May 20, 1958 W. P. WACHSMAN 2,834,969

CONVERTIBLE FURNITURE

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Fig-1

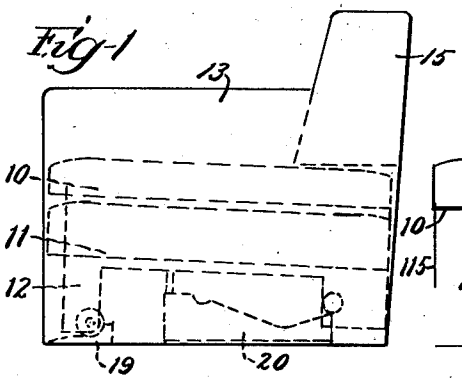


Fig-2

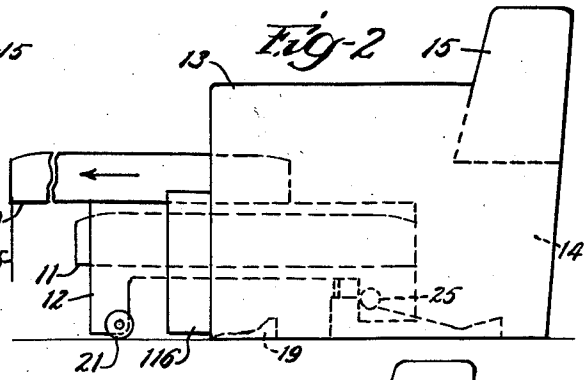


Fig-3

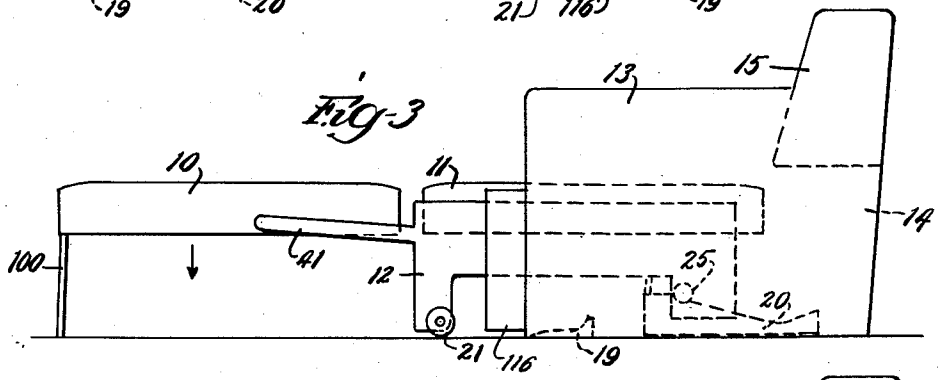


Fig-4

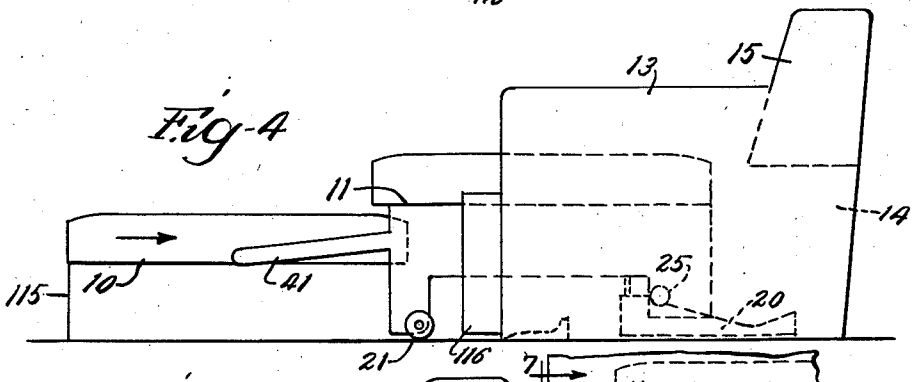


Fig-5

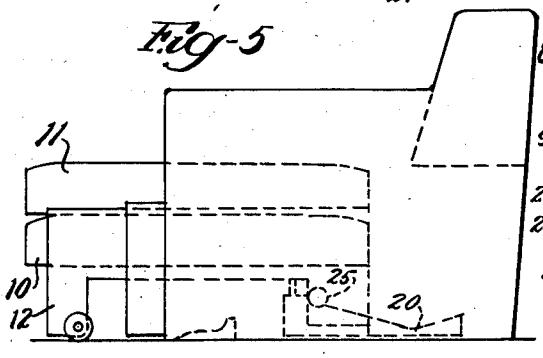
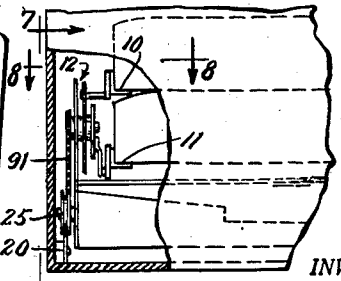


Fig-6



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May 20, 1958 W. P. WACHSMAN 2,834,969

CONVERTIBLE FURNITURE

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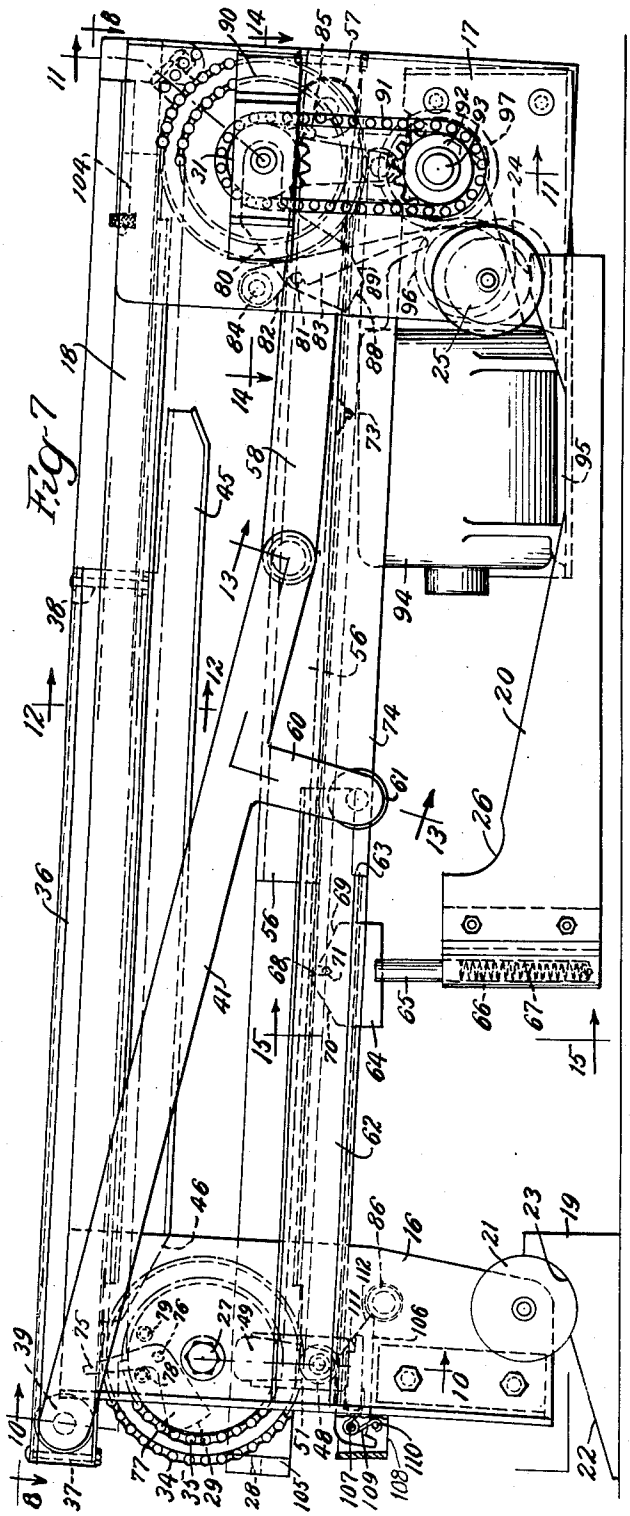


