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SEAT ASSEMBLIES HAVING FIXED FRAMES AND MOVABLE SEAT CUSHIONS AND MOVABLE SEAT BACKS WITH POWER LUMBAR MECHANISMS, TILT MECHANISMS, AND HEATING/COOLING MECHANISMS

Abstract

A kinetic seat assembly includes primary seat cushion frame, a secondary seat cushion frame movable relative to the primary seat cushion frame, a primary seat back frame, and a secondary seat back frame movable relative to the primary seat back frame. In embodiments, the secondary seat back frame includes a power lumbar mechanism. In embodiments at least one of the secondary seat cushion frame and the secondary seat back frame includes at least one of a cooling mechanism and a heating mechanism.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS [0001] This application is a continuation application of co-pending U.S. Nonprovisional patent application Ser. No. 17/873,762, filed Jul. 26, 2022, for “Seat Assemblies Having Fixed Frames And Movable Seat Cushions And Movable Seat Backs With Power Lumbar Mechanisms, Tilt Mechanisms, And Heating/Cooling Mechanisms”, which claims the priority benefit of expired U.S. Provisional Patent Application No. 63/227,174, filed Jul. 29, 2021, for “Seat Assembly Having Fixed Frame And Movable Seat Cushion And Movable Seat Back,” which are hereby incorporated by reference in their entireties including the drawings.

TECHNICAL FIELD
[0002] The present specification generally relates to kinetic seat assemblies for vehicles and, more specifically, kinetic seat assemblies for vehicles that accommodate rotation of an occupant's body during turning operations with a force applied in a counter-turning direction.
BACKGROUND
[0003] When driving a vehicle, the driver typically experiences fatigue due to repeated rotation of the driver's torso and pelvis. In addition, a driver's knees and head are also rotated during turning of the vehicle. Thus, this movement requires the driver to continuously compensate for rotation during turning. Over time, this rotation of the driver's torso, pelvis, knees, and head can lead to various aches and pains limiting the amount of driving time one can withstand.
[0004] It has been known to provide a seat assembly including a seat back and a seat cushion that mimic the walking movement of an occupant's pelvis and torso. Specifically, the known seat assembly allows the seat cushion to pivot at a cushion pivot axis and the seat back to pivot at a seat back pivot axis such that the seat back and the seat cushion pivot in opposite directions. However, rotating the pelvis and the torso in opposite directions during turning may cause discomfort in some drivers.
[0005] Accordingly, a need exists for alternative kinetic seat assemblies that offer torso rotation and pelvic rotation in the same direction to maintain a centered position of the driver's head and knees.
SUMMARY
[0006] In one embodiment, a kinetic seat assembly includes: a primary seat back frame; a secondary seat back frame; and an upper pivot mechanism coupling the secondary seat back frame to the primary seat back frame, the upper pivot mechanism including: a bracket; and a pivotable link extending from each of a pair of opposite sides of the bracket and interconnecting the bracket and the primary seat back frame, a first end of each of the pivotable links pivotally attached to the bracket, which is coupled to the secondary seat back frame, and an opposite second end each of the pivotable links pivotally fixed to the primary seat back frame, wherein the secondary seat back frame is permitted to move in a vehicle vertical direction relative to the primary seat back frame as the pivotable links permit the bracket to move in the vehicle vertical direction relative to the primary seat back frame.
[0007] In another embodiment, a kinetic seat assembly includes: a secondary seat cushion frame; a

