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(54) **EXTENDABLE AND FLIP-OVER
CONVERTIBLE SEAT**

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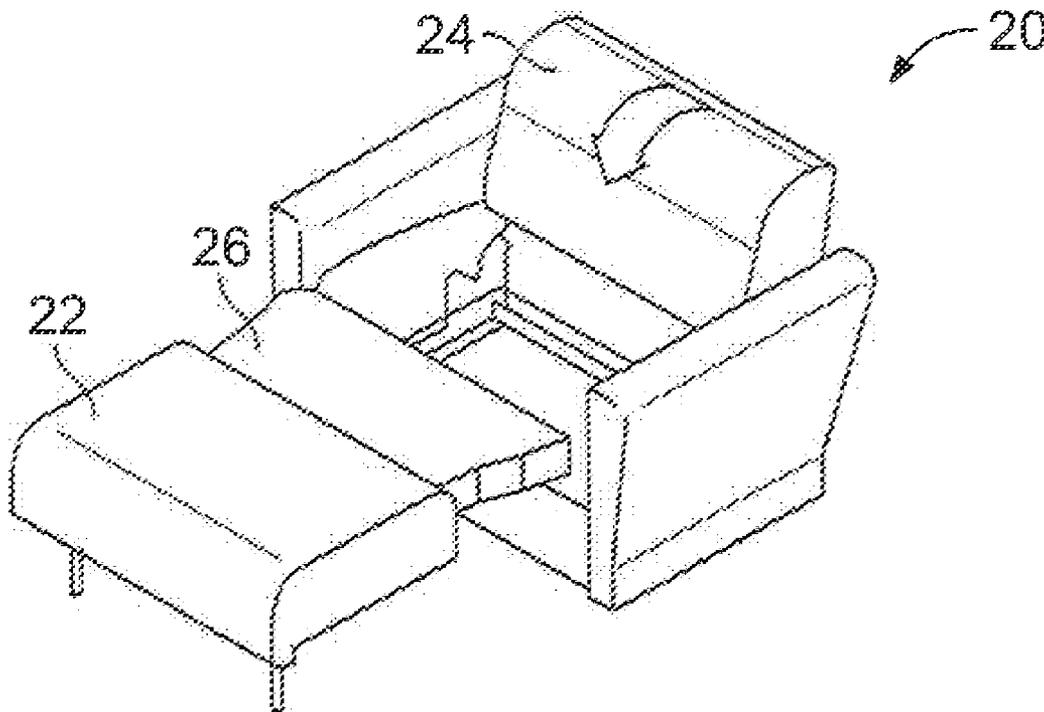
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(57) **ABSTRACT**

A convertible seating unit is adaptable for use in different applications (e.g., motor home, travel trailer, hospital room, commercial, and residential). A frame and linking mechanism reduces the number of steps required to position the unit between seat and bed configurations. The mechanism includes seat and mid seat sections that are attached via a set of articulating linkage which provide that when the seat front is lifted and pulled up/outward, support feet automatically extend without secondary motion by the user. Once the support feet are supported by the floor, a back section is rotated forward from its seat to its bed position, thus completing conversion from a chair to a bed.