Fig-7

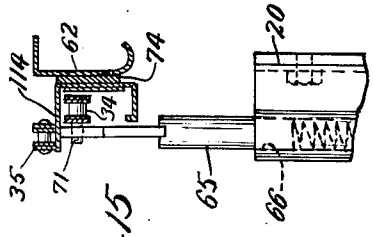


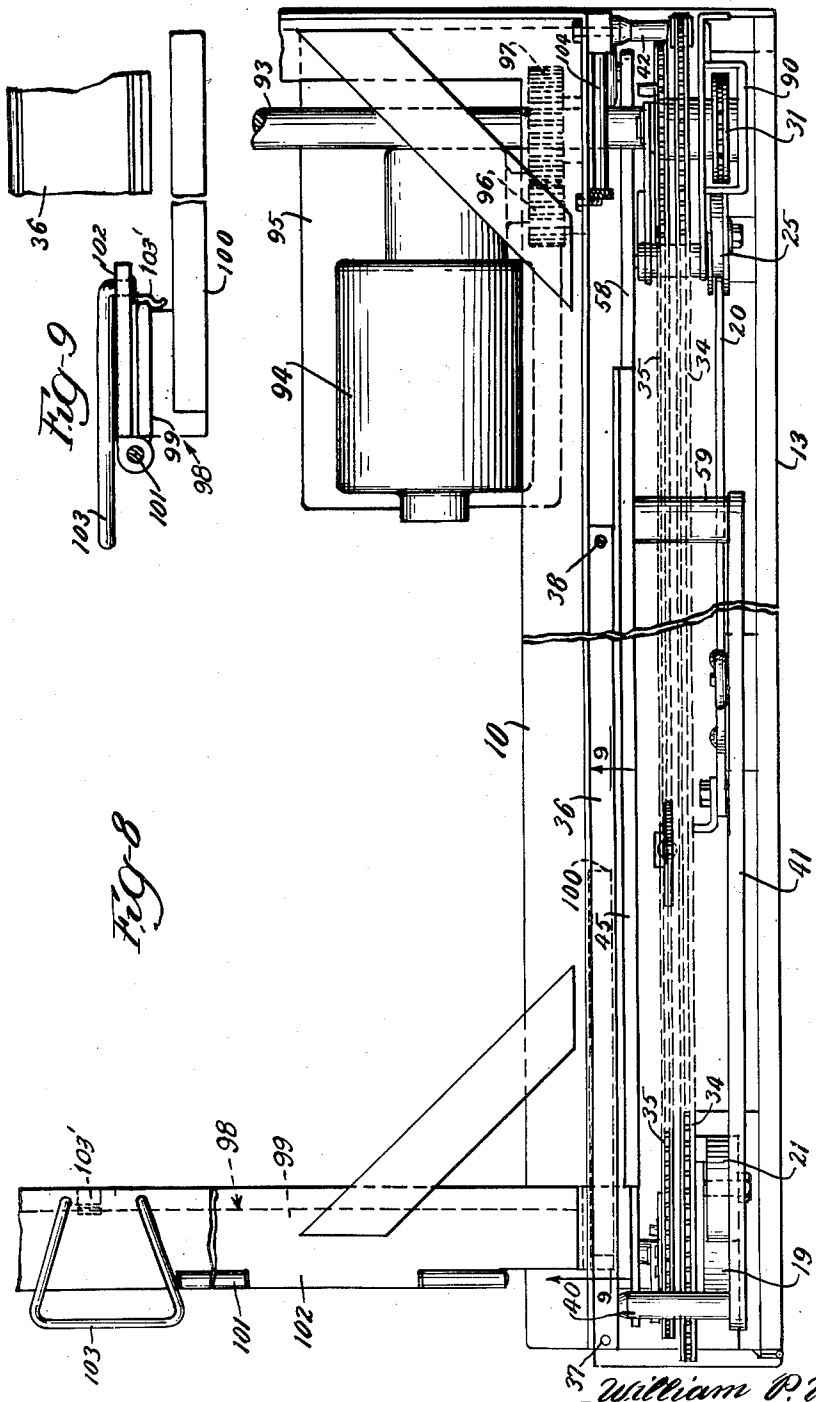
Fig-15

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CONVERTIBLE FURNITURE

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Fig-10

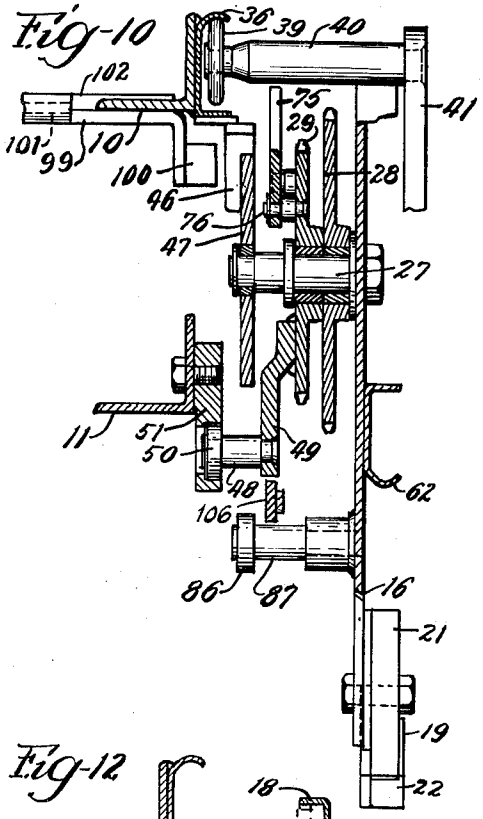


Fig-11

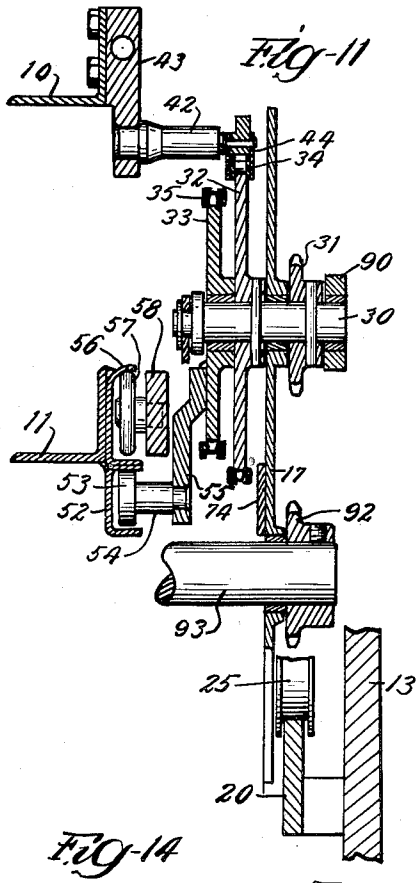


Fig-12

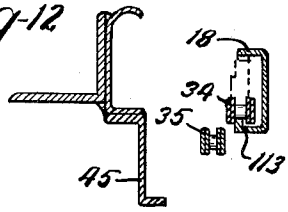


Fig-13

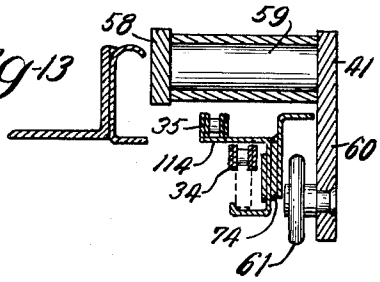
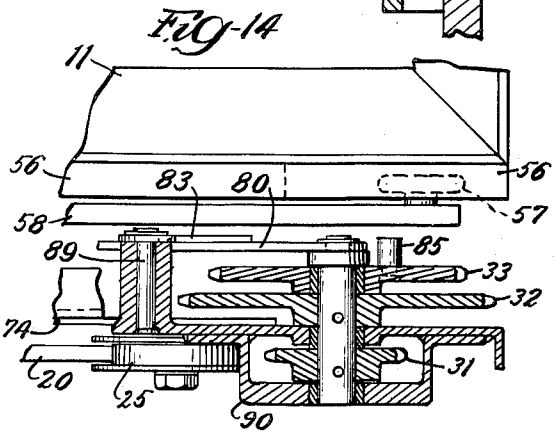


Fig-14



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United States Patent Office 2,834,969 Patented May 20, 1958

2,834,969

CONVERTIBLE FURNITURE

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Application January 14, 1955, Serial No. 481,790

27 Claims. (Cl. 5—21)

This invention relates to convertible or dual purpose furniture and is more particularly concerned with improvements in a davenport, studio couch or sofa which is adapted to be converted for use as a bed.