secondary seat back frame; and a linkage assembly including: a connection bracket having a first end and an opposite second end, the first end fixed to the secondary seat cushion frame; a connector bracket fixed to a front surface of the connection bracket, the connector bracket including a base wall fixed to the front surface of the connection bracket and a pair of side walls extending from opposite ends of the base wall and perpendicular to the base wall, an opening formed in each side wall of the pair of side walls, wherein the secondary seat back frame pivotally fixed to the connector bracket at the opening formed in each side wall of the pair of side walls.
[0008] In yet another embodiment, a vehicle includes: a passenger compartment; and a kinetic seat assembly within the passenger compartment, the kinetic seat assembly including: a primary seat cushion frame; a secondary seat cushion frame pivotally coupled to the primary seat cushion frame; a primary seat back frame; a secondary seat back frame pivotally coupled to the primary seat back frame; a linkage assembly interconnecting the secondary seat back frame to the secondary seat cushion frame, the linkage assembly restricting movement of the secondary seat back frame and the secondary seat cushion frame to being in phase with one another; and an upper pivot mechanism pivotally coupling the primary seat back frame and the secondary seat back frame.
[0009] These and additional features provided by the embodiments described herein will be more fully understood in view of the following detailed description, in conjunction with the drawings.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
[0010] The embodiments set forth in the drawings are illustrative and exemplary in nature and not intended to limit the subject matter defined by the claims. The following detailed description of the illustrative embodiments can be understood when read in conjunction with the following drawings, where like structure is indicated with like reference numerals and in which:
[0011] FIG. **1** schematically depicts a system for a vehicle having kinetic seat assembly, according to one or more embodiments shown and described herein, and illustrated in a vehicle as a driver's seat;
[0012] FIG. **2** schematically depicts a front view of the kinetic seat assembly of FIG. **1**, according to one or more embodiments shown and described herein;
[0013] FIG. **3** schematically depicts a rear view of the kinetic seat assembly of FIG. **1**, according to one or more embodiments shown and described herein;
[0014] FIG. **4** schematically depicts a rear perspective view of the kinetic seat assembly of FIG. **1**, according to one or more embodiments shown and described herein;
[0015] FIG. **5** schematically depicts another rear perspective view of the kinetic seat assembly of FIG. **1**, according to one or more embodiments shown and described herein;
[0016] FIG. **6** schematically depicts a first side view of the kinetic seat assembly of FIG. **1**, according to one or more embodiments shown and described herein;
[0017] FIG. **7** schematically depicts a second side view of the kinetic seat assembly of FIG. **1**, according to one or more embodiments shown and described herein;
[0018] FIG. **8** schematically depicts a top view of the kinetic seat assembly of FIG. **1**, according to one or more embodiments shown and described herein;
[0019] FIG. **9** schematically depicts a bottom view of the kinetic seat assembly of FIG. **1**, according to one or more embodiments shown and described herein;
[0020] FIG. **10** schematically depicts a front view of a primary seat back frame of the kinetic seat assembly of FIG. **1**, according to one or more embodiments shown and described herein;
[0021] FIG. **11** schematically depicts a rear view of the primary seat back frame of FIG. **10**, according to one or more embodiments shown and described herein;
[0022] FIG. **12** schematically depicts a front perspective view of the primary seat back frame of

FIG. **10**, according to one or more embodiments shown and described herein;

[0023] FIG. **13** schematically depicts another front perspective view of the primary seat back frame of FIG. **10**, according to one or more embodiments shown and described herein;

[0024] FIG. **14** schematically depicts a front perspective view of a secondary seat back frame of the kinetic seat assembly of FIG. **1**, according to one or more embodiments shown and described herein;

[0025] FIG. **15** schematically depicts another front perspective view of the secondary seat back frame of FIG. **14**, according to one or more embodiments shown and described herein;

[0026] FIG. **16** schematically depicts a perspective view of a front pivot mechanism of the kinetic seat assembly of FIG. **1**, according to one or more embodiments shown and described herein;

[0027] FIG. **17** schematically depicts a perspective view of a ball joint and coupling of an upper pivot mechanism of the kinetic seat assembly of FIG. **1**, according to one or more embodiments shown and described herein;

[0028] FIG. **18** schematically depicts a front perspective view of the upper pivot mechanism of the kinetic seat assembly of FIG. **1** in a first position, according to one or more embodiments shown and described herein;

[0029] FIG. **19** schematically depicts a side view of the upper pivot mechanism of FIG. **18** in the first position, according to one or more embodiments shown and described herein;

[0030] FIG. **20** schematically depicts a front perspective view of the upper pivot mechanism of FIG. **18** in a second position, according to one or more embodiments shown and described herein;

[0031] FIG. **21** schematically depicts a side view of the upper pivot mechanism of FIG. **18** in the second position, according to one or more embodiments shown and described herein;

