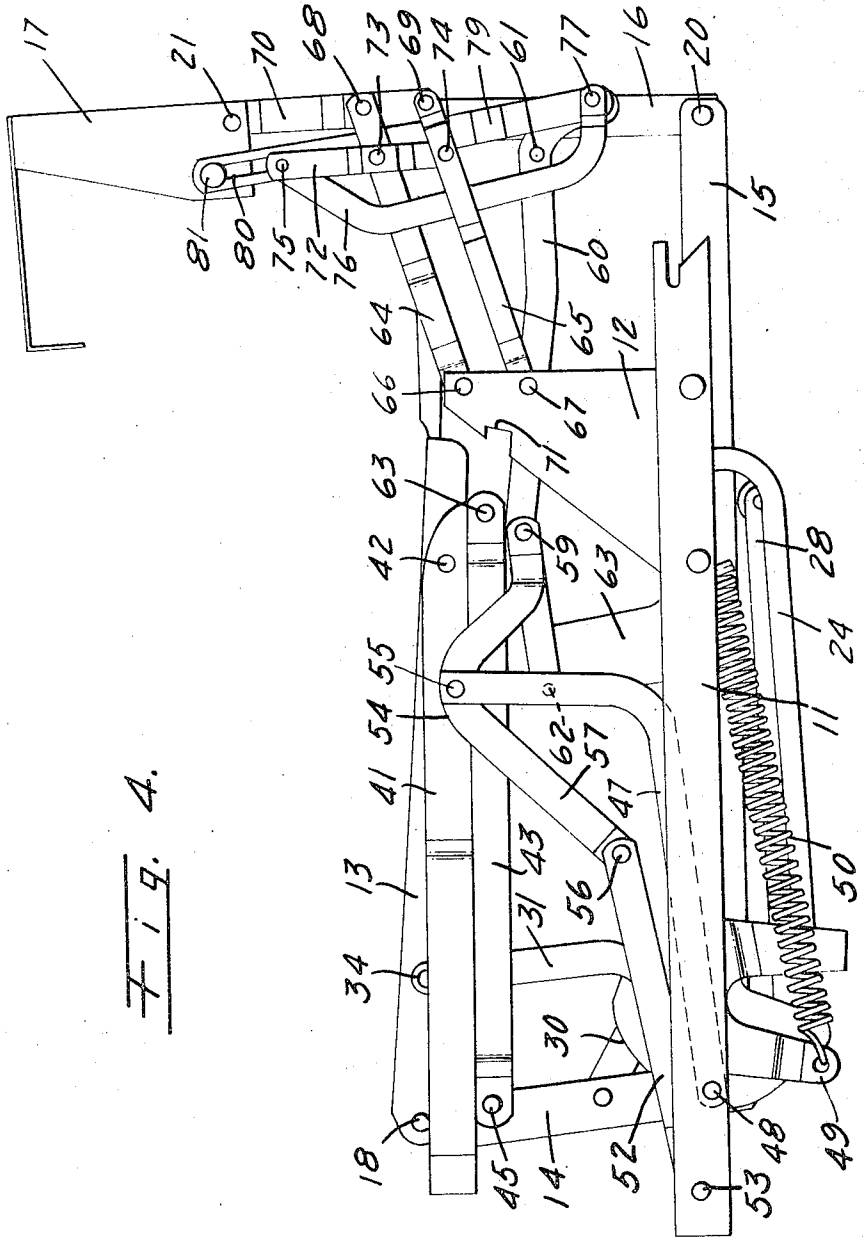


Fig. 4.