It is a general object of the invention to provide a furniture piece which normally serves as a sofa, studio couch or day bed and which may be readily converted or changed into a sleeping unit comprising an unfolded bed complete with all necessary bedding.

It is another object of the invention to provide a convertible piece of furniture of the type which is normally used as a sofa and which may be converted to a sleeping bed without the removal of any cushions and without the need for making up the bed with sheets, blankets and other bedding, and which provides full deep cushion comfort when used as a sofa and full mattress comfort when converted to a bed.

It is a further object of the invention to provide a convertible furniture piece having a sofa cushion unit and a sleeping bed unit which are connected by mechanism which is operative to move the units relative to each other to interchange their position and wherein the uppermost unit is supported in a relaxed or floating position on the lowermost unit when the piece is converted for use either as a sofa or as a sleeping bed.

It is another object of the invention to provide a structure for use in convertible type furniture which consists of generally horizontal seat and bed forming frames which are supported between vertical end supporting and connecting frames which permit the horizontal frames to be readily interchanged wherein the structure is simple and compact in design and adapted to be readily incorporated in a variety of convertible sofa, davenport, or day bed designs.

It is another object of the invention to provide a convertible furniture piece comprising a sofa forming frame, a bed forming frame, end supporting frames and mechanism connecting the sofa and bed frames with the end supporting frames which connecting mechanism is operative to permit the sofa and bed frames to be moved in drawer-like fashion horizontally and vertically relative to each other to selectively interchange the same and adapt the piece for use either as a sofa or as a bed.

It is a more specific object of the invention to provide a convertible sofa or the like having a seat forming unit and a bed forming unit with the latter initially positioned beneath the seat forming unit and with the units connected for relative movement so that the bed forming unit may be moved to position it in the initial position of the sofa unit and the sofa unit may be moved to position it out of the way beneath the bed unit or it may be moved to an extended position in side-by-side relation with the bed unit to form therewith a twin bed.

It is a further object of the invention to provide a convertible furniture piece of the type which includes a sofa or seat cushion unit and a sleeping bed unit in which the sofa and bed units are mounted on end support mechanisms which are operative upon a forward pull being exerted on the sofa unit to cause the sofa unit and the bed unit to move forwardly relative to the frame in which they are mounted in drawer-like fashion, with the sofa unit rising initially a sufficient distance to clear the bed unit and also moving forwardly relative to the bed unit, the forward movement of the sofa unit continues until its back edge is above and slightly forward of the front edge of the bed unit when the sofa unit moves downwardly while the bed unit rises and presents a completely made-up bed with the sofa unit in a position to be supported at its outer edge in an extended horizontal position in alignment with the bed unit for use as a twin bed, the downward movement of the sofa unit is continued to a lower position where it will slide drawer fashion beneath the raised bed unit, where it is accommodated in the space initially occupied by the bed unit, and where it serves as a support in the nature of a box spring for the bed unit which is released or relaxed so that it rests in floating relation upon the same.

It is another object of the invention to provide a convertible piece of furniture comprising a sofa cushion unit, a sleeping bed unit and an end connecting mechanism wherein the end connecting mechanism is operable to selectively position the units interchangeably in superimposed relation and wherein the end connecting mechanism includes a frame structure and an elongate pivot arm which is connected at its ends to the sofa and bed units and which has a sliding pivotal connection with the frame structure intermediate its ends whereby the sofa and bed units are interchanged with a sliding and pivoting movement relative to the end frame structure.

It is another object of the invention to provide a convertible furniture piece having a seat forming frame and a bed forming frame which are adapted to be positioned in horizontal alignment or in superimposed relation and end supporting frames having mechanism connecting the seat and bed frames thereto wherein the end supporting frames include a horizontal track formation and the connecting mechanisms include a pivot arm member which is pivotally connected at spaced points to the ends of the seat and bed frames and which has an intermediate pivot member adapted to be slidably and pivotally supported by the track formation whereby the weight of the bed frame is balanced about the pivot member by the weight of the seat frame during movement of the frames into and out of their aligned and superimposed positions.

It is another object of the invention to provide a convertible furniture piece having a sofa cushion unit and a sleeping bed unit which are connected by end supporting mechanisms wherein the end supporting mechanisms are operable to interchange the units to adapt the piece for use either as a sofa or as a bed, and wherein a motor is incorporated in the end supporting mechanisms for moving the sofa and bed units.

These and other objects and advantages of the invention will be apparent from a consideration of the apparatus which is shown by way of illustration in the accompanying drawings, wherein:

Fig. 1 is an end elevation of a convertible sofa which embodies therein the principles of the invention, with the sofa cushion and bed units and their associated supporting and shifting mechanism being shown schematically;

Fig. 2 is an end elevation similar to Fig. 1 with the sofa cushion and bed units and their associated supporting and shifting mechanism being rolled out from under the sofa back;

Fig. 3 is an end elevation similar to Fig. 1 with the sofa unit fully extended and supported to form with the uncovered bed unit a double bed;

Fig. 4 is an end elevation similar to Fig. 1 with the sofa unit fully depressed and partially retracted beneath the bed unit;

Fig. 5 is an end elevation similar to Fig. 1 with the sofa unit fully retracted beneath the bed unit and with the sofa converted for use as a single bed;

Fig. 6 is a partial rear elevation with the back of the sofa broken away to show the location of the sofa and bed unit end supporting and shifting mechanism;

Fig. 7 is an end elevation, to an enlarged scale, of the sofa and bed units and their associated supporting and shifting mechanism with the sofa and bed units in sofa forming position, the view being taken on the line 7—7 of Fig. 6;

Fig. 8 is a partial plan view with portions broken away and to an enlarged scale, the view being taken on the line 8—8 of Fig. 6;

Fig. 9 is a view to an enlarged scale taken on the line 9—9 of Fig. 8;

Fig. 10 is a section taken on the line 10—10 of Fig. 7;

Fig. 11 is a section taken on the line 11—11 of Fig. 7;

Fig. 12 is a section taken on the line 12—12 of Fig. 7;

Fig. 13 is a section taken on the line 13—13 of Fig. 7;

Fig. 14 is a section taken on the line 14—14 of Fig. 7; and

Fig. 15 is a section taken on the line 15—15 of Fig. 7.

Referring first to Figs. 1 to 6 of the drawing the invention as illustrated is embodied in a sofa structure which comprises a sofa unit consisting of a rectangular supporting frame **10** having a conventional sofa cushion arranged thereon and a bed unit consisting of a similar rectangular supporting frame **11** having a bed mattress of the same size and shape as the cushion on the sofa unit. Both the sofa cushion and the bed mattress are preferably made of foam rubber but they may be of inner spring or any other suitable construction. The sofa frame **10** is located immediately above the bed frame when the device is in use as a sofa. The opposite ends of both frames **10** and **11** are mounted on end supporting frames or mechanisms **12** which are of identical construction except for being rights and lefts so that they face each other with the frames **10** and **11** forming a connecting structure between them. The frames **10** and **11** are connected to the end supports **12** by mechanisms which permits the frames **10** and **11** to be moved relative to each other and to the end supports **12** so that these frames may be shifted to and from the several positions required in order to convert the apparatus from sofa use to bed use and vice versa. In the normal position when the device is adjusted for use as a sofa the superimposed sofa and bed units and their end supporting mechanisms **12** are in retracted position as in Fig. 1 with the end suporting mechanisms **12** housed in the hollow compartment forming sofa arms **13** and the rearmost portions of the units are positioned in the space **14** (Fig. 2) beneath the sofa back **15** which extends between and connects the arms **13** in the usual manner. The sofa arms **13** may be connected by cross braces or a frame (not shown) extending between the bottom edges thereof beneath the sofa and bed units and the entire sofa frame may be made knock-down to facilitate handling and shipment.