[0032] FIG. **22**A schematically depicts a cross-sectional view of the upper pivot mechanism of FIG. **18** taken along line **22**A-**22**A of FIG. **8** in the first position mounted to the primary seat back frame and the secondary seat back frame, according to one or more embodiments shown and described herein;

[0033] FIG. **22**B schematically depicts a cross-sectional view of the upper pivot mechanism of FIG. **18** in the second position mounted to the primary seat back frame and the secondary seat back frame, and the secondary seat back frame moved toward the primary seat back frame, according to one or more embodiments shown and described herein;

[0034] FIG. **23** schematically depicts a top perspective view of a secondary seat cushion frame of the kinetic seat assembly of FIG. **1**, according to one or more embodiments shown and described herein;

[0035] FIG. **24** schematically depicts another top perspective view of the secondary seat cushion frame of FIG. **23**, according to one or more embodiments shown and described herein;

[0036] FIG. **25** schematically depicts a front perspective view of a linkage assembly of the kinetic seat assembly of FIG. **1**, according to one or more embodiments shown and described herein;

[0037] FIG. **26** schematically depicts another front perspective view of the linkage assembly of FIG. **25**, according to one or more embodiments shown and described herein;

[0038] FIG. **27** schematically depicts a front perspective view of the secondary seat cushion frame of FIG. **23** mounted to the secondary seat back frame of FIG. **14**, according to one or more embodiments shown and described herein;

[0039] FIG. **28** schematically depicts another front perspective view of the secondary seat cushion frame of FIG. **23** mounted to the secondary seat back frame of FIG. **14**, according to one or more embodiments shown and described herein;

[0040] FIG. **29** schematically depicts a partial rear view of the kinetic seat assembly of FIG. **1**, according to one or more embodiments shown and described herein;

[0041] FIG. **30** schematically depicts a partial side view of a vertical damper of the kinetic seat assembly extending between a connector bracket and a clamp, according to one or more embodiments shown and described herein;

[0042] FIG. **31** schematically depicts a partial perspective view of the primary seat cushion frame and a tilt bar mechanism of the kinetic seat assembly of FIG. **1**, according to one or more embodiments shown and described herein;

[0043] FIG. **32** schematically depicts an exploded, perspective view of a pair of clamps of the kinetic seat assembly of FIG. **1**, according to one or more embodiments shown and described herein;

[0044] FIG. **33** schematically depicts a perspective view of the pair of clamps of FIG. **32** in an assembled state, according to one or more embodiments shown and described herein; and

[0045] FIG. **34** schematically depicts an enlarged perspective view of a portion of the tilt mechanism of FIG. **31**, according to one or more embodiments shown and described herein.

DETAILED DESCRIPTION

[0046] FIG. **1** generally depicts an environmental view of an embodiment of a vehicle including a kinetic seat assembly. The vehicle general comprises a passenger compartment which passengers or other occupants occupy. A plurality of vehicle seats including a front driver seat, front passenger seat, and one or more rear passenger seats may be provided within the passenger compartment of the vehicle.

[0047] As shown, the kinetic seat assembly is utilized as the driver's seat. However, it is to be understood that a plurality of kinetic seat assemblies may be utilized as multiple seats of the vehicle. The kinetic vehicle seat assembly generally comprises a kinetic seat cushion assembly, a kinetic seat back assembly, a vertical damping mechanism, and a lateral damping mechanism. The kinetic seat cushion assembly includes a primary seat cushion frame, a secondary seat cushion frame, and a front pivot mechanism that pivotally couples a front portion of the primary seat cushion frame to a front portion of the secondary seat cushion frame. The kinetic seat back assembly includes a primary seat back frame, a secondary seat back frame, and an upper pivot mechanism that pivotally couples an upper portion of the primary seat back frame to an upper portion of the secondary seat back frame.

[0048] The vertical damping mechanism provides a damping effect as the secondary seat cushion frame and the secondary seat back frame move in a vehicle vertical direction. The lateral damping mechanism provides a damping effect as a rear end of the secondary seat cushion frame and a lower end of the secondary seat back frame move in a vehicle lateral direction. The front pivot mechanism allows the secondary seat cushion frame to rotate with respect to the primary seat cushion frame. Similarly, the upper pivot mechanism allows the secondary seat back frame to rotate, and in some embodiments move in the vehicle vertical direction, with respect to the primary seat back frame.