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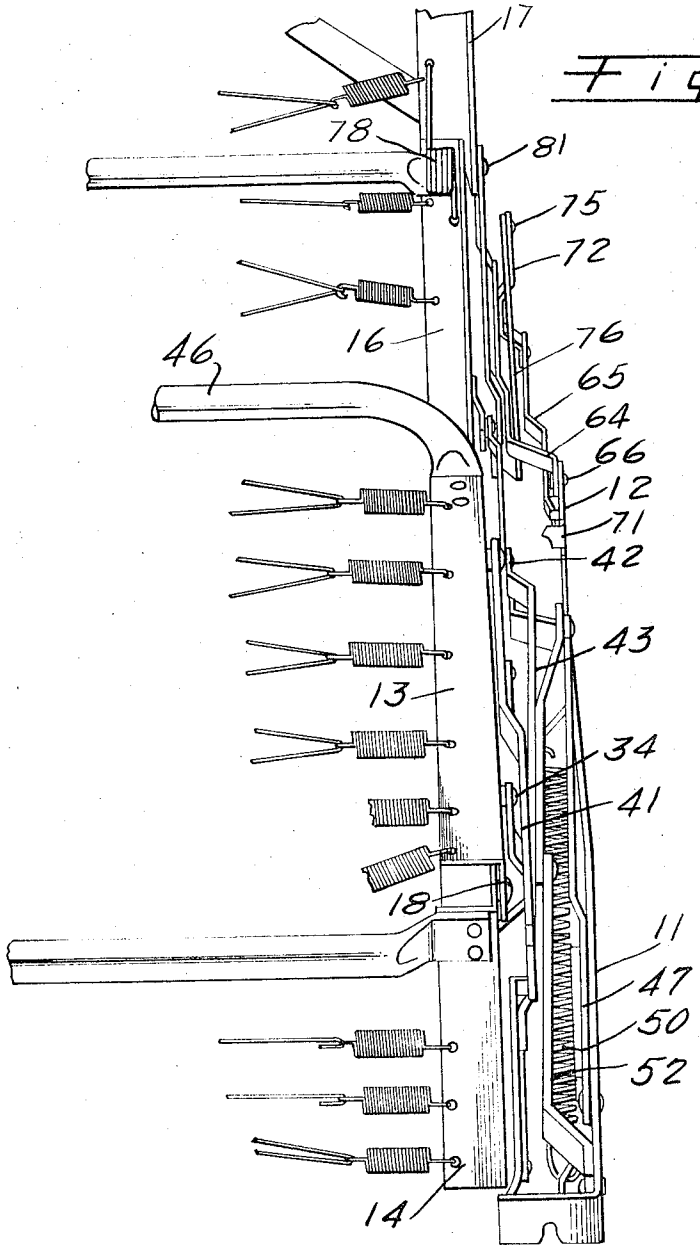
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Fig. 5.



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FOLDING SOFA-BED CONSTRUCTION

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8 Claims. (Cl. 5—13)

The present invention relates generally to sofa-beds, and is more particularly concerned with an improved folding sofa-bed construction, wherein a plurality of frame sections are moveably interconnected in end-to-end relation and adapted to be displaced from a folded seat-forming position to an extended or bed-forming position.

Among the various objects of the herein described invention, it is a general object to provide a sofa-bed construction which will have improved operating characteristics over existing conventional arrangements, and particularly with respect to ease of operation such that it may be converted from a sofa to a bed by the expenditure of a minimum of effort by the person making the conversion.

A further object is to provide in a sofa-bed construction an embodiment which will permit the formation a bed of substantially greater length than heretofore obtainable in conventional sofa-beds, while at the same time maintaining the heretofore established folded sofa depth. Previously, the bed length has been limited to approximately 74 inches, which has become generally known in the bedding industry as "standard length bedding." This length has proved to be too short for a large segment of the public in recent years, and for such reason a great portion of stationary bedding manufactured currently is known as "extra long." For example, the length of such bedding is approximately 80 inches (queen length) or approximately 84 inches (king length).

Another object of the present invention is to provide in a folding sofa-bed construction, an articulated bed frame having five foldable sections instead of the conventional four sections. The additional fifth section is added as a new or auxiliary section at the head end of the bed, and is so designed that the two sections at the head end of the bed cooperate in such a way that they may be positioned behind the cushioned back center rail of a sofa frame structure of relatively standard dimensions. The utilization of a five section articulated bed frame structure results in being able to obtain a bed approximately 6 inches longer than existing models, yet which will fold to a sofa position no deeper than that of existing models.