The supporting mechanisms **12** at the ends of the frames **10** and **11** each comprise a frame which may be conveniently formed of plate sections welded or otherwise connected to provide an inverted U-shaped construction consisting of a front vertically extending plate **16** (Fig. 7) and a rear vertically extending plate **17** with an inwardly facing relatively narrow channel-shaped connecting member **18** which extends between the tops of the end plates **16** and **17**. Each end supporting frame **12** is supported initially on a pair of track forming members **19** and **20** which are mounted in fixed relation at the bottom of each sofa arm **13**. The forward track member **19** is adapted to support a front roller **21** which is rotatably mounted on the outer side at the lower end of the front vertical plate **16**. The forward track member **19** has a forwardly and downwardly sloping track surface **22**

and an elevated semi-circular seat formation **23** which supports the roller **21** in its initial position of rest and holds the front end of the mechanism **12** in an elevated position. The rear track member **20** is in the form of a vertical plate provided with a track surface on the upper edge which comprises a rear elevated portion **24** which is arranged at a somewhat higher level than the track surface **23** and which is adapted to support a grooved roller **25** secured on the outer side at the lower end of the rear vertical plate **17**. The elevation of the track surface **24** on the rear track member **20** relative to the elevation of the track surface **23** on the forward track **19** is such that the entire mechanism is supported, when the rollers **21** and **25** are in engagement with these track surfaces, in a rearwardly inclined position to give the top surface of the sofa cushion the pitch toward the back **15** which is normally provided on a sofa seat. The rear track member **20** extends forwardly with a downward and then upward sloping track surface which terminates in a semi-circular seat formation **26** which is adapted to support the rear roller **25** in an elevated position in which the sofa and bed frames **10** and **11** are in horizontal position with the entire end supports **12** extended as shown in Figs. 2 to 5 and the front roller **21** supported on the floor in front of the sofa. The intermediate portion of the track on member **20** permits the rear end of mechanism **12** to drop down at the beginning of the forward movement a sufficient distance to clear the bottom edge of the sofa back **15** (Fig. 2).

The end frame **12** is provided with a stud shaft **27** (Fig. 10) at the front end adjacent the top of the front end plate **16** which extends inwardly of the plate **16** and carries in rotatable relation thereon outer and inner sprocket members **28** and **29**, the inner sprocket **29** being somewhat smaller in diameter than the outer sprocket **28**. The rear end plate **17** carries adjacent its top end a rotatable shaft **30** on the outer end of which there is secured a drive sprocket **31**. The shaft **30** carries on an inwardly extending portion a pair of outer and inner sprocket members **32** and **33** which are of the same diameter as the corresponding sprocket members **28** and **29**, respectively, at the forward end of the frame **12**, and which are connected thereto in driving relation by outer and inner chains **34** and **35**, so that the sprockets **28** and **32** move in unison and the sprockets **29** and **33** also move in unison upon movement of the respective connection chains **34** and **35**.

The top sofa frame **10** is provided at its forward end with an outwardly opening channel forming a track **36** of generally C-shaped cross section. The track **36** extends from the front end of the frame **10**, where it is closed by a stop pin **37**, to an intermediate portion of the end of the frame **10** where it is closed by a stop pin **38**. The track **36** is adapted to receive a roller **39** which is mounted on an inwardly extending pin **40** on the front end of a pivot arm **41**. The frame **10** is adapted to move initially relative to the arm **41** when it is pulled forwardly of the roller **39** until the roller **39** reaches the stop pin **38** at the inner end of the track **36** when further movement of the frame **10** will exert a pull on the end of the pivot arm **41**.

The sofa frame **10** is provided at its rear end with an outwardly extending pivot pin **42** (Fig. 11) which is supported on a depending vertical bracket **43** attached to the end of the frame **10**. The pivot pin **42** is pivotally connected at its outer end to a link **44** of the outer chain **34**. In the initial sofa forming position of the mechanism **12** the pivot connection with the link **44** or the axis of pivot pin **42** is located rearwardly of the axis of the shaft **30** so that movement of the chain **34** and rotation of the sprocket **32** in a counterclockwise or forward direction about the shaft **30** will elevate the frame **10** a relative short predetermined distance. The front end portion of the sofa frame **10** also carries a cam forming angular track **45** (Figs. 7 and 10) which

has a beveled portion 46 at its forward end aligned for engagement with a roller member 47 which is rotatably mounted on the inner end of the stub shaft 27 so that forward movement of the frame 10 elevates the forward end of the same and causes the roller 47 to ride beneath the track 45, the latter extending to a point which is spaced from the rear end of the frame 10. As the frame 10 is pulled or moved forward and carries the chain 34 in the forward direction, due to the pivotal connection 44, the frame 10 will move in a horizontal plane until the roller 47 reaches the end of the track 45 when the frame 10 is freed from its support on the roller 47. Further movement in the forward direction causes the pin 42 or pivot connection 44 to move downwardly around the front of the sprocket 28 and carries the top sofa frame 10 to a lower level extending forwardly of the supporting mechanism in a horizontal plane with the lower bed frame 11 rising in a manner which will be described.

The lower bed frame 11 is pivotally connected at its forward end to the inner front sprocket 29 by means of a pivot pin 48 which extends inwardly of an arm 49 which is fixed on the inner face of the sprocket 29 and a roller bearing 50 which is mounted in a depending bracket arm 51 on the end of the frame 11. With this connection initial movement of the sprocket 29 in the counterclockwise direction will elevate the forward end of the bed frame 11. The frame 11 is provided at its rear end with a relatively short track-like bearing member 52 (Fig. 11) of channel-shaped cross section which receives a roller bearing 53 on the end of a pivot pin 54 which extends inwardly of a radial arm 55 secured on the inner sprocket 33 so that movement of the sprocket 33 in the counterclockwise direction raises the rear end of the frame 11. The two sprockets 29 and 33 being connected by the chain 35 are rotated in unison upon movement of the chain 35 and the pivots 48 and 54 elevate the frame 11 while holding it in a horizontal plane.

The bed frame 11 also carries at its rear end an outwardly opening track forming channel 56 which is adapted to receive the roller 57 on the rear end of the rear portion 58 of the pivot arm 41. The rear portion 58 of the pivot arm 41 is offset from the forward portion of the arm 41 at the connecting point 59 and extends at a slight angle thereto, so that as the pivot arm 41 is pulled or moved in a forward direction the roller 57 is carried in the track 56, the track 56 extending forwardly to a point beyond the center of the frame 11.

Pivot arm 41 has a downwardly extending side arm 60 forwardly of the connecting point 59 which carries a roller 61 which is rotatably mounted on the end thereof and which is adapted to be received in a track forming channel 62 which is secured to the outside of the front vertical plate 16 of the end support frame and extends rearwardly thereof to an intermediate point on the frame and is open for a short distance at the lower end at 63 permitting the roller 61 to move free of the track when in the relaxed position as it is shown in Fig. 7. The roller 61 acts as a traveling pivot support moving in the track 62 and when the upper sofa frame 10 is in fully extended position, the weight of the sofa frame 10 is applied about the roller 61 as a pivot to assist in raising the lower bed frame 11.