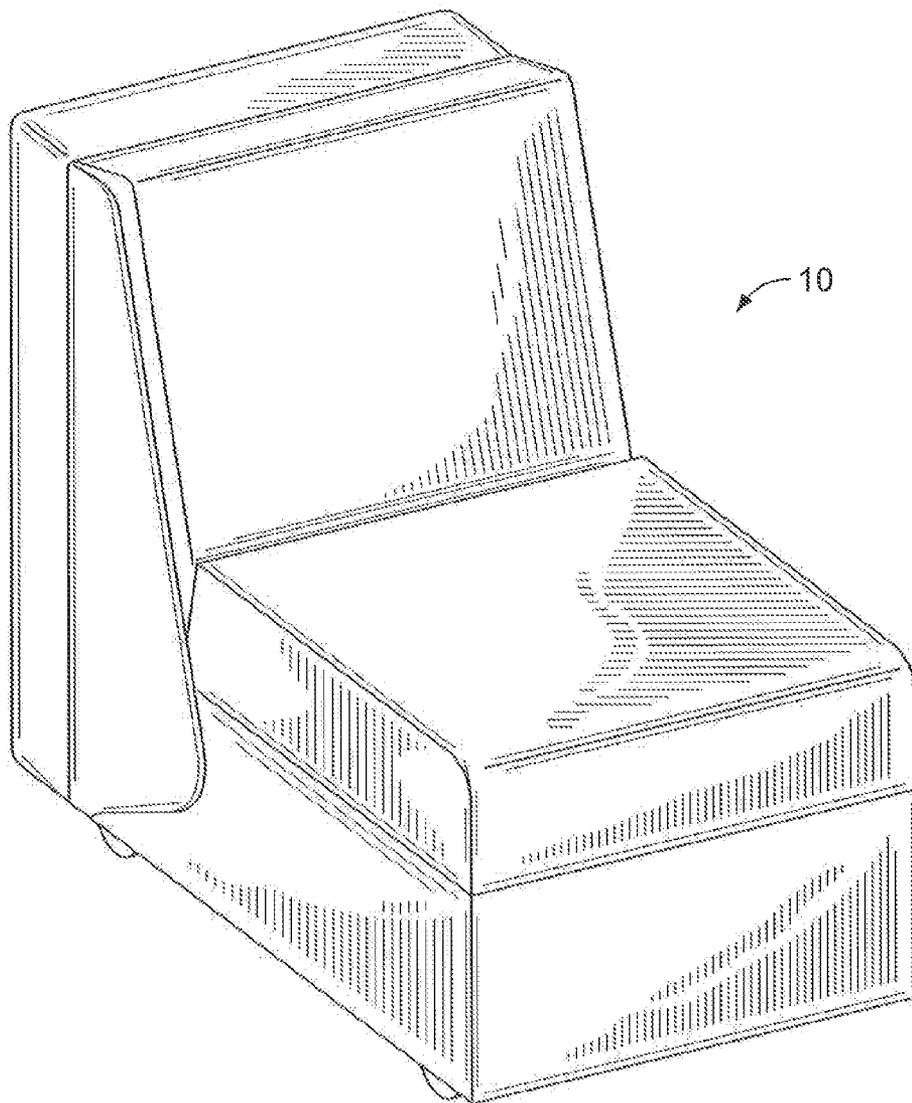


FIG. 1A
PRIOR ART

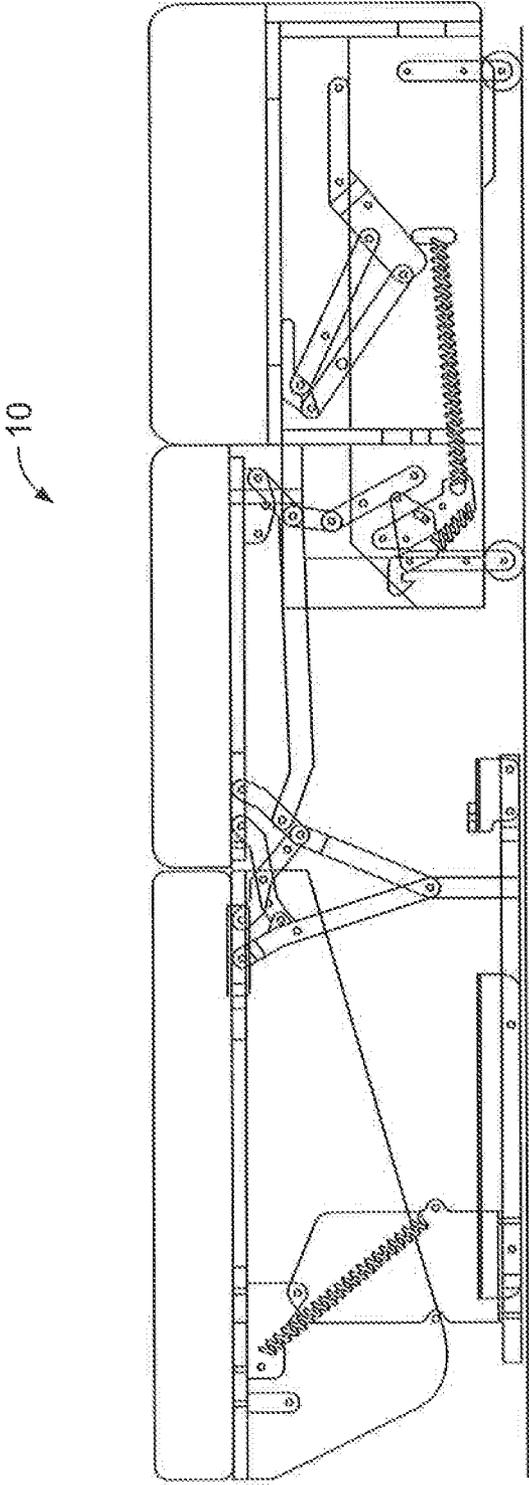


FIG. 1B
PRIOR ART

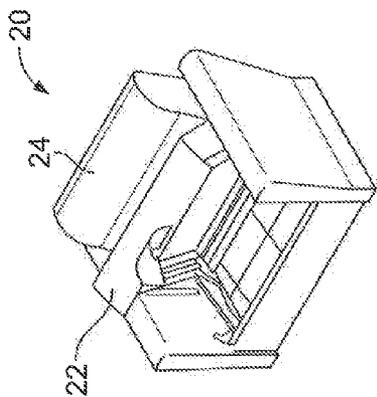


FIG. 2B

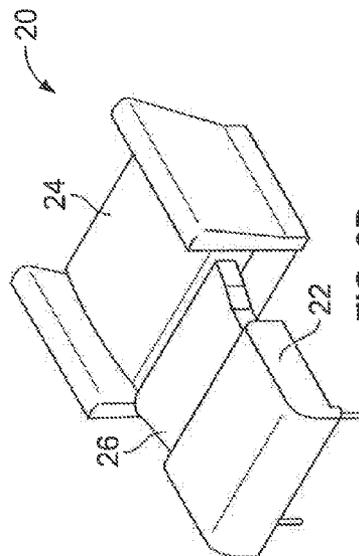


FIG. 2D

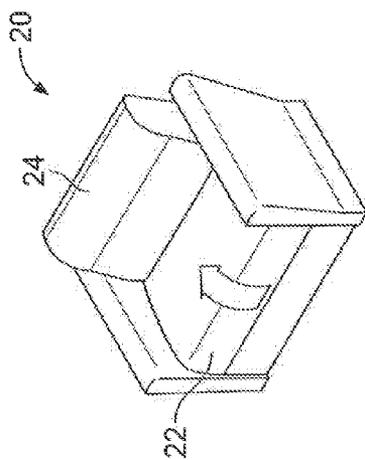


FIG. 2A

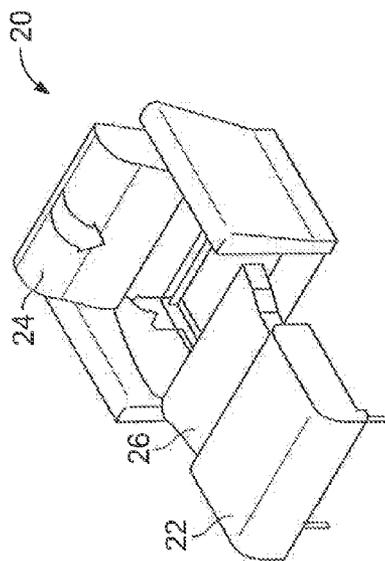


FIG. 2C

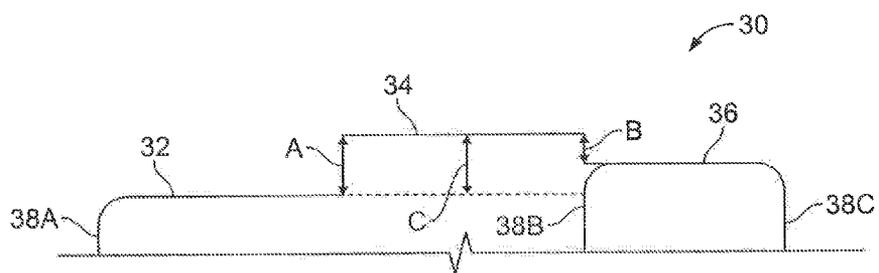


FIG. 3

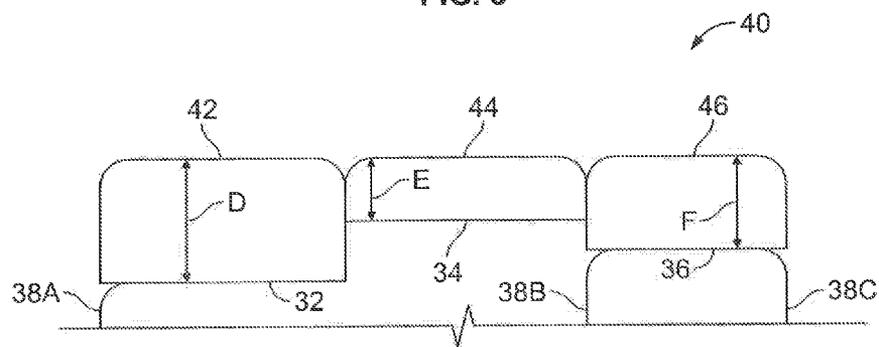


FIG. 4

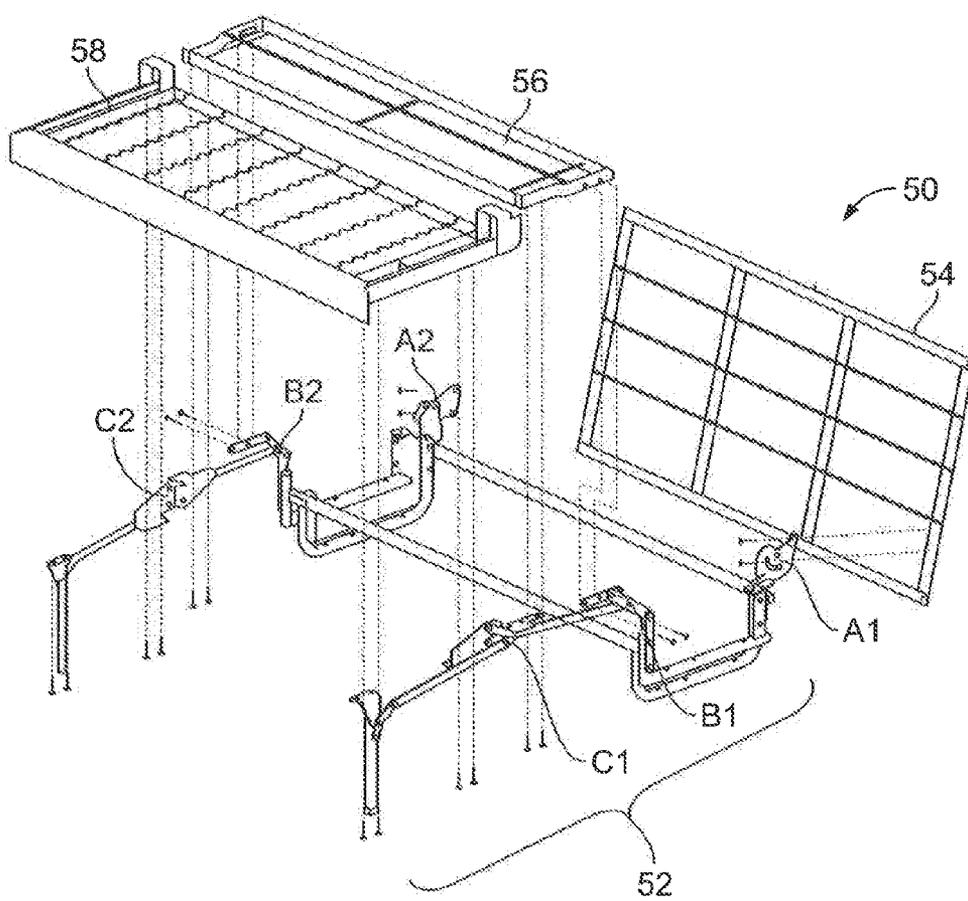


FIG. 5

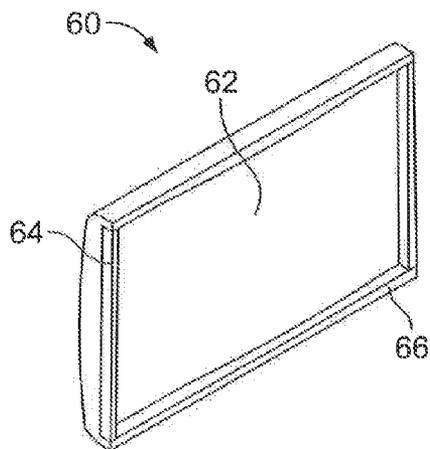


FIG. 6A

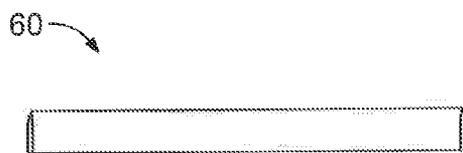