Still another object is to improve the contour of the mechanism so as to enable the upholsterer to deepen the seat of the upholstered sofa, if desired. Many popular sofa styles, including loose pillow back and other designs require a deeper seat section than heretofore obtainable in sofa-beds of conventional type.

Further objects of invention will be brought out in the following part of the specification, wherein detailed description is for the purpose of fully disclosing the invention without placing limitations thereon.

Referring to the accompanying drawings, which are for illustrative purposes only:

FIG. 1 is a side elevational view of a sofa-bed construction embodying the present invention, the structure being extended to bed-forming position;

FIG. 2 is an enlarged side view showing the outer end of the structure shown in FIG. 1 as being in an initial folding position;

FIG. 3 is a similar view of the same parts shown in their relative positions during a further folding operation;

FIG. 4 is a similar view showing the parts when completely folded into seat-forming position;

FIG. 5 is a perspective view of the structure shown in FIG. 4 as viewed from the front end thereof.

Referring more specifically to the drawings, the sofa-bed structure according to the present invention is shown in FIG. 1 as being embodied in a conventional upholstered sofa structure as generally indicated in phantom lines at A. The upholstered sofa structure, which forms no part of the present invention, usually comprises back and end portions that are associated with a fixed wooden frame structure having a back center rail member **10** below and back of which certain parts of the articulated bed structure must be moved when the bed frame is folded to a seat-forming position.

The folding sofa-bed frame structure of the present invention includes on each side of its head end, a fixed stationary frame structure in which a main horizontal frame member **11** is fixedly secured in any desired manner to the adjacent frame structure of the sofa. The member **11** together with a fixedly secured upstanding bracket **12** thereon thus provide a supporting base structure for the suspension linkages interconnecting the bed frame structure with the sofa, the details of which will be subsequently explained.

The bed frame structure comprises a plurality of generally rectangular folding sections identified by their side rails, namely, as a foot section by rail **13**, knee section by rail **14**, trunk section by rail **15**, head section by rail **16** and auxiliary head end section by rail **17**. These sections are connected in end-to-end articulated relation by joint pivots **18**, **19**, **20** and **21** respectively. The side rails of the sections and the operative linkage mechanisms are the same and duplicated on opposite sides of the bed frame structure. In the following description, reference will be made to only one side.

A bell crank **22** is rotatably supported at its elbow on rail **15** by a fulcrum pin **23**. One end of a link **24** is pivoted at **25** to arm **26** of the bell crank, the other end of link **24** being pivoted at **27** to a folding leg **28** having its inner end hingedly supported on a connected lug **29** fixedly secured to the rail **15**.

A second bell crank **30** is fulcrum on the joint pivot **19** at the connected ends of side rails **14** and **15**. One end of an anchor link **31** is pivoted at **32** to the upper arm **33** of the bell crank **30**. The other end of link **31** is pivoted at **34** to side rail **13** adjacent joint pivot **18**. The other arm **35** of bell crank **30** is formed with a elongate slot **36** to slidably receive a connection pin **37** at one end of a link **38**, the other end of this link being provided with a longitudinal slot **39** for slidably receiving connection pin **40** carried by the arm **26** of bell crank **22**.

The foot section of the bed frame is supported in its extended position upon an end leg **41** which is pivoted inwardly of its upper end at **42** to side rail **13**, and an elongate link **43** has one end pivoted at **44** to the upper end of leg **41**, and its other end pivoted at **45** on side rail **14** adjacent joint pivot connection **18**.

The bell cranks **22** and **30** together with their associated connecting linkages and other linkages as thus far described, are conventionally known arrangements for controlling the movements of the foot and knee sections, and to fold the legs **28** and **41** during folding and unfolding movements of these sections by an operator grasping a forward cross bar **46** at the end of the foot section.