The bottom rear fixed track 20 carries at its front end a vertically extending plate support or fork member 64 which is mounted on the top of a post 65 seated in a socket 66 and urged in the upward direction by a compression spring 67. The fork-like plate member 64 has an upwardly opening slot 68 which is at the upper end of a rearwardly and downwardly tapered cam forming edge 69. The fork member 64 is provided with a forwardly and downwardly tapered front cam edge 70. Both of the cam edges 69 and 70 operate to depress the fork member 64 at predetermined points in the operation of the mechanism. The slot 68 is adapted to receive a pin 71 which extends inwardly of the outer chain 34 and which locks the chain 34 against movement relative to the fixed track member 20 when the pin 71 is engaged in the slot 68 as in Fig. 7. Initial movement of the top or sofa frame 10 exerts a pull on the chain 34 through the pivot connection 44 which results in forward movement of the chain 34 and also of the entire end frame structure towards the front edge of the sofa. The sofa frame 10 and the end supporting mechanism 12 move forwardly simultaneously with the sofa frame moving ahead of the mechanism 12 until they reach the positions shown in Fig. 2 where the sofa frame 10 and the bed frame 11 are leveled, the rear end of the supporting mechanism 12 is moved clear of the back 15 of the sofa and the front side edge of the sofa frame 10 extends forwardly of the end supporting mechanism 12 and the bed frame 11. As movement of the chain 34 pulls the entire supporting mechanism 12 to the point shown in Fig. 2 the cam edge 69 on the forked plate member 64 is engaged by a cam member 73 which projects downwardly of an intermediate connecting bar 74 (Fig. 13) extending between the frame end plates 16 and 17. The cam member 73 depresses the forked plate 64 against the force of the spring 67 and releases the pin 71 from engagement in the slot 68 and frees the chain 34 for movement relative to the supporting tracks 19 and 20. At this point the rear support roller 25 is positioned in the seat 26 and the end supporting frame comes to a stop in the position shown in Fig. 2.

When the end supporting mechanism comes to rest in its forward position further pull on the sofa frame 10 causes the chain 34 to move while the end supporting frame members and the bed frame 11 remain in relatively fixed position with the sofa frame 10 moving forwardly toward the fully extended position where the rear edge thereof is positioned above and slightly forward of the front edge of the bed frame 11. The forward movement of the chain 34 moves the pivot pin 42 to a position above the inner front end sprocket 29 where it engages with the upstanding end of the arm 75 (Figs. 2 and 10) on the bell crank which is pivoted at 76 to the inner face of the inner sprocket 29 and which has its other end 77 weighted to hold the arm in proper position between the spaced stop members 78 and 79 on the sprocket 29. Continued movement of the sofa frame 10 in the forward and then downward direction causes the two sprockets 28 and 29 to move in unison about the shaft 27 and results in the arms 49 and 55, which carry the bed frame 11, moving counterclockwise around the shafts 27 and 30 to elevate the bed frame 11.

The continuing forward movement of the sofa frame 10 after the chain 35 is released by depressing the forked plate member 64 moves the stop in 38 at the end of the track 36 on the sofa frame 10 into engagement with the roller 39 on the pivot arm 41 which pulls the pivot arm 41 in a forward direction and engages the roller 61 in the track 62 so that when the sofa frame 10 is in the fully extended forward position and begins to move downwardly about the sprocket 28 the weight thereof on the end of the pivot arm 41 is effective through pivot roller 61 to assist in lifting or elevating the bed frame 11 to its uppermost position. As the sofa frame 10 is moved downward by movement of the pivot connection 44 around the first sprocket 28 the pivot arm 41 swings about the roller 61 as a pivot until the sofa frame 10 is in a position to retract or more backwards towards the rear of the sofa and the end frame structure. The lower run of the chain 34 and the pivot arm 41 support the sofa frame 10 as it moves rearwardly with the weight being carried by the pivot connection 44 and the pivot roller 39.

The inner sprockets 29 and 33 are locked against movement to hold the bed frame 11 in elevated position by a mechanism which comprises a stop arm member 80

(Figs. 7 and 14) of angular shape which is pivoted at one end on the inner end of the shaft **30** and which extends toward the front of the mechanism. The arm **80** carries a pin **81** which is adapted to be engaged in a locking slot **82** in a downwardly extending trip arm or lever **83** which is pivoted at **84** to the rear end frame plate **17**. The trip lever **83** is spring urged in a clockwise direction. The stop arm **80** is held in locked position by an inwardly extending stop pin **85** on the inner face of the inner sprocket **33**. Upon initial movement of the sprocket **33** the pin **85** travels counterclockwise to a position where it engages the top edge of the arm **80** and holds the latter in locked position. This holds the crank arms **49** and **55** up just past 180 degrees and locks them against movement in either direction, the bed frame **11** being elevated to permit the sofa frame **10** to roll beneath the same.

As the sofa frame **10** moves toward its final retracted position the pivot roller **61** drops free of the track **62** and the pivot arm no longer provides a support for the front of the sofa frame **10**. At this point the front of the sofa frame is supported by a roller **86** mounted on an inwardly extending stub shaft **87** on the inner face of the front end plate **16** which roller **86** is engaged by the track **45** on the end of the sofa frame **10**.

The stop arm **80** is unlocked by engagement of pivot pin **42** on the chain **35** with the trip lever **83** as the chain carries the pin **42** to its final position beneath the center of the sprocket **32**. The pin **42** first engages the cam surface **88** on the end of the stop arm **80** and lifts the arm **80** which separates the pin **81** from its locking slot **82** and thereafter strikes the lever arm **83** permitting the arm **80** to fall downwardly and allowing the sprocket **33** to rotate. This releases the rear of the bed frame **11** and allows it to relax or rest upon the sofa frame **10** when the latter is in its final retracted position beneath the bed frame **11**.

Upon its return movement, the pivot pin **42** on the chain **34** engages the cam surface **89** on the end of the stop arm **80** and elevates the arm **80** to engage the pin **81** in the slot **82** on the spring pressed lever arm **83** thereby rotating the sprocket **33** by engagement of the arm **80** with the stop pin **85** on the sprocket **33** and causing the bed frame **11** to be raised by the clockwise movement of the crank arms **49** and **55** to provide clearance for outward or return movement of the sofa frame **10**.

The drive sprocket **31** is secured on the shaft **30** between the end frame plate **17** and an outer end bearing in a bearing support bracket **90** which is secured to the outer face of plate **17**. The sprocket **31** is connected by a chain **91** with a drive sprocket **92** at the lower end of the frame plate **17**. The drive sprocket **92** is mounted on a cross shaft or torque tube **93** arranged below the sprocket **31** and extending crosswise along the rear edge of the bed frame **11** to the corresponding end supporting mechanism **12** at the other end of the frames **10** and **11** so that the end supporting mechanisms **12** on both sides of the sofa operate in unison upon rotation of the shaft or tube **93**.

If it is desired the frame moving or shifting mechanism may be automatically operated by a motor **94** (Figs. 7 and 9) which has a suitable reduction gearing (not shown) and which may be mounted on a suitable support **95** at the bottom of the vertical end plate **17** adjacent the shaft **93** and connected in driving relation with the shaft **93** by the gears **96** and **97**, the latter being secured on the shaft **93**. The motor **94** may be operated by a dial selector switch in conjunction with conventional limit switches, to start and stop the movement of the mechanism and to provide for stopping the movement at the intermediate point where the sofa frame **10** and the bed frame **11** are both in elevated and aligned position as illustrated in Fig. 3.

In the double or twin bed arrangement of Fig. 3 the front edge of the sofa frame is supported by lowering a frame **98** which comprises a cross bar **99** (Figs. 8 and 9) and end supporting legs **100**, with the cross bar pivoted on the pins **101** to the forward cross bar **102** of the sofa frame **10**. The cross bar members **99** and **102** on the sofa frame **10** are formed of plate material so that in the sofa position of the frame there is considerable resiliency or flexibility in the front edge. When the support frame **98** is swung downwardly about the pivot **101** to provide adequate support for the outer side of the frame in the bed position the plate members **99** and **102** form a front edge member which is angular in cross section and provide a rigid front edge for the frame. Handles **103** are spaced along the front edge of the cross plate **99** which may be grasped for manual operation and one or more spring catches **103'** are provided to hold the frame **98** when it is retracted or folded as in Fig. 9. The side members of the sofa frame **10** may be provided with locking bolts **104** at the rear corners which are adapted to be slid into locking sleeves **105** provided in the front corners of the bed frame **11** when the frames are arranged in double bed relation.