[0049] During a turning operation, the occupant and the kinetic seat assembly receive a force pushing the occupant and the kinetic seat assembly in an opposite direction of the turning operation. Thus, the pivot mechanisms and the vertical and lateral damping mechanisms cause the secondary seat cushion frame and the secondary seat back frame to rotate in the direction of the force and in phase with one another. As used herein, the term “in phase” describes two objects, for example, the secondary seat cushion frame and the secondary seat back frame, moving synchronously with one another in the same direction. As such, the term “out of phase” as used herein describes two objects, for example, the secondary seat cushion frame and the secondary seat back frame, not moving synchronously and in the same direction with one another. Further, it should be understood that when two objects are moving in phase with one another, the directions in which those object are moving are similarly in phase with one another.

[0050] In some embodiments, the upper pivot mechanism and the damping mechanisms are adjustable, either manually or electronically, in order to increase or decrease the amount of movement of the secondary seat cushion frame and/or the secondary seat back frame.

[0051] In some embodiments, the vehicle includes a display unit and a user interface. The vehicle also includes an onboard computing device including an electronic control unit having a processor and a memory component. Thus, the pivot mechanisms and the damping mechanisms may be operable by an occupant of the vehicle by operating controls on the user interface. In some embodiments, the electronic control unit also includes a network interface hardware configured to interface with a transceiver to connect to a network. The network couples the vehicle to a mobile computing device in order to allow an occupant to control the pivot mechanisms and the damping mechanisms wirelessly.

[0052] As used herein, the term “vehicle longitudinal direction” refers to the forward-rearward direction of the vehicle (i.e., in the +/-vehicle X direction depicted in FIG. **1**). The term “vehicle lateral direction” refers to the cross-vehicle direction (i.e., in the +/− vehicle Y direction depicted in FIG. **1**), and is transverse to the vehicle longitudinal direction. The term “vehicle vertical direction” refers to the upward-downward direction of the vehicle (i.e., in the +/− vehicle Z direction depicted in FIG. **1**). As used herein, “upper” and “above” are defined as the positive Z direction of the coordinate axis shown in the drawings. As used herein, “lower” and “below” are defined as the negative Z direction of the coordinate axis shown in the drawings. Further, the term “outboard” or “outward” as used herein refers to the relative location of a component with respect to a vehicle centerline. The term “inboard” or “inward” as used herein refers to the relative location of a component with respect to the vehicle centerline. Because the vehicle structures may be generally symmetrical about the vehicle centerline, the direction to which use of terms “inboard,” “inward,” “outboard,” and “outward” refer may be mirrored about the vehicle centerline when evaluating components positioned along opposite sides of the vehicle.

[0053] As used herein, the term “kinetic seat vertical direction” refers to the same direction as the vehicle vertical direction. In a configuration in which the kinetic seat assembly is a normal, front-facing seat in a vehicle, the term “kinetic seat longitudinal direction” refers to a direction parallel to the vehicle longitudinal direction. However, it should be appreciated that other configurations are contemplated in which the kinetic seat assembly is oriented in a direction in which the kinetic seat longitudinal direction is perpendicular, i.e., parallel to the vehicle lateral direction, or some other direction therebetween.

[0054] Also used herein, it is to be understood that the “turning direction” means a direction in which the occupant is turning the vehicle. Similarly, “counter-turning direction” means a direction opposite the turning direction.

[0055] Reference will now be made in detail to various embodiments of the kinetic seat assembly described herein, examples of which are illustrated in the accompanying drawings. Whenever possible, the same reference numerals will be used throughout the drawings to refer to the same or like parts.

[0056] Referring to FIG. **1**, a vehicle is generally illustrated at **12**. The vehicle **12** includes a passenger compartment **14** provided in an interior thereof. The passenger compartment **14** is a portion of an interior of the vehicle **12** which passengers or other occupants occupy. A plurality of vehicle seats including a driver seat **16**, front passenger seat (not shown), and one or more rear passenger seats **18**, such as second row passenger seats or third row passenger seats, are provided within the passenger compartment **14** of the vehicle **12**.