When the bed frame structure is completely folded into a seat-forming position as shown in FIG. 4, the foot section is indicated by the rail **13**, becomes the seat base upon which the seat cushions of the sofa are placed. The knee section as indicated by rail **14**, is vertically maintained behind the front of the sofa frame structure, and the trunk section as indicated by the rail **15** is horizontally maintained generally along the bottom of the sofa below the foot section with which it cooperates to hold the folded mattress therebetween. The head section as indicated by the rail **16** and the auxiliary head end section

as indicated by the rail 17 are vertically maintained generally adjacent to the back of the sofa frame, and rearwardly of the back center rail member 10 (FIG. 1).

From a consideration of the positions of the bed sections as shown in FIG. 4, and particularly the head section and auxiliary end section which provides the extra bed length, it will become evident that if standard sofa dimensions are to be utilized, control means other than conventionally available must be provided in order to control the movements of the head section and the auxiliary head end section as they are moved between a seat-forming position and a bed-forming position. Also, that due to the extra section, namely, the auxiliary head end section, it will be necessary to move the entire bed frame structure further forwardly, when the bed sections are extended into a bed-forming position. The mechanism for controlling such movements are of primary concern in the present invention and will now be explained in detail.

Two cooperatively associated linkage systems are utilized, a forward control system as generally indicated at B at the forward end of the main frame member 11, and a rear control system C at the rear end of member 11. The forward control system B functions primarily to shift the extended bed frame further forward than is ordinary possible with conventional constructions. For this purpose, an anchor link 47 at its lower end is pivoted at 48 adjacent the forward end of the main frame member 11. This end of link 47 carries an angularly supported arm 49 which is connected to one end of a tension spring 50, the other end of this spring being anchored to a fixed lug 51 on the member 11. This spring is to assist the operator in moving the bed frame to extended position, and normally urges the anchor link 47 in a counter-clockwise direction, as viewed in FIG. 1. Operatively associated with anchor link 47 is a link 52 having its lower end pivoted at 53 to member 11 at a point forwardly spaced from pivot point 48 of anchor link 47. The uppermost ends of links 47 and 52 are connected to a angle link 54, the uppermost end of link 47 being pivoted at 55 at its elbow, and the uppermost end of link 52 being pivoted at 56 to the end of arm 57 of the angle link. The other arm 58 of the angle link has its end pivoted at 59 to a link 60 of the linkage system for the controlling folding of the bed frame sections. The link 60 is fulcrum between its ends by a pin 61 carried by side rail 16 of the head section. Outwardly spaced from the pivoted connection 59, this end of the link 60 is pivoted at 62 on the end of arm 63 of the bell crank 22. Because of the contours of the links 47, 52 and 54 and the manner in which they are pivotally interconnected, and the positioning of pivotal connection 53 forwardly of pivotal connection 48, it will be readily apparent that as link 47 swings forwardly during movement of the bed frame structure from the seat-forming position into the bed-forming position, the pivotal connection 59 will variably increase its rate of forward movement in relation to that of pivotal connection 55. Conversely, in moving from the bed-forming position into the seat-forming position, the rate of inward movement of piovtal connection 59 variably decreases in relation to the movement of pivotal connection 55. Thus, the bed frame structure connected at pivot connection 59 will be permitted to move outwardly a greater distance from the sofa frame in order to reach the bed-forming position, yet will be returned to the normal seat-forming position in the sofa. The space thus required in order to obtain the extra length bed at the head end may be accomplished without having to resort to a non-standard sofa frame structure.

The rear control system C comprises a parallel linkage arrangement in which links 64 and 65 have corresponding ends respectively pivoted at 66 and 67 in vertically spaced relation on the upper end of bracket 12. The other ends of links 64 and 65 are pivoted at 68 and 69 respectively in space relation at one end of link 70, the other end of link 70 having a pivotal connection with joint pivot 21 at the connection between rails 16 and 17. The head end of the frame structure is thus supported for movement between a bed-forming position and a seat-forming position during which the parallel linkage is moved from one side of the bracket 12 to the opposite side through a curved path which extends below the pivots 66 and 67. Upward swinging movement, as shown in FIG. 1, is terminated by means of an abutment projection 71 on the bracket 12 which is in the path of movement of link 65.