In order to insure that the bell crank arm **75** will remain in its proper position when it is moved to the bottom of the sprocket **29** until the pivot pin **42** reaches it on the return movement of the latter, a latch plate member **106** may be provided which is pivotally mounted at **107** on a bracket **108** secured on the inside of the front frame plate **16** and urged in counterclockwise direction by a torsion spring **109** with a stop pin **110** limiting the movement of the same. The end of the latch plate **106** is slotted at **111** to receive and hold the end **75** of the bell crank and also beveled at **112** for engagement by the pivot pin **42**, the latter moving the plate **106** aside to release the crank arm **75** for clockwise return movement of the sprocket **29**.

The outer chain **34** which travels with the sofa bed frame **10** may be guided and supported between the sprockets **28** and **32** by inwardly extending flange members **113** and **114** (Figs. 12 and 13) on the end frame members **18** and **74**, the latter also carrying the cam plate **73** (Fig. 7).

In the illustrated form of the invention the sofa as shown is provided with a depending front cover flap **115** (Figs. 2 to 5) at the front edge thereof and the sofa arms **13** are provided with hinged front panels **116** which conceal the end support mechanisms **12** when they are in retracted position.

In the sofa position, the lower bed frame **11** is supported by the arms **49** and **55** on the two inner sprockets **29** and **33**. The upper sofa frame **10** is supported in the rear by the chain link support pin **42** and the front end of the frame relaxes or rests on the cushion of lower bed frame **11**.

The sofa can be changed to a double or single bed by motor drive through the torque tube or rod **93** or by manual pull on the handles **103** of sofa frame **10**. In the case of motor drive the power is transmitted through sprockets **91** and **31** to the sprocket **32** which carries the chain **34** to which the chain link support pin **42** is attached which sets the sofa frame **10** in motion. In the case of hand operation the application of power is reversed. Manual pull on sofa frame **10** sets frame **10** in motion which transmits motion through sprockets **32**, **31** and **92** to the torque tube **93** which is used to synchronize the operation of both end supporting mechanisms **12**.

Since the chain **34** which carries sofa frame **10** is supported on sprockets **32** and **28**, when motion starts, the chain link support pin **42** rolls up and forwardly about the sprocket **32**, raising the rear edge of the frame **10** and the track **45** moves forwardly and up onto roller **47** raising the front edge of the sofa frame **10**. Thus the sofa frame **10** is raised off the top of the bed frame **11** and rolls forwardly without interference.

In the meantime force is applied to the chain pin **71**,

which is on the same chain 34 as chain link support pin 42. Since pin 71 is held in the slot 68 in the forked plate 64 which is fixed relative to the bottom of the sofa arm 13 the force applied to the pin 71 results in the entire end support mechanism 12 moving out of sofa arm 13, the mechanism being supported on the rollers 21 and 25. Front roller 21 will roll down off its track 19 onto the floor and rear roller 25 will roll along its track which drops down at first in order that the sofa frame 10 will not interfere with sofa back 15 and then slopes up to bring the frames 10 and 11 level. The forward travel of the end support mechanism 12 is halted when the forked plate 64 is pushed down by the cam block 73 which releases the pin 71 and permits the chain to continue to move without movement of the end support mechanism 12.

In the meantime sofa frame 10 has been rolling out of the mechanism. As stop bolt 38 in the end of the track 36 on the frame 10 reaches the roller 39 on pivot arm 41 the roller 61 enters the track 62 and the pivot arm 41 rolls out with the sofa frame 10. The pivot roller 57 on the opposite end of the pivot arm 41 rolls in the track 52 on the bed frame 11. As the pivot arm 41 rolls out with the sofa frame 10, it will support and hold the sofa frame 10 in a horizontal position after the track 45 leaves the roller 47.

When the chain link support pin 42 comes in contact with crank arm lever 75, both crank arms 49 and 55 begin to turn as they are connected by the inner chain 35. The crank arms 49 and 55 raise the bed frame 11 in a circular motion while the sofa frame 10 is lowered in a circular motion. The pivot arm 41 still holds the sofa frame 10 level, because the rate at which roller 39 drops is the same rate at which roller 57 raises. Also the crank center distance is the same as the center distance of the chain link support pin 42.

After the crank arms 49 and 55 have moved 90 degrees the double bed position has been reached. If the mechanism is hand operated, bolts 104 at the rear end of the sofa frame 10 can be slid into the lock members 105 at the front end of the bed frame 11. If the mechanism is motor operated, the worm gear reduction in the motor 93 will hold the sofa frame 10 in this position after the limit switch has stopped the motor. The front edge supporting frame 96 on the sofa frame 10 is then swung downwardly to position the legs 100 for supporting the frame 10 and the double bed position is completed.

If the double bed position is not required, operation of the mechanism can be continued until the crank arms 49 and 55 have turned more than 180 degrees at which time chain link support pin 42 escapes from or moves out of engagement with the crank arm lever 75. The lock lever 106 will hold crank lever 75 so that the movement of the cranks 49 and 55 can not be reversed. The stop pin 85 which is on the same sprocket 33 as crank arm 55 comes to rest against the stop arm 80 which in turn is held in place by trip lever 83. This holds the crank arms 49 and 55 up just past 180 degrees and except for the normal amount of play the crank arms 49 and 55 can not move in either direction of rotation. This holds the bed frame 11 up, providing clearance for the sofa frame 10 to roll under without interference. The forked plate 64 is in the way of pivot pin 42 moving inward on the chain 34 but the cam edges 69 and 70 allow the pin 42 to push the forked plate down and pass by. As pin 42 approaches the end of its travel it engages trip lever 83 and releases the stop arm 80 and stop pin 85 for rotation which in turn allows the crank arms 49 and 55 to rotate. The front of the sofa frame 10 is supported by roller 87 engaging beneath the track 45 when the roller 61 moves out of track 62 ending the support provided by pivot arm 41. Since the crank arms 49 and 55 are free to turn counterclockwise and the pivot arm 41 gives no support to the bed frame 11, the latter relaxes or rests on the cushion of the sofa frame 10 which is now in the bottom position. This is the final condition of the mechanism for single bed use.

The stop arm 80 is in front of pivot pin 42, as the return cycle starts, and pin 42 turns the stop arm 80 clockwise which in turn works against stop pin 85 turning the crank arms 49 and 55 clockwise until pin 42 escapes from or moves past the lower end of the stop arm 80 and the trip lever 83 locks the stop arm 80. This action raises the bed frame 11 providing clearance for the sofa frame 10 to move out from beneath the same. The pivot pin 42 moves out until it engages and trips lock plate 106 releasing the crank arm lever 75 which is ready to receive the pin 42 and be pushed back around the shaft 27. As the sofa frame 10 is returning to the sofa position the pin 71 contacts the cam edge 69 of the forked plate 64 and engages in the slot 68 whereupon the entire end support mechanism 12 is returned into the sofa arm 13.

While specific details of construction have been referred to in the illustrated form of the invention it will be understood that other details of construction may be employed within the spirit of the invention.

I claim:

1. A convertible furniture piece comprising a seat forming frame and a bed forming frame arranged in superimposed relation, end support frames and mechanism connecting said seat and bed forming frames to said end support frames for sliding movement of said seat and bed forming frames relative to each other in horizontal and vertical planes to selectively interchange the seat and bed forming frames.

2. A convertible furniture piece comprising a seat forming frame and a bed forming frame, end support frames and mechanism connecting said seat and bed forming frames to said end support frames for sliding movement of said seat forming frame relative to said bed forming frame to position the frames in horizontal alignment or to position each one of said frames in the space initially occupied by the other one of said frames.

3. A convertible furniture piece comprising a seat forming frame, a bed forming frame, end support structures normally supporting said frames in superimposed relation, and mechanism connecting said seat and bed forming frames to said end support structures including means for imparting a sliding and pivotal movement of said frames relative to each other and to said end support structures whereby said seat frame may be moved in vertical and horizontal planes into and out of the position normally occupied by said bed forming frame to provide a seat which rests on the top of the bed or a bed which rests on the top of the seat.