FIG. 6D

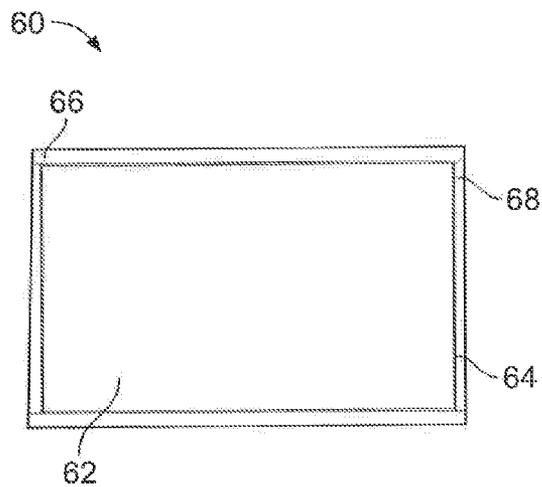


FIG. 6C

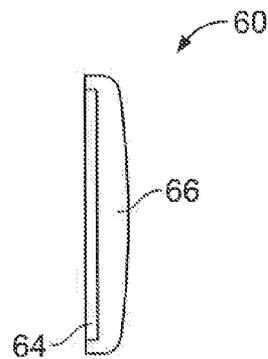


FIG. 6B

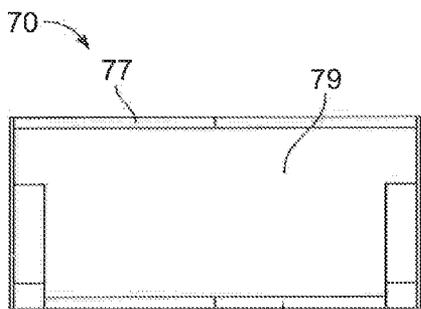


FIG. 7E

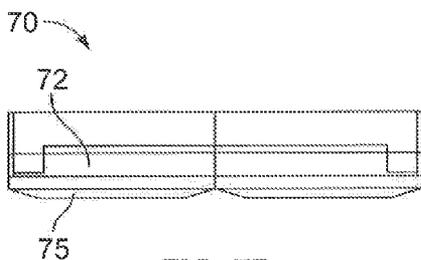


FIG. 7D

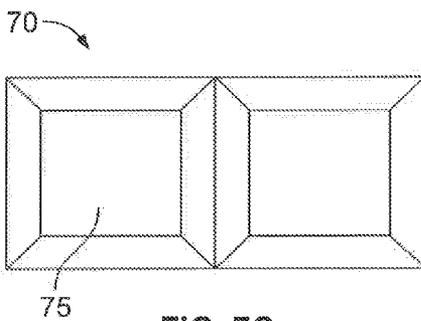


FIG. 7C

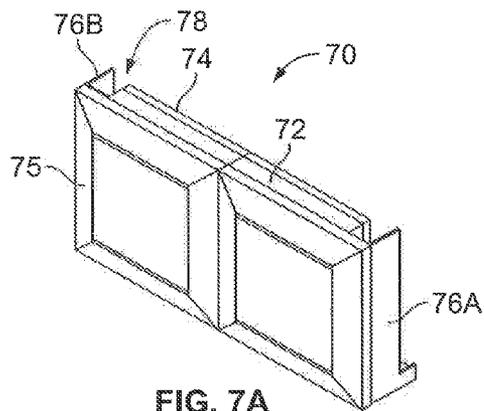


FIG. 7A

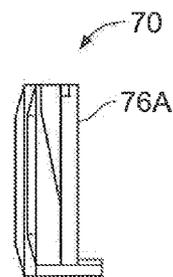
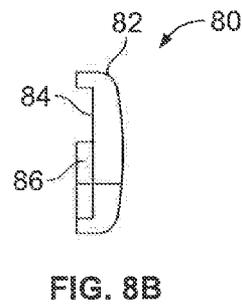
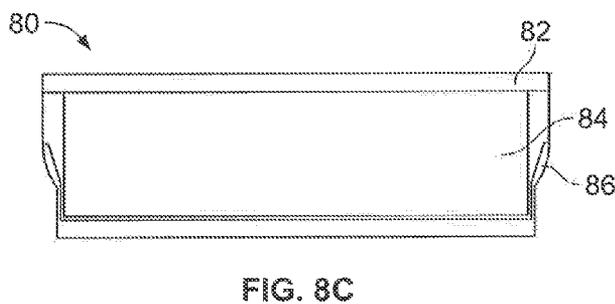
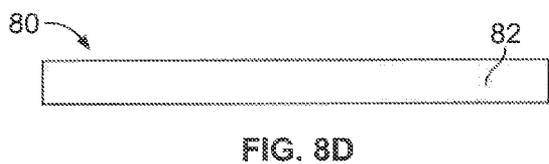
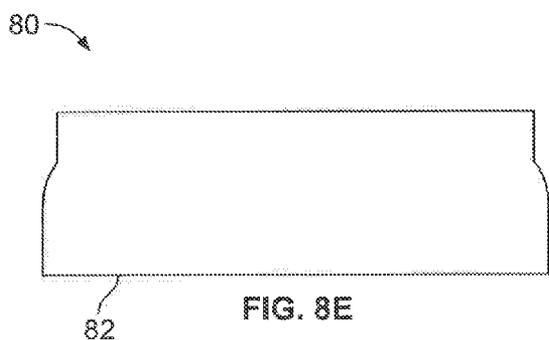
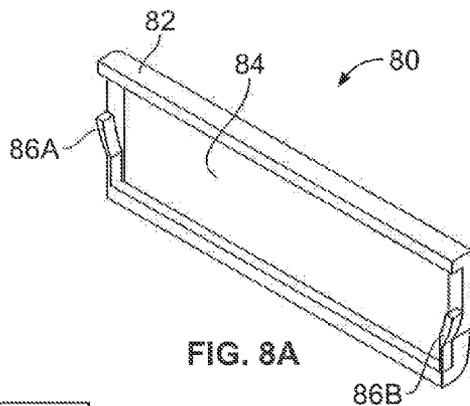