In the above described linkage, it will be observed that link 70 is at all times maintained in a vertical position. The bracket 12 is so positioned on the frame member 11 as to provide for one developed distance between joint pivot 21 and pivot connection 59 when the bed frame is in the seat-forming position as shown in FIG. 4, and another developed distance therebetween in the bed-forming position shown in FIG. 1. Thus, the two control systems B and C operate in a controlled relationship to one another in determining the arcuate paths of movement of the bed frame unit, and in controlling the variations in the contour of the bed frame sections as the movement takes place.

Referring to FIG. 4, it will be seen that in the seat-forming position, the link 70 is alongside the head rail 16 and lies roughly in the same vertical plain with respect to the adjacent position of the back of the sofa. In this position, pivotal connection 66 is located below the foot section rail 13 which forms the seat of the sofa. This relatively lower position of the pivoted connection 66 constitutes an important consideration of the present invention over conventional arrangements in which the pivotal support extends above the seat-forming frame section of the bed. Lowering of the pivotal connection is made possible in the present invention by virtue of the linkage arrangement described above which has the characteristic of moving the joint pivot 21 through a variable radius path of movement extending between maximum radius positions on opposite sides of the bracket 12 and a reduced radius position directly below the pivoted connection 66. This result from the fact that during the swinging movement of links 64 and 65 from one side of bracket 12 to the other, the joint pivot 21 follows a path which passes between the ends of the links 64 and 65 when these members are positioned vertically below the pivoted connection 66. Thus, the lowest point of movement of the adjacent bed-frame structure may be obtained without being carried into engagement with the underlying floor surface. As a further result of lowering the pivoted connection 66, the back center rail member 10 (FIG. 1) of the sofa frame may be moved further rearwardly than with existing constructions, to provide a deeper seat section than heretofore possible.

The links 64 and 65 adjacent their outermost ends carry also a link 72 (FIG. 1) which is inwardly spaced from link 70 and extends in parallel relation thereto, this link being pivoted at 73 and 74 respectively to the links 64 and 65. At its upper end, the link 72 is pivoted at 75 to one end of a connecting link 76 the other end of which is pivoted at 77 to the adjacent end of link 60. Referring further to FIG. 1, it will be seen that the pivoted connection 75 is positioned behind joint pivot 21, when the bed frame is in extended bed-forming position, whereas the pivoted connection 75 will be disposed of in front of joint pivot 21, in the seat-forming position as shown in FIG. 4. Pivoted connection 75 thus provides displaceable means for operating the other described linkages for controlling the folding and unfolding of the bed sections. This control is accomplished through the actuation of links 76, 60 and the bell crank 22.

Again in FIG. 4, it will be seen that in the seat-forming position, rail 16 of the head section and rail 17 of the auxiliary head end section are in substantially vertical alignment. Further, it is immediately apparent that this

alignment cannot be maintained within the limited space at the back of the sofa frame behind the back center rail member **10** during movements of these sections to extended bed-forming position, and vice-versa. Mechanism must therefore be provided for automatically varying the angular relationship between the head section and the auxiliary head end section. As illustrated in FIG. 5, means in the form of a spring **78** having one end connected with rail **16** and its other end connection with rail **17** normally urges these rails towards a right angle relationship, as shown in FIG. 3.

The relative position of rail **17** is varied as the bed frame is moved outwardly to a bed-forming position. For such purpose, a link **79** is connected at one end to the pivot connection **77**. The other end of the link **79** is formed with an elongate slot **80** for slidably receiving therein a pin **81** fixedly mounted on side rail **17** adjacent to but spaced from joint pivot **21**. A lost motion connection is thus established with the side rail **17** of the auxiliary end of section, wherein during the initial stages of movement of the bed frame from a seat-forming position, the rail **17** will remain in a substantially vertically position. However, after predetermined initial movement, the rail **17** will be urged also into an increasing angular relationship with respect to side rail **16** in order to maintain a substantially vertical position as shown in FIG. 3. This change of relationship is controlled by the movement of pin **81** towards the inner end of slot **80** as its position is gradually changed. At the desired point of movement, the link **79** is then actuated as a pusher member, with the pin **81** against the inner end of the slot, to rotate the auxiliary end section into its bed-forming position with the rail **17** in alignment with rail **16**, as shown in FIG. 1, and in front of the sofa frame back center rail **10** to provide the extra bed length.