4. A convertible seat and bed construction comprising a pair of generally rectangular frames arranged one above the other when in initial seat forming position, the lowermost frame being provided with a bed structure and the uppermost frame being provided with a seat cushion structure, and means at the ends of said frames for supporting said frames for movement relative to each other, said means including mechanism for supporting the uppermost frame while it is moved horizontally outwardly and then downwardly relatively to the lowermost frame and mechanism to elevate said lowermost frame in response to outward and downward movements of said uppermost frame whereby said uppermost frame may be moved horizontally beneath said lowermost frame to interchange said frames and position the lowermost frame above the uppermost frame.

5. A convertible seat and bed construction comprising a pair of generally rectangular frames arranged one above the other when in initial seat forming position, the lowermost frame being provided with a bed structure and the uppermost frame being provided with a seat cushion structure, and means at the ends of said frames for supporting said frames for movement relative to each other, said means including mechanism for sup-

porting said uppermost frame while it is moved horizontally outwardly and then downwardly relative to said lowermost frame and elevating mechanism for said lowermost frame which is operative in response to outward and downward movements of said uppermost frame whereby said uppermost frame may be moved horizontally beneath said lowermost frame to interchange said frames and position said lowermost frame above said uppermost frame, said elevating mechanism being arranged to support said lowermost frame while it is moving and to release the same for support on said uppermost frame when the latter frame is positioned beneath said lowermost frame.

6. A convertible furniture piece of the sofa type comprising a sofa seat forming frame and a bed forming frame normally positioned in superimposed relation, end support structures, mechanism connecting said sofa and bed forming frames to said end support structures for movement of the bed forming frame into and out of the position normally occupied by said sofa seat forming frame, said mechanism being constructed to rigidly support said frames while they are being moved and to release the frame which is in the uppermost position at the end of its movement for support on the frame which is in the lowermost position.

7. A sofa bed construction comprising a pair of generally rectangular frames arranged one above the other when in initial sofa forming position, the lowermost frame being provided with a bed forming structure and the uppermost frame being provided with a sofa cushion forming structure, and upright rigid frames at the ends of said sofa and bed frames each having means for supporting said sofa and bed frames for movement relative to each other, said supporting means including a pivot arm having pivotal and sliding connections with the sofa and bed frames and with the rigid end frame for supporting the upper sofa frame while it is moved horizontally outwardly and then downwardly relatively to the lower bed frame and mechanism to elevate said lower bed frame upon outward and downward movement of said upper sofa frame whereby said sofa frame may be moved horizontally beneath said bed frame to interchange said frames and position the bed frame above the sofa frame.

8. A sofa bed construction as recited in claim 7 and the mechanism to elevate said lower bed frame comprising spaced crank arms pivotally mounted on said rigid end frame and pivotally connected to the end of said lower bed frame which crank arms are simultaneously rotated to raise the bed frame with a circular motion.

9. A convertible furniture piece comprising a seat forming frame and a sleeping bed forming frame which are adapted to be positioned in horizontal alignment or in superimposed relation, and supporting structures and mechanism movably connecting the ends of said seat and bed forming frames to said end supporting structures, said connecting mechanism including a fixed frame having a generally horizontal track, an elongate pivot arm which is pivotally connected at its ends to the ends of said seat and bed frames respectively, said pivot arm having a pivot member intermediate its ends which is slidably received in said track, and associated connecting members whereby said seat frame may be extended in a generally horizontal plane and depressed while the bed frame is raised to position the frames in side-by-side relation and thereafter said seat frame may be further depressed and retracted beneath the bed frame with the weight of the seat frame acting through the pivot arm to balance the weight of the bed frame as the frames move relative to each other and to the fixed frame.

10. A convertible furniture piece comprising a sofa seat forming frame and a sleeping bed forming frame which are adapted to be positioned in horizontal alignment or in superimposed relation, end supporting frames and mechanism movably connecting the ends of said sofa and bed forming frames to said end supporting frames, said end connecting mechanism including a fixed frame having a generally horizontal track, an elongate pivot arm which is pivotally and slidably connected at its ends to the front and rear ends of said sofa and bed frames respectively, said pivot arm having a pivot member intermediate its ends which is slidably received in said track, and associated connecting members between said sofa and bed frames whereby said sofa frame may be extended in a generally horizontal plane and depressed while the bed frame is raised to position the frames in side-by-side relation and thereafter said sofa frame may be further depressed and retracted while in a lower horizontal plane to position it beneath the bed frame with the weight of the sofa frame acting through the pivot arm to balance the weight of the bed frame as the frames move relative to each other and to the fixed frame of the end connecting mechanism.

11. A convertible furniture piece comprising a sofa seat forming frame and a sleeping bed forming frame which are adapted to be positioned in horizontal alignment or in superimposed relation, end supporting frames and mechanism movably connecting the ends of said sofa and bed forming frames to said end supporting frames, said connecting mechanism including a fixed frame having a generally horizontal track, an elongate pivot arm which is pivotally and slidably connected at its ends to the ends of said sofa and bed frames, respectively, said pivot arm having a pivot member intermediate its ends which is slidably received in said track, a pair of sprockets mounted on said fixed frame, a chain on said sprockets, a pivot member connecting the rear end of said sofa frame to said chain, a pair of crank arms mounted for pivotal movement about the axis of said sprockets, and means connecting said crank arms for movement with said chain when said sofa frame is extended in a generally horizontal plane and depressed whereby the bed frame is raised to position the frames in side-by-side relation and thereafter said sofa frame may be further depressed and retracted while in a lower horizontal plane to position it beneath the bed frame with the weight of the sofa frame acting through the pivot arm to balance the weight of the bed frame as the frames move relative to each other and to the fixed frame.

12. In a convertible furniture piece, a seat forming frame and a bed forming frame which are adapted to be positioned in horizontal alignment or in superimposed relation, end supporting structures comprising a rigid frame having a track mounted thereon, spaced sprocket shafts, inner and outer sprockets on each shaft and a pair of parallel chains connecting the sprockets, a pivot connecting the rear end of said seat forming frame with one of said chains, bracket arms on the inner sprockets, and pivot connections between said bracket arms and said bed forming frame, an elongate pivot arm which is pivotally and slidably connected at its ends to the front and rear ends of said seat and bed frames, respectively, said pivot arm having a pivot member intermediate its ends which is slidably received in said track, and means operated upon predetermined movement of said seat frame to connect said chains for simultaneous movement whereby when the seat frame is extended and depressed the bed frame is raised to position the frames in side-by-side relation and thereafter said seat frame may be further depressed and retracted beneath the bed frame with the weight of the seat frame acting through the pivot arm to balance the weight of the bed frame as the frames move relative to each other and to the fixed frame.

13. A convertible furniture piece comprising a sofa seat forming frame and a bed forming frame which are adapted to be positioned in superimposed relation, rigid end supporting frames having track formations and mechanism movably connecting the ends of said sofa and bed forming frames to each of said end supporting frames, said connecting mechanism including a pair of sprockets

mounted for rotation at each end of the end supporting frame, inner and outer chains carried on said sprockets, bracket arms fixed on the inner sprockets, pivot members connecting the ends of the bracket arms with the ends of the bed forming frame, a pivot member connecting the end of the seat forming frame adjacent the rear edge thereof with the outer chain, an elongate pivot arm which is pivotally and slidably connected at its ends to the ends of said seat and bed forming frames, respectively, said pivot arm having a pivot member intermediate its ends which is slidably received in the track on the rigid end frame, means movably supporting the rigid end frame, means connecting the outer chain to the rigid end frame to cause the end frame to move forwardly a predetermined distance upon forward movement of the seat forming frame and means connecting the chains for simultaneous movement upon predetermined movement of said seat forming frame whereby when said seat forming frame is extended in a generally horizontal plane and depressed the bed forming frame is raised to position the frames in side-by-side relation and thereafter said seat forming frame may be further depressed and retracted while in a lower horizontal plane to position it beneath the bed forming frame with the weight of the seat forming frame acting through the pivot arm to balance the weight of the bed forming frame as the frames move relative to each other and to the rigid end frame.