FIG. 7B



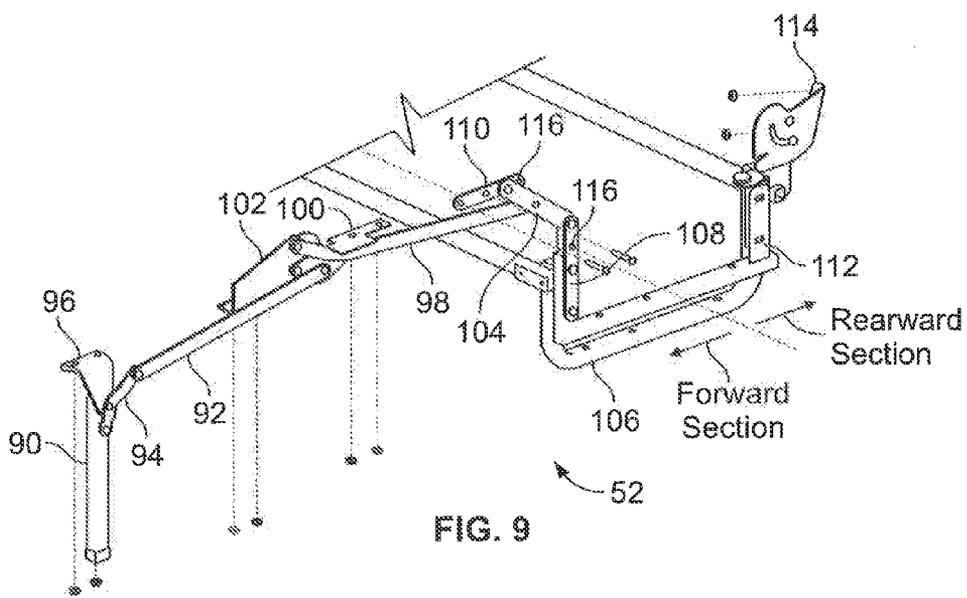


FIG. 9

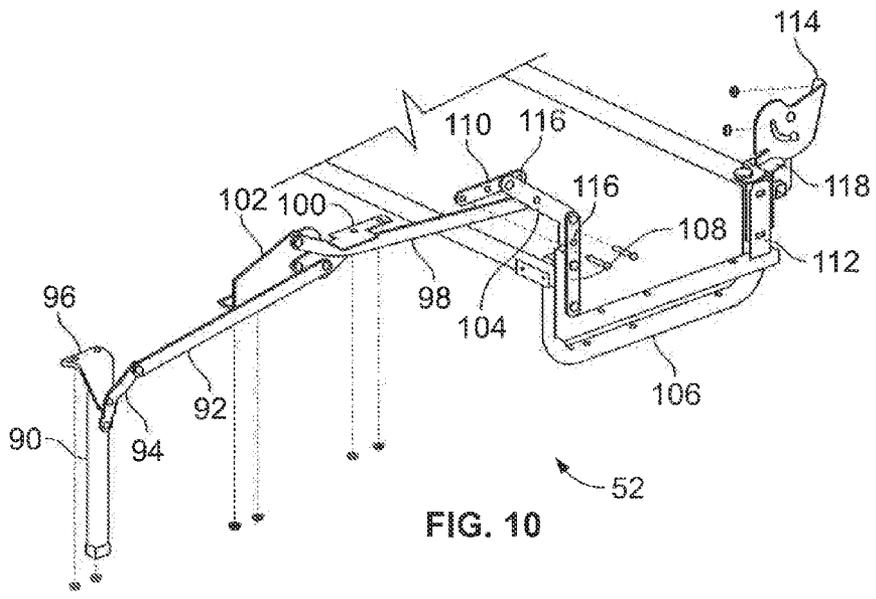


FIG. 10

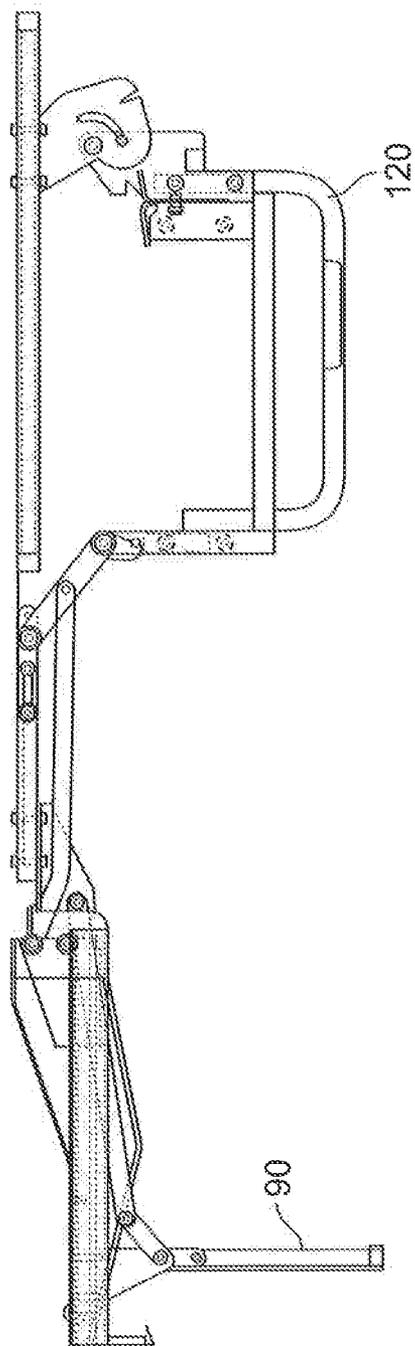


FIG. 12

**EXTENDABLE AND FLIP-OVER
CONVERTIBLE SEAT**

**CROSS-REFERENCE TO RELATED
APPLICATIONS**

[0001] The present application claims priority to U.S. provisional application 61/828,450, filed May 29, 2013, entitled Extendable and Flip-Over Convertible Seat, incorporated herein by reference in its entirety. This application is also related to U.S. patent application Ser. No. _____ (Attorney Docket No. CU-71246) filed concurrently and commonly owned, and entitled "Convertible Seat/Bed Having Noncoplanar Bed Base Sections," which is also hereby incorporated by reference in its entirety.

BACKGROUND

[0002] 1. Technical Field

[0003] The present invention pertains to the field of convertible seats, and in particular to a convertible seat deployable between a chair/loveseat configuration and a bed configuration, and a frame there for.

[0004] 2. Background of the Invention

[0005] Seating units (e.g., sofas, chairs, etc.) that are convertible into beds are popular with consumers because of their multi-functionality. Many consumers find it very convenient to have a seating unit that can provide a bed for a guest; as such a unit can eliminate the need for an additional, separate bed. Some such seating unit designs include their own complete mattress that is folded within a cavity of the sofa or chair during periods of non-use. This type of sofa-bed can be quite heavy, and typically requires not only a separate mattress, but also a relatively intricate mechanism to convert the seat into a bed as well as control the unfolding and folding of the mattress.

[0006] Convertible seats are popular in health care environments (e.g., hospitals), because they provide a family member visiting a patient with a furniture piece in the patient's room on which one can either sit or sleep. They are also used as recreational vehicles to expand sleep areas without sacrifice to space of conventional convertible sofa sleeper. In one example, a convertible seat includes linkage that directs a seat back over a seat deck in a flipping movement. The seat back flips, or moves through a rollover, so that the upholstery faces forward in the seat back position and up in the bed position, roughly moving through 270 degrees. Bed legs are deployable by manual rotation about an axis.

[0007] Other versions of convertible seats include a seat and reversible backs that are moveable from the rear to the front of the seat.

[0008] Day-beds have seat backs that have upholstery on one side and a mattress on the other. To be used as a bed, the seat back is pulled forward and folded down, The upholstered seating side faces down and the mattress surface faces up.

[0009] Convertible seats with three deck, flip over back configurations require an air mattress to provide an adequate sleep surface for the user. Such seats require the execution of multiple steps to convert the unit from a sitting/seat configuration to a sleeping/bed configuration. The steps typically include opening a seat or back section to expose folded support legs, opening the legs while completing movement to the bed position, and retrieving, preparing and inflating an air mattress. The three deck convertible seats have limited storage area under the sofa, create pinch points that can damage

the air mattress, and create large, non-functional spaces between the bed and the wall where, for example, pillows can fall.

BRIEF SUMMARY OF THE INVENTION

[0010] Disclosed are embodiments of a seating unit convertible between a seat configuration and a bed configuration. The seating unit may have a base having a forward section to which linkage for a mid-seat section and a seat section are connected, and a rearward section to which linkage for a back section is connected. The linkage for the mid-seat section and the seat section may function separately from linkage for the back section and may be connected through the base. A mid-seat frame and a seat frame may be connected to the forward section, wherein in a seat configuration the mid-seat frame may be located underneath the seat frame.

[0011] The seating unit may further comprise a leg connected to the seat section that extends from a substantially horizontal plane to a substantially vertical plane as the seat frame is extended. A back frame mounting bracket may be connected to the rearward section of the base, wherein the back frame mounting bracket includes a hinge guide bracket to guide the back frame mounting bracket as the convertible seat is converted from a bed to a seat. Linkage for the mid-seat section may include two stop pins that limit movement of the mid-seat section to a substantially horizontal orientation as the convertible seat is converted from a bed to a seat.