Various modifications may suggest themselves to those skilled in the art without departing from the spirit of my invention, and, hence, I do not wish to be restricted to the specific form shown or uses mentioned, except to the extent indicated in the appended claims.

I claim:

1. In a folding sofa-bed structure:
(a) a stationary frame;
(b) a foldable bed suspended therefrom, including a plurality of frame sections of which one is a head section, said sections being pivotally inter-connected in end-to-end relation for selective unfolding movement to an extended coplanar bed-forming position and a folding movement to a folded retracted sofa seat-forming position in which the head section extends in an upright position at the rear of the sofa seat; and
(c) mechanism for controlling and changing the position of said head section in response to the movement of the bed frame to said extended and retracted positions, including a movable articulated supporting frame structure having fixed pivot connections at its inner end on said stationary frame and a pivot connection at its outer end with a part carried by said head section, said structure being swingable generally in a path above its fixed pivot connections between rear and forward positions corresponding with the retracted and extended positions of the bed frame, said structure being variable in response to its swinging movement to provide a greater spacing between its end pivot connections at the forward position than at the rear position thereof.

2. In a folding sofa-bed structure:
(a) a stationary frame;
(b) a foldable bed suspended therefrom, including a plurality of frame sections of which one is a head section, said sections being pivotally interconnected in end-to-end relation for selective unfolding movement to an extended coplanar bed-forming position and a folding movement to a folded retracted sofa seat-forming position in which the head section extends in an upright position at the rear of the sofa seat; and
(c) mechanism for controlling and changing the position of said head section in response to the movement of the bed frame to said extended and retracted positions, including a compound linkage assemblage having an inner pair of adjacently spaced fixed pivot connections on said stationary frame, and an outer pivot connection on a part carried by said head section, said assemblage being swingable generally in a path above said fixed pivot connections between rear and forward positions corresponding with the retracted and extended positions of the head frame, and having parts operative to move said outer pivot connection between said rear and forward positions in a non-circular path and increase its distance from the fixed pivot connections in said forward position.

3. In afolding sofa-bed structure:
(a) a stationary frame;
(b) a foldable bed suspended therefrom, including a plurality of frame sections of which one is a head section, said sections being pivotally interconnected in end-to-end relation for selective unfolding movement to an extended coplanar bed-forming position and a folding movement to a folded retracted sofa seat-forming position in which the head section extends in an upright position at the rear of the sofa seat; and
(c) mechanism for controlling and changing the position of said head section in response to the movement of the bed frame to said extended and retracted positions, including a compound linkage having a pair of elongate links with adjacent inner ends supported on horizontally spaced fixed pivots on said stationary frame, an angle link pivotally connected at its elbow to the outer end of one of said elongate links, at one end pivotally connected to the outer end of the other of eaid elongate links, and at its other end to a part carried by said head section, whereby said angle link will pivot at its elbow during swinging movements of said elongate links and vary the spacing between the pivot connection to the part carried by the head section with respect to the fixed pivots on the stationary frame.

4. In a folding sofa-bed structure:
(a) a stationary frame;
(b) a foldable bed suspended therefrom, including a plurality of frame sections of which one is a head section, said sections being pivotally interconnected in end-to-end relation for selective unfolding movement to an extended coplanar bed-forming position and a folding movement to a folded retracted sofa seat-forming position in which the head section extends in an upright position at the rear of the sofa seat; and
(c) mechanism for controlling and changing the position of said head section in response to the movement of the bed frame to said extended and retracted positions, including a compound linkage having forward and rear elongate links pivoted at their inner ends on said stationary frame by horizontally spaced forward and rear pivots, an angle link having one end pivotally connected to a part carried by said head section and its other end pivotally connected to the outer end of the forward elongate link, said angle link being pivotally connected at its elbow to the outer end of the rear elongate link, whereby the movement of the pivotal connection of the angle link to the head section part will be varied from a circular path during swinging movements of the elongate links.