14. A convertible furniture piece as recited in claim 13 and said track being terminated short of the final position of the pivot member on said pivot arm to release said pivot member when said seat forming frame is in its initial and final positions to allow the uppermost frame to rest on the lowermost frame.

15. A sofa bed construction comprising a pair of generally rectangular frames arranged one above the other when in initial sofa forming position, the lowermost frame being provided with a bed forming structure and the uppermost frame being provided with a sofa cushion forming structure, and supporting and moving means for said frames at the ends thereof, said end supporting and moving means including mechanism for supporting the upper sofa frame and moving it horizontally outwardly and then downwardly relatively to the lower bed frame, mechanism for supporting said lower bed frame and for moving the same to an elevated position upon outward and downward movement of said upper sofa frame whereby said sofa frame may be moved horizontally outwardly and then inwardly beneath said bed frame to interchange said frames and position the bed frame above the sofa frame, and a motor drive means connected to said end supporting and moving means for said sofa and bed frames.

16. A sofa bed construction comprising a pair of generally rectangular frames arranged one above the other when in initial sofa forming position, the lowermost frame being provided with a bed forming structure and the uppermost frame being provided with a sofa cushion forming structure, and means at the ends of said frames for supporting and moving said frames relative to each other, said end supporting and moving means including spaced shafts having sprockets mounted thereon and a chain drive connecting the sprockets, the upper sofa frame having a pivotal connection with said drive and being movable with said chain drive horizontally outwardly and then downwardly and inwardly relatively to the lower bed frame, the lower bed frame having separable connections with said shafts and being movable to an elevated position in response to predetermined movements of said chain drive whereby said sofa frame may be moved horizontally outwardly and then inwardly beneath said bed frame to interchange said frames and position the bed frame above the sofa frame, and a motor connected in driving relation with one of said shafts to operate said chain drive.

17. A convertible furniture piece comprising a seat forming frame and a bed forming frame normally positioned in superimposed relation, end support structures at opposite ends of said seat and bed forming frames, mechanism for connecting said seat and bed forming frames to said end support structures and for moving said seat and bed forming frames, said mechanism being operative to move each of said frames into and out of the position normally occupied by the other of said frames and a connecting shaft extending between said end support structures for operating said mechanisms simultaneously.

18. In a convertible sofa having a sofa seat forming frame, a bed forming frame, end support frames and mechanism connecting said sofa and bed forming frames to said end support frames for movement of said sofa and bed forming frames relative to each other to convert the sofa frame for use as a bed frame, said sofa frame being formed of relatively rigid members along the ends and rear side edge and having a normally flexible front edge, said front edge consisting of a pair of relatively flexible flat plate members extending in flat face-to-face relation between the rigid end members and having a hinge joint along the outer edge whereby said plate members may be swung relatively to each other to form a substantially rigid angle member when the sofa frame is converted for use as a bed.

19. A convertible furniture piece comprising a seat forming frame and a bed forming frame normally positioned in superimposed relation, end support structures at opposite ends of said seat and bed forming frames, mechanism for connecting said seat and bed forming frames to each of said end support structures and for moving said seat and bed forming frames, said mechanism comprising means for moving said frames selectively from their normal superimposed relation into coplanar extended relation or into interchanged relation, and means for operating said mechanisms simultaneously including a connecting shaft extending between said mechanisms.

20. In a convertible sofa having a sofa seat forming frame, a bed forming frame, end support frames and mechanism connecting said sofa and bed forming frames to said end support frames for movement of said sofa and bed forming frames relative to each other to convert the sofa frame for use as a bed frame, said sofa frame being formed of relatively rigid members along the ends and rear side edge, and a front edge frame structure which is normally flexible, said front edge frame structure comprising relatively flat narrow strip members which connect the rigid end frame members and which are arranged to be rotated relative to each other into angular relation thereby to form a substantially rigid edge structure when the sofa frame is converted for use as a bed.

21. In a convertible sofa having a sofa seat forming frame, a bed forming frame, end support frames and mechanism connecting said sofa and bed forming frames to said end support frames for movement of said sofa and bed forming frames relative to each other to convert the sofa frame for use as a bed frame, said sofa frame being formed of relatively rigid members along the ends and rear side edge and having a normally flexible front edge, said front edge comprising a pair of relatively flexible flat plate members which connect the rigid end members, one of said plate members being mounted for rotation about a longitudinally extending axis to bring it into angular relation with the other of said plate members to form therewith a substantially rigid front edge when the sofa frame is converted for use as a bed.

22. A convertible furniture piece of the sofa type comprising a fixed frame having end arm forming members and a connecting back forming member, a sofa frame and a bed frame initially arranged in superimposed relation with a side portion thereof beneath the back forming member, a supporting structure for said sofa and bed frames having upright end support members mounted for horizontal movement outwardly of the fixed frame to shift the superimposed sofa and bed frames from beneath the

back forming member, mechanism connecting said sofa and bed frames to said end support members for relative movement in horizontal and vertical planes, said mechanism being operative to move the sofa frame outwardly to one side of the bed frame, thereafter to move the bed frame vertically upward while simultaneously moving the sofa frame vertically downward and then to move the sofa frame horizontally inward to position the sofa frame beneath the bed frame.

23. A convertible furniture piece of the sofa type comprising a sofa seat forming frame and a bed forming frame normally positioned in superimposed relation, and mechanism at the ends of said frames for supporting said frames for movement relative to each other to interchange the position of the same, said supporting mechanism comprising a fixed end member and a horizontally movable end member, and means movably connecting said seat and bed forming frames to said movable end member, said connecting means being operative to move said sofa frame horizontally from a position above said bed frame to a position at the forward side of said bed frame and thereafter to simultaneously move the sofa and bed frames vertically relative to each other and to move the sofa frame beneath the bed frame.

24. A convertible furniture piece comprising a seat forming frame and a bed forming frame, end support members for said frames, mechanism connecting said frames to said end support members for movement in horizontal and vertical directions relative to each other and to said end support members, said frames being initially positioned in superimposed relation, said mechanism being operative to move said frames relative to each other horizontally and then vertically into extended side by side coplanar relation, said sofa frame having relatively rigid members along the ends and the rear side thereof and a pair of relatively narrow flat plate members extending along the forward side which are initially positioned in generally horizontal planes so as to provide a relatively flexible side edge on said sofa frame, one of said flat plate members being movable when the sofa frame is in extended position to bring it into a generally vertical plane for cooperation with the other plate member to provide a relatively rigid forward side edge on said sofa frame.

25. A convertible sofa comprising a sofa seat forming frame and a bed forming frame normally positioned in superimposed relation, end support structures, mechanism for movably connecting said sofa and bed forming frames to said end support structures, said mechanism including means operable to initially move said sofa frame vertically relative to the bed frame, means operable to move said sofa frame horizontally to a position at one side of said bed frame, means operable to lower said sofa frame and simultaneously elevate said bed frame to position said frames in side by side coplanar relation, and a motor drive connected to said mechanism for operating said means.

26. A convertible furniture piece of the seat and bed type comprising a fixed support frame having end members and a cross connecting member, a seat frame and a bed frame initially positioned in superimposed relation, upright end support members mounted on said fixed support frame for limited movement in a horizontal direction, mechanism connecting the ends of said seat and sofa frames to said upright end members for movement in horipontal and vertical directions relative to each other and to said upright end members, said connecting mechanism being operative to move said seat frame outwardly in a horizontal direction to a position at one side of the bed frame to lower the seat frame and simultaneously to elevate the bed frame while they are in side by side position thereby to bring the seat and bed frames into different horizontal planes and to move the sofa frame in a reverse horizontal direction to a position beneath the bed frame.

27. A convertible furniture piece as recited in claim 26, and mechanism for locking said sofa and seat frames in side by side coplanar relationship to form a double bed.

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