[0012] In a bed configuration a support leg connected to the base frame may extend below a plane that defines a surface that supports a main base support of the base. In a bed configuration a mid-deck frame that comprises the mid-seat section may lie within a first horizontal plane, a back deck frame that comprises the back section may lie within a second horizontal plane, and a seat deck frame that comprises the seat section may lie within a third horizontal plane, The first horizontal plane may be at a first elevation, the second horizontal plane may be at a second elevation which is lower than the first elevation, and the third horizontal plane may be at a third elevation which is lower than the second elevation, A vertical distance between the first and second horizontal planes may be less than a vertical distance between the first and third horizontal planes. In the seat configuration, a seat cushion may abut a back cushion. The abutment may prevent rotation and movement of a back frame mounting bracket.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] FIG. 1A is a perspective view of a convertible chair of the prior art with the bed shown in the folded/chair configuration;

[0014] FIG. 1B is a side section view of the convertible chair of FIG. 1A shown in the Unfolded/sleeper configuration;

[0015] FIG. 2A is a perspective view of an embodiment of a convertible seat in its seat configuration;

[0016] FIG. 2B is a perspective view of the convertible seat of FIG. 2A with its front being lifted from the seat configuration;

[0017] FIG. 2C is a perspective view of the convertible seat of FIG. 2A in an intermediate position;

[0018] FIG. 2D is a perspective view of the convertible seat of FIG. 2A in a bed configuration;

[0019] FIG. 3 illustrates an embodiment of noncoplanar deck sections of a convertible seat;

[0020] FIG. 4 illustrates an embodiment of cushions supported by the noncoplanar deck sections illustrated in FIG. 3;

[0021] FIG. 5 is an exploded view of frame components of an embodiment of a convertible seat;

[0022] FIG. 6A is a rear perspective view of an embodiment of a back cushion assembly for a convertible seat;

[0023] FIG. 6B is a side elevational view of the back cushion assembly of FIG. 6A;

[0024] FIG. 6C is a rear elevational view of the back cushion assembly of FIG. 6A;

[0025] FIG. 6D is a top plan view of the back cushion assembly of FIG. 6A;

[0026] FIG. 7A is a top perspective view of an embodiment of a seat cushion assembly for a convertible seat;

[0027] FIG. 7B is a side elevational view of the seat cushion assembly of FIG. 7A;

[0028] FIG. 7C is a top plan view of the seat cushion assembly of FIG. 7A;

[0029] FIG. 7D is an inverted rear elevational view of the seat cushion assembly of FIG. 7A;

[0030] FIG. 7E is a bottom plan view of the seat cushion assembly of FIG. 7A;

[0031] FIG. 8A is a rear perspective view of an embodiment of a mid-seat cushion assembly for a convertible seat;

[0032] FIG. 8B is a side elevational view of the mid-seat cushion assembly of FIG. 8A;

[0033] FIG. 8C is a rear elevational view of the mid-seat cushion assembly of FIG. 8A;

[0034] FIG. 8D is a top plan view of the mid-seat cushion assembly of FIG. 8A;

[0035] FIG. 8E is a front elevational view of the mid-seat cushion assembly of FIG. 8A;

[0036] FIG. 9 is an exploded assembly view of the base frame section of the frame components of FIG. 5;

[0037] FIG. 10 is an exploded view of the base frame section of the frame components of FIG. 5 that includes a hinge guide bracket;

[0038] FIG. 11 is an exploded view of the lower base of the base frame section of FIG. 10; and

[0039] FIG. 12 is a side view of the base, linkage, and frame components of a non-limiting version of the convertible seat.

DETAILED DESCRIPTION OF THE INVENTION

[0040] The present invention will be described more particularly hereinafter with reference to the accompanying drawings. The invention is not intended to be limited to the illustrated embodiments; rather, these embodiments are intended to fully and completely disclose the invention to those skilled in this art. In the drawings, like numbers refer to like elements throughout. Thicknesses and dimensions of some components may be exaggerated for clarity. Well-known functions or constructions may not be described in detail for brevity and/or clarity.

[0041] In addition, spatially relative terms, such as “under”, “below”, “lower”, “over”, “upper” and the like, may be used herein for ease of description to describe one element or feature’s relationship to another element(s) or feature(s) as illustrated in the figures. The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used herein, the singular forms “a”, “an” and “the” are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms “comprises” and/or “comprising,” when used in this specification,

specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof. As used herein the expression “and/or” includes any and all combinations of one or more of the associated listed items.

[0042] Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein. It is to be understood that the elements of the convertible seat described herein are with reference to the convertible seat in a normal upright position wherein in a seat configuration a user may sit on the seat, and in a bed configuration a person may lie on a bed. Relative terms such as “underneath” are to be interpreted with reference to the seat in its normal upright position. “Forward” is to be generally interpreted as a section or part of a seat that is opposite a seat back of a seat. “Rear” and “rearward” is to be generally interpreted as a section or part of a seat where the seat back support is.

[0043] By way of introduction, a convertible seat is adapted for use in applications from recreational vehicles to health-care, commercial and residential applications. The convertible seat (hereinafter sometimes referred to as “mechanism” or “unit”) reduces the number of steps required to position the unit from the chair/seat configuration to a bed/sleeper configuration. The convertible seat consists of seat and mid seat sections that are attached via a set of articulating linkage which, when the seat front is lifted and pulled up/outward, begin to extend and position support legs without secondary motion by the user. Once the legs of the now extended seat are supported by the floor the back section is rotated forward, completing conversion of the mechanism from the seat to the bed configuration. An extendable and flip-over convertible seat has a base frame, a back frame, a seat frame, a mid-seat frame and linkage. The back frame is pivotally connected to the base frame so that it rotates from a seating position aligned slightly back from vertical, to a bed position in which the top of the seatback section is pulled forward to a horizontal position.

[0044] Cross members are affixed to the respective frames so as to complete a seat deck, mid-seat deck and a back deck. The seat frame and the mid-seat frame are pivotally connected to one another such that in a seating position the mid-seat deck is folded under the seat deck.

[0045] While the seat deck and mid-seat deck are folded and in the seat position the seat deck positively engages and locks the back deck in the seatback position.

[0046] Articulated legs of the lower section preferably include stops placed such that they increase the bearing surface and load capacity of the bed surface without sacrifice for added weight, structure, etc.

[0047] In order to convert the convertible seat from a seat configuration to a bed configuration in which the seat deck and the mid-seat deck form an extended first bed assembly, the seat deck is lifted up by its front edge and then frontwardly extended to an intermediate position. Linkage moves the mid-seat deck from an unseen location below the seat deck to

an exposed, substantially horizontal orientation. When the seat deck and mid-seat deck are folded and in the seat position the seat deck positively engages and locks the back deck in the seatback position.

[0048] A support leg, or preferably a pair, are pivotally connected to the front edge of the seat deck and connected by a link mechanism to the base frame whereby the legs transition from a folded position to an extended position simultaneously as the first bed assembly (the seat deck and mid-seat deck combination) is extended to and through the intermediate position and then downward to the bed position. The legs support the front edge in the bed position. This articulating leg/linkage assembly reduces the number of operations required by a user to convert the convertible seat from a seat configuration to a bed configuration.

[0049] The convertible seat may also feature cushions that eliminate the need for an air mattress. Also, the convertible seat includes an integrated locking system that requires no action by the user. The frame of the convertible seat may also provide space for a drawer that may be used to store items.

[0050] The back deck has a seat back surface facing forward when in the seat configuration and a lying/sleeping surface opposite, facing rearward, when in the seat configuration. After extending the seat deck and mid-seat deck into the first bed assembly the back deck may be pivoted (top moved forward and down) from the seat position to the bed position. The seat back (frontwardly facing) surface faces downwardly and the sleeping surface (the back of the seat back when in the seat position) faces upwardly to define a second bed assembly. The first bed assembly and the second bed assembly complete the bed.