5. In a folding sofa-bed structure:
(a) a stationary frame;
(b) a foldable bed suspended therefrom composed of

a plurality of frame sections which include a head section and an auxiliary head end section, said frame sections being pivotally interconnected in end-to-end relation for selective unfolding movement to an extended coplanar bed-forming position and a folding movement to a folded retracted sofa seat-forming position in which the head section and auxiliary head end section extend in an upright position at the rear of the sofa seat;

(c) mechanism for controlling and changing the position of said head section in response to the movement of the bed frame to said extended and retracted positions, including pivotal supporting means between said head section and said stationary frame; and

(d) means operative in response to movements of said pivotal supporting means for varying the angular relationship between said head section and auxiliary head end section during movement of the bed frame to said extended and retracted positions.

6. In a folding sofa-bed structure:

(a) a stationary frame;

(b) a foldable bed suspended therefrom composed of a plurality of frame sections which include a head section and an auxiliary head end section, said frame sections being pivotally interconnected in end-to-end relation for selective unfolding movement to an extended coplanar bed-forming position and a folding movement to a folded retracted sofa seat-forming position in which the head section and auxiliary head end section extend in an upright position at the rear of the sofa seat;

(c) mechanism for controlling and changing the position of said head section in response to the movement of the bed frame to said extended and retracted positions, including a suspension linkage between said head section and said stationary frame; and

(d) means including a lost motion connection between said suspension linkage and said auxiliary head end section for controlling and changing its angular relationship with respect to said head section during movement of the bed frame to said extended and retracted positions.

7. In a folding sofa-bed structure:

(a) a stationary frame;

(b) a foldable bed suspended therefrom composed of a plurality of frame sections which include a head section and an auxiliary head end section, said frame sections being pivotally interconnected in end-to-end relation for selective unfolding movement to an extended coplanar bed-forming position and a folding movement to a folded retracted sofa seat-forming position in which the head section and auxiliary head end section extend in an upright position at the rear of the sofa seat;

(c) spring means normally urging said auxiliary head end section towards a position in right angled relation to said head end section;

(d) mechanism for controlling and changing the position of said head section in response to the movement of the bed frame to said extended and retracted positions, including pivotal supporting means between said head section and said stationary frame; and

(e) means operable by said supporting means for variably controlling the movement of said auxiliary head end section under the action of said spring so as to position said head section and auxiliary head end section in coplanar alignment in the retracted and extended positions of said bed frame, and vary the relative angular relationship of said head section and auxiliary head end section during movement between said extended and retracted positions.

8. In a folding sofa-bed structure:

(a) a stationary frame;

(b) a foldable bed suspended therefrom composed of a plurality of frame sections which include a head section and an auxiliary head end section, said frame sections being pivotally interconnected in end-to-end relation for selective unfolding movement to an extended coplanar bed-forming position and a folding movement to a folded retracted sofa seat forming position in which the head section and auxiliary head end section extend in an upright position at the rear of the sofa seat;

(c) spring means normally urging said auxiliary head end section towards a right angled position with respect to said head section;

(d) mechanism for controlling and changing the position of said head section in response to the movement of the bed frame to said extended and retracted positions, including parallel spaced links having inner ends pivoted on said stationary frame and outer ends pivotally connected at spaced points adjacent one end of an arm member which has its other end pivotally connected to said head section; and

(e) an articulate linkage having a driving connection with said parallel links, and including an elongate link having a slotted outer end for slidably receiving a crank pin carried by said auxiliary head end section, whereby the relative positions of said head section and said auxiliary head end section will be controlled in dependency upon the movement of said parallel links as the bed frame is moved between its retracted and extended positions.

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