[0051] In an embodiment, for vehicle applications the base and frame may transfer any crash load through the frame structure and not through the arms (i.e., the arms are not load bearing). Preferably, the convertible seat includes an integrated locking mechanism that requires no extra operations by the user to release or engage the unit to/from the seat and bed configurations.

[0052] Linkage provides relative positional movement of the seat deck, mid-seat deck, and the back deck and may also include a plurality of stops that, when fully extended, provides a continuous, locked structure. The first bed assembly may be pivotally connected to the base with a downwardly depending arm and an upwardly depending strut so that when pivoted from a seat position to a bed position, the arm and strut abut one another at first and second stops. Additionally the seat deck and the mid-seat deck are preferably connected to one another such that when pivoted to the first bed position, as the mid-seat deck rotates through approximately 180 degrees, a plate and a tab abut one another at a third stop. Thus, in an embodiment the frames in conjunction with the stops provide a substantially rigid structure in both the seat and bed configurations.

[0053] In a version, the convertible seat (also referred to as a sleeper sofa) may be customized for installation in a range of floor height platforms, including a flat floor (0.0") and 2', 3.5", 4" or 5" raised floors, as examples, without the need for a complete new frame. This feature may be achieved by replacing the legs with legs having a length that corresponds to the particular application/floor height platform.

[0054] The convertible seat may comprise a section of a modular sleeper sofa that can be mated to other sections/modules. In certain applications, such as healthcare, commercial, and residential, the independent leg assemblies used to fit

the various vehicle platforms may be removed, and the arms may be adapted to support the sleeper sofa.

[0055] Because of the compact and efficient, yet strong and functional mechanism, clearance underneath the seat when in its seat position may provide space for storage and storage type devices. Such storage devices may include simple pull out drawers that may be accessed from the front panel area of the bed and/or bins accessible from the upper area when the seat/mid seat sections are in the bed position.

[0056] In a version, a pivot for a back frame is located at a relative elevated location and an extended frame is provided beneath the pivot to virtually eliminate any gap between the seat and a wall, such as those that other sleeper-sofas exhibit. By having the back frame extend below a pivot and closing the gap, the amount of distance the bed is extended is shortened, with respect to a conventional sleeper.

[0057] In order to adapt to compactness and seating comfort requirements and support for lying wherein a person's mass is not evenly distributed, the decks, in the bed position may be, in some embodiments, aligned at different heights—in different planes. For example, the mid-seat deck may be highest, the back deck may be slightly lower and the seat deck may be considerably lower. This design configuration accommodates different thickness and density in the seat cushion which is always facing up, whether in a seat or bed position.

[0058] The relative heights of the decks and corresponding thicknesses of the cushions provide a unique and comfortable support surface for supporting a person's mass. In a lying/sleeping position, a person's trunk is their center of mass and is, in a vast majority of bodily shapes, the heaviest part of the body. In an embodiment, with the unit in the bed configuration, the mid-seat deck is highest and its cushion thinnest (relative to those of the seat deck/cushion and back deck/cushion), to thereby provide a first robust support surface for a person in the lying/sleeping position on the bed. The back deck/cushion supports a person's upper torso, arms, and head (usually the second heaviest part of the body) to provide a second robust support surface for a person in the sleeping position on the bed. And the seat deck/cushion supports a person's legs in the sleeping position and provides a comfortable support surface there for, as well as in conjunction with the thickest of the three cushions, a soft seating surface for the unit in the seat configuration. In an embodiment, the cushion for the back deck is thinner than the cushion for the seat deck, but thicker than the cushion for the mid-seat deck.

[0059] The particular cushions are formed and arranged to provide advantageous and comfortable seating and sleeping surfaces. A cushion is mounted on the seating surface having a flat bottom on the deck and a top arcuate surface. A plane intersecting the crest of the cushion's arcuate surface defines a first plane. The mid-seat deck has a cushion that, when the seat is in the seating position, is unused, while in the sleeping position a person's center of mass may well rest on the mid-seat deck cushion. Thus, the mid-deck cushion has its own thickness and density with a flat bottom (in the sleeping position) and an arcuate top surface. In the sleeping configuration a plane intersecting the crest of the arcuate surface of the mid-seat deck cushion defines a second plane. Finally, the back deck sleeping surface has a third cushion having a flat bottom on the deck and an arcuate surface. A plane intersecting the crest of the arcuate surface of this cushion defines a third plane. The first, second, and third planes are co-planar, but the particular cushion thicknesses are, as described above, different.

[0060] The sleep surface of this bed unit has extra padding added and is contoured in a manner that even with its thin profile, provides a comfortable sleep surface without the need for an air mattress, such as those required for like furniture. The sleep surface can be tailored in any material desired to meet customer expectations.

[0061] With the contour profile and extra padding added to the sleep surface the user is able to easily use the unit as a bed without the need for additional products, such as an air mattress. If desired, however, a user may also set an air mattress over the sleep surface.

[0062] The arcuate surfaces are preferably formed by affixation of a fabric or sheet material over an elastomeric material, such as a foam, which foam may be formed either as a curvilinear surface for the mid and back decks or as a pyramidal frustum for the seat. The combination of fabric and foam permits formation of the pyramidal frustum using combined planar surfaces, four angled and a fifth flat while the upholstery procedure of stretching the fabric or sheet produces the final arcuate surface.

[0063] As can be seen in the drawings (discussed below) the cushions are formed so as to have extending flanges at the perimeters and additionally have filler pieces. These configurations provide a combination of properties including edge support and better fit on the respective frames. The cushions preferably cover the frames to avoid contact with a user and also reduce the occurrence of chaffing the bedding.

[0064] Referring now to FIGS. 2A-2D, an embodiment of a convertible seat **20** is illustrated. The convertible seat **20** is illustrated in the seat (FIG. 2A), transitional (FIGS. 2B and 2C), and bed (FIG. 2D) configurations. The convertible seat **20** includes a seat **22**, a back rest **24**, and a mid-section **26**. In order to convert the convertible seat **20** to a bed in which the seat **22** and mid-seat **26** form an extended first bed assembly, the seat **22** is lifted up by its front edge (illustrated in FIGS. 2A and 2B) and then frontwardly extended to an intermediate position (FIG. 2C). Linkage moves the mid-seat **26** from an unseen location below the seat **22** to an exposed, substantially horizontal orientation. The back **24** in the seat configuration (FIG. 2A) is aligned slightly back from vertical and is flipped forward to a bed configuration (FIG. 2D) in which the top is pulled forward to a horizontal position.

[0065] FIG. 3 illustrates an embodiment of deck sections **30** of a convertible seat in the sleeper configuration. The deck sections **30** may be provided in a convertible seat such as the one illustrated in FIGS. 2A-2D. The illustrated deck sections **30**, or variations thereof, may be provided in other types and configurations of convertible chairs or sofas, as examples. In the bed configuration, the seat deck **32** is at a lowest relative elevation, the mid-deck **34** is at a highest relative elevation, and the back deck **36** is at an intermediate elevation. The decks are supported by a frame (an embodiment of which is illustrated in FIG. 5) having legs **38(A)**, **38(B)**, and **38(C)**. The seat deck **32** lies within a first plane, the mid-deck **34** lies within a second plane, and the back deck **36** lies within a third plane. A relative vertical distance between the three planes is represented by A, B, and C in FIG. 3.

[0066] FIG. 4 illustrates an embodiment of cushions supported by the deck sections, such as those illustrated in FIG. 3 as an example. A seat cushion **42** rests on or is fixed to the seat deck **32** and has a thickness represented by D. A mid-cushion **44** rests on or is fixed to the mid-deck **34** and has a thickness represented by E. A back cushion **46** rests on or is fixed to the back deck **36** and has a thickness represented by

F. The thicknesses of the cushions **42**, **44**, and **46**, in conjunction with the relative elevations of the decks **32**, **34**, and **36** provide a flat or substantially flat sleeping surface. Other embodiments are contemplated. For example, the thickness of the mid-cushion **44** may be slightly thicker than that illustrated in FIG. 4, providing additional or elevated lumbar support. In other embodiments, relative elevations of the decks and relative thicknesses of the cushions may be other than those illustrated.

[0067] FIG. 5 is an exploded view of frame components **50** of an embodiment of a convertible seat. The back frame **54** is shown upright (in the “seat” configuration) and pivots forward (corresponding to the movement illustrated in FIGS. 2C and 2D) about pivot points referred to as “A1” and “A2”. The frame components **50** further include a base support assembly (also referred to as a base frame) **52**, a mid-frame **56**, and a seat frame **58**. The back frame **54**, mid-frame **56**, and seat frame **58** may support a back deck, mid-deck, and a seat deck, respectively. Respective cushions may rest on or be fixed to the back deck, mid-deck, and seat deck (not shown). The illustrated embodiment of the base support assembly **52** includes frame elements, including linkage, that enable the convertible bed to transition between a chair/loveseat/sofa and a bed, such as the conversion illustrated in FIGS. 2A to 2D, as an example. The back frame **54**, mid-frame **56**, and seat frame **58** are supported by and attached to the base support assembly **52**. The base support assembly **52** is configured to rest on an underlying surface, such as a floor.

[0068] In FIG. 5, the mid-frame **56** and the seat frame **58** are illustrated (as an exploded view) in the bed configuration (for example, corresponding to the convertible chair of FIGS. 2C and 2D). In the bed configuration, having the back frame **54** rotated forward and down, the base support assembly **52** supports the mid-frame **56**, the back frame **54**, and the seat frame **58** within highest, mid, and lowest planes, respectively, corresponding to the heights of the decks illustrated in FIG. 3, as an example. The bed is converted into a seat by rotating the back frame **54** up and back, into the illustrated position, and lifting seat frame **58**, causing the mid-frame **56** to pivot up and backwards (i.e., clockwise in the figure) about pivot points “B1” and “B2” as the mid-frame **56** flips under the seat frame **58** about points “C1” and “C2” (i.e., clockwise in the figure). The seat frame **58** is then urged into the seat configuration (corresponding to the movement illustrated by FIGS. 2C to 2A, as an example).

[0069] As discussed above, the particular cushions are formed and arranged to provide advantageous seating and sleeping surfaces. A back deck sleeping surface has a first cushion having a flat bottom on the deck and an arcuate surface. The back deck sleeping surface faces rearward when the back deck is set in the seating configuration.

[0070] FIG. 6A is a rear perspective view of an embodiment of a back cushion assembly **60** for a convertible seat. FIG. 6B is a side elevational view of the back cushion assembly **60**. FIG. 6C is a rear elevational view of the back cushion assembly **60**. And FIG. 6D is a top plan view of the back cushion assembly **60**,

[0071] The back cushion assembly **60** preferably includes a backing **62**, filler **64**, a main taper **66**, and a fillers taper **68**. The back cushion assembly **60** preferably has an arcuate top/sleeping surface. With the convertible seat in the bed configuration, a first cushion plane intersects the crest of the arcuate surface of the back cushion assembly **60**.

[0072] A cushion is mounted on the seating surface having a flat bottom on the deck and a top arcuate surface. FIG. 7A is a top perspective view of an embodiment of a seat cushion assembly 70 for a convertible seat. FIG. 7B is a side elevational view of the seat cushion assembly of FIG. 7A. FIG. 7C is a top plan view of the seat cushion assembly of FIG. 7A, FIG. 7D is an inverted rear elevational view of the seat cushion assembly of FIG. 7A. And FIG. 7E is a bottom plan view of the seat cushion assembly of FIG. 7A.

[0073] The seat cushion assembly 70 preferably includes a main body 72 between filler 74 and a top lam 75. The sides of the seat cushion assembly are defined by left and right side lams 76A and 76B. The seat cushion assembly 70 further includes backing 79 and a cut main poly 78. With the convertible seat in the bed configuration, a second cushion plane intersects the crest of the arcuate surface of the seat cushion assembly 70.

[0074] The mid-seat deck has a cushion that, when the seat is in the seating position, is unused. In the sleeping position a person's center of mass may well rest on the mid-seat deck cushion. Thus, the cushion has its own thickness and density with a flat bottom and an arcuate top surface. FIG. 8A is a rear perspective view of an embodiment of a mid-seat cushion assembly 80 for a convertible seat. FIG. 8B is a side elevational view of the mid-seat cushion assembly 80 of FIG. 8A. FIG. 8C is a rear elevational view of the mid-seat cushion assembly 80 of FIG. 8A. FIG. 8D is a top plan view of the mid-seat cushion assembly 80 of FIG. 8A. And FIG. 8E is a front elevational view of the mid-seat cushion assembly 80 of FIG. 8A. The mid-seat cushion assembly preferably includes a main body 82, backing 84, and left and right lams 86A and 86B.

[0075] With the convertible seat in the bed configuration, a third cushion plane intersects the crest of the arcuate surface.

[0076] Preferably, the first, second, and third cushion planes (corresponding to the base frames) are co-planar, but the particular arcuate surfaces and cushion thicknesses are different.

[0077] The arcuate surfaces of the cushions may be formed by affixation of a fabric or sheet material over an elastomeric material, such as foam, which foam may be formed either as a curvilinear surface, for the mid and back cushions, or as a pyramidal frustum for the seat cushion. The combination of fabric and foam permits formation of the pyramidal frustum using combined planar surfaces, four angled and a fifth flat while the upholstery procedure of stretching the fabric or sheet produces the final arcuate surface.

[0078] As illustrated in the drawings, the cushions may be formed so as to have extending flanges at the perimeters and additionally have filler pieces where shown. These configurations provide a combination of properties including edge support, better fit on the respective frames and covering the frames to avoid contact with persons and reduce chafe on bedding.

[0079] FIG. 9 is an exploded assembly view of the base frame 52 shown in FIG. 5. The base frame 52 preferably includes a folding leg 90 connected to a folding leg link 92 by way of, preferably, a bellcrank 94. The bellcrank 94 is connected to a leg bracket 96 to which the seat frame 58 may be attached. Preferably, the folding leg link 92 is connected to a seat/mid-seat link 98 by way of mid-seat frame mounting bracket 100. A seat frame mounting bracket 102 is connected to the mid-seat frame mounting bracket 100. The mid-frame

56 may be attached to the mid-seat frame mounting bracket 100. The seat frame 58 may be further attached to the seat frame mounting bracket 102.

[0080] The base frame 52 preferably further includes a mid-seat frame stop link 104 connected to a lower base 106 by way of a pivot link 108. A mid-seat frame mounting link 110 may be connected to the mid-seat frame stop link 104. The mid-frame 56 may be further attached to the base frame 52 by way of the mid-seat frame mounting link 110.

[0081] The base frame 52 may further include, at its back end, a base frame lower hinge 112 connected to a back frame mounting bracket 114 to which the back frame 54 is attachable.

[0082] The connections and attachments described with reference to FIG. 9 may be pivotal or fixed, the particulars of which, in an embodiment, correspond to the movements of the frames described above. For example, in an embodiment the mid-seat frame stop link 104 is pivotally connected to both the pivot link 108 and the mid-seat frame mounting link 110 to provide for the clockwise rotation of the mid-frame 56 as described above. The mid-seat frame mounting link 110 and the pivot link 108 may both have respective stop pins 116 attached thereto to restrict movement of the mid-frame 56 to a horizontal orientation when the convertible seat 20 is in the bed configuration.

[0083] FIG. 10 is an exploded view of the seat frame and mid-seat frame sections of the frame components of FIG. 5 that includes a hinge guide bracket 118 attached to the rear corners of the base frame 52. The hinge guide bracket 118 may be fixedly attached to the base frame 52 by way of nuts and bolts.

[0084] FIG. 11 is an exploded view of the lower base 106 of the base frame section of FIG. 10. The lower base 106 preferably includes left and right components including main base supports 120(A) and 120(B), cross bars 122(A) and 122(B), brackets 124(A) and 124(B), stabilizers 126(A) and 126(B), and mid-seat linkage supports 128(A) and 128(B).

[0085] Referring back to FIG. 9, the lower base 106 has a forward section and a rearward section (separated by the dashed line). The seat frame 58 and mid-seat frame 56 are connected to the forward section of the lower base 106 by way of the brackets and linkage that provide for rotation of the mid-seat frame 56 when the convertible seat 20 transitions between a seat and a bed. The back frame 54 is connected to the rearward section of the lower base 106 by way of the brackets and linkage that provide for the forward and rearward flipping motion of the back frame 54 when the convertible seat 20 transitions between a seat and a bed. Preferably, as illustrated in the drawings, there are no linkage components or brackets that connect the forward assembly (mid-seat frame 56 and seat frame 58) to the back frame 54. Nor are there any linkage components or brackets between the forward and rearward sections of the lower base 106. In other words, in the preferred embodiment the main base supports 120(A) and 120(B) and the stabilizers 126(A) and 126(B) are the only components of the convertible seat 20 that connect the forward section to the rearward section. Thus, when the convertible seat 20 transitions from a seat to a bed, as illustrated in FIGS. 2(A) to 2(C), only the linkages of the convertible seat 20 connected further forward of the forward section of the lower base 106 are engaged for moving the seat frame 58 and mid-seat frame 56 (and likewise back from the bed to the seat configuration). When the convertible seat 20 transitions from a seat to a bed, as illustrated in FIGS. 2(D) to 2(F),

only the linkage of the convertible seat 20 connected further aft of the rearward section of the lower base 106 are engaged for flipping the back frame 54 through its illustrated motion (and likewise back from the bed to the seat configuration).

[0086] In use, when a user pulls the seat 22 upward and outward (FIGS. 2(A) and 2(B)) the linkage in the forward section (connected to the seat 22 and mid-seat 26) is active while the linkage in the rearward section (connected to the back 24) is not. Because the leg bracket 96 is connected to the seat frame mounting bracket 102 via the seat frame 58, and the folding leg link 92 is pivotally connected to the mid-seat frame mounting bracket 100 and the bellcrank 94, the counter-clockwise rotation of the seat/mid-seat link 98 causes the folding leg 90 to extend out from under the seat 22 into a vertical orientation (as illustrated in FIGS. 2(D) and 5). Thus, the extension or retraction of the folding leg 90 does not require handling by the user. Meanwhile, the counter clockwise rotation of the mid-seat frame 56 (from underneath the seat frame 58) causes the mid-seat frame stop link 104 to engage both stop pins 116, thereby securing the mid-seat 26 in the horizontal orientation as illustrated in FIG. 2(D). The user may then pull the back 24 forward, guided by its connection to the back frame mounting bracket 114 to horizontal while the hinge guide 118 guides the back frame mounting bracket by way of slit 115.

[0087] To convert the convertible seat 20 from a bed to a chair, a user first flips the back 24 to its near vertical orientation, and then lifts the seat 22 upwards and pushes it forward.

[0088] FIG. 12 illustrates the base, linkage, and frame components of a non-limiting version of the convertible seat. The indicated heights are shown for exemplary purposes only and the invention is in no way limited to the dimensions illustrated in FIG. 12. In a version, the main base support 120 is optional. The main base support 120 may be eliminated altogether or, if included, the main base support may be of a desired height depending on the floor/support surface of application. Likewise, the length of folding leg 90 may be of a desired height depending on the floor/support surface of application. For example, if the floor/support surface is vertically lower at the foot-end of the bed than at the head section of the bed, the folding leg may descend lower than the bottom of the main base support 120. On the other hand, if the floor/support surface is completely flat and even, the length of the folding leg 90 and that of the main base support 120 may be provided such that they descend to the same horizontal plane. Nearly endless possible relative vertical lengths of the folding leg 90 and main base support 120 are contemplated.

[0089] The foregoing is illustrative of the present invention and is not to be construed as limiting thereof. Although exemplary embodiments of this invention have been described, those skilled in the art will readily appreciate that many modifications are possible in the exemplary embodiments without materially departing from the novel teachings and advantages of this invention. Accordingly, all such modifications are intended to be included within the scope of this invention as defined in the claims. The invention is defined by the following claims, with equivalents of the claims to be included therein.

I claim:

1. A seating unit convertible between a seat configuration and a bed configuration, comprising:

a base having:

a forward section to which linkage for a mid-seat section and a seat section are connected, and

a rearward section to which linkage for a back section is connected, wherein

linkage for the mid-seat section and the seat section function separately from

linkage for the back section and are connected through the base; and

a mid-seat frame and a seat frame connected to the forward section, wherein in a seat configuration the mid-seat frame is located underneath the seat frame.

2. The seating unit of claim 1 further comprising a leg connected to the seat section that extends from a substantially horizontal plane to a substantially vertical plane as the seat frame is extended.

3. The seating unit of claim 1 further comprising a back frame mounting bracket connected to the rearward section of the base, wherein the back frame mounting bracket includes a hinge guide bracket to guide the back frame mounting bracket as the convertible seat is converted from a bed to a seat.

4. The seating unit of claim 1 wherein the linkage for the mid-seat section includes two stop pins that limit movement of the mid-seat section to a substantially horizontal orientation as the convertible seat is converted from a bed to a seat.

5. The seating unit of claim 1 wherein, in a bed configuration a support leg connected to the base frame extends below a plane that defines a surface that supports a main base support of the base.

6. The seating unit of claim 1 wherein in a bed configuration a mid-deck frame that comprises the mid-seat section lies within a first horizontal plane, a back deck frame that comprises the back section lies within a second horizontal plane, and a seat deck frame that comprises the seat section lies within a third horizontal plane, and wherein the first horizontal plane is at a first elevation, the second horizontal plane is at a second elevation which is lower than the first elevation, and the third horizontal plane is at a third elevation which is lower than the second elevation.

7. The seating unit of claim 1 wherein a vertical distance between the first and second horizontal planes is less than a vertical distance between the first and third horizontal planes.

8. The seating unit of claim 1, wherein in the seat configuration a seat cushion abuts a back cushion and wherein the abutment prevents rotation and movement of a back frame mounting bracket.

9. A method of converting a convertible seat from a seat configuration to a bed configuration, comprising:

extending a forward section of the bed, wherein the extension of the forward section rotates a mid-bed from underneath a seat; and

after the extension of the forward section and rotation of the mid-bed, flipping a back of the seat to complete conversion of the convertible seat to the bed configuration.

10. The method of claim 9 wherein extending the forward section of the bed rotates the mid-bed 180 degrees, and flipping the back of the seat flips the back of the seat approximately 90 degrees.

11. The method of claim 9 wherein extending the forward section of the bed includes activating linkage that unfolds a folding leg that supports the bed at a foot of the bed.

12. The method of claim 9 further comprising engaging two stop pins with a mid-seat frame stop link to prevent further movement of the mid-bed.

13. The method of claim **9** wherein converting the convertible seat to a bed configuration further comprises aligning a mid-deck frame that comprises the mid-seat section within a first horizontal plane, aligning a back deck frame that comprises the back section within a second horizontal plane, and aligning a seat deck frame that comprises the seat section within a third horizontal plane, and wherein the first horizontal plane is at a first elevation, the second horizontal plane is at a second elevation which is lower than the first elevation, and the third horizontal plane is at a third elevation which is lower than the second elevation.

14. A seating unit convertible between a seat configuration and a bed configuration, comprising:

a seat;
a mid-seat; and
and a back,

wherein in the seat configuration the mid-seat is underneath the seat and a first side of the back is aligned for contact with a user in a sitting position on the seat, and wherein in the bed configuration the mid-seat is exposed to support a user in a lying position and a second side of the back, opposite the first side, is aligned to support the user in the lying position.

15. The seating unit of claim **14** further comprising:
means for extending a forward section of the bed, wherein the extension of the forward section rotates a mid-bed from underneath a seat; and

means for, after the extension of the forward section and rotation of the mid-bed, flipping a back of the seat to complete conversion of the convertible seat to the bed configuration.

16. The seating unit of claim **14** further comprising means for activating linkage that unfolds a folding leg that supports the bed at a foot of the bed.

17. The seating unit of claim **14** further comprising:
means for aligning the mid-deck within a first horizontal plane, aligning the back within a second horizontal plane, and aligning the seat within a third horizontal plane, and

wherein the first horizontal plane is at a first elevation, the second horizontal plane is at a second elevation which is lower than the first elevation, and the third horizontal plane is at a third elevation which is lower than the second elevation.

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