[0057] In FIG. **1**, the driver seat **16** is provided as a kinetic seat assembly **10**. However, the kinetic seat assembly **10** is not limited to the driver seat **16**. In embodiments, any one or any combination of the driver seat **16**, the passenger seat, and the one or more rear passenger seats **18** may be provided as the kinetic seat assembly **10**.

[0058] In FIG. **1**, the vehicle **12** is provided as an automobile which includes coupes, sedans, minivans, trucks, crossovers, hybrids, and sports utility vehicles. However, the kinetic seat assembly **10** is not limited to automobiles. In embodiments, the kinetic seat assembly **10** may be provided in any vehicle **12** such as a watercraft, aircraft, or the like.

[0059] The vehicle **12** includes a steering wheel **20** located in front of the driver seat **16** in the vehicle longitudinal direction. The vehicle **12** includes a display unit **22** and a user interface **24**. In some embodiments, the user interface **24** includes manual buttons or touchscreen controls provided on the display unit **22**. It is appreciated, that the vehicle **12** in which the kinetic seat assembly **10** is provided may be an autonomous vehicle in which no steering wheel **20** is provided.

[0060] The vehicle **12** includes an onboard computing device **26**. In some embodiments, a network **28** couples the vehicle **12** to a mobile computing device **30**. The network **28** may include a wide area network, such as an internet or cellular network (such as 3G, 4G, 4G LTE, WiMAX, etc.). Similarly, the network **28** may include a local area network, such as a wireless fidelity (Wi-Fi) network, a Bluetooth network, a near field communication network, hardware, and the like.

[0061] The onboard computing device **26** of the vehicle **12** includes an electronic control unit **32**. In some embodiments, the onboard computing device **26** includes a transceiver **34** in electrical communication with the electronic control unit **32** and configured for two way communication with the network **28** to couple the vehicle **12** to the network **28** and, thus, the mobile computing device **30**.

[0062] The mobile computing device **30** may be configured as a mobile phone, a tablet, a personal computer, and/or other devices for performing the functionality described herein. The mobile computing device **30** may be operated by a third party such as a driver or other occupant or owner of the vehicle **12**.

[0063] Still referring to FIG. **1**, the electronic control unit **32** includes a local interface **36**, a processor **38**, an input/output hardware **40**, a data storage component **42**, and a memory component **44** coupled to the processor **38**.

[0064] The local interface **36** is implemented as a bus or other communication interface to facilitate communication among the components of the electronic control unit **32**. The local interface **36** is formed from any medium that is configured to transmit a signal. As non-limiting examples, the local interface **36** is formed of conductive wires, conductive traces, optical waveguides, or the like. The local interface **36** may also refer to the expanse in which electromagnetic radiation and their corresponding electromagnetic waves traverses. Moreover, the local interface **36** may be formed from a combination of mediums configured to transmit signals. In one embodiment, the local interface **36** comprises a combination of conductive traces, conductive wires, connectors, and buses that cooperate to permit the transmission of electrical data signals to and from the various components of the mobile computing device **30**. Additionally, it is noted that the term “signal” means a waveform (e.g., electrical, optical, magnetic, mechanical or electromagnetic) configured to travel through a medium, such as DC, AC, sinusoidal-wave, triangular-wave, square-wave, vibration, and the like.

[0065] The processor **38** may include processing components operable to receive and execute machine-readable instructions, such as those stored in the data storage component **42** and/or the memory component **44**. As a non-limiting example, the processor **38** may be one of a shared processor circuit, dedicated processor circuit, or group processor circuit.

[0066] The input/output hardware **40** may refer to a basic input/output system (BIOS) that interacts with hardware of the vehicle **12**, the mobile computing device **30**, drivers that interact with particular devices of the vehicle **12** or the mobile computing device **30**, one or more operating systems, user applications, background services, background applications, etc. In some embodiments, the input/output hardware **40** includes the display unit **22**, the user interface **24**, and/or the other hardware in the vehicle **12**.

[0067] The data storage component **42** is communicatively coupled to the processor **38**. As a non-limiting example, the data storage component **42** may include one or more database servers that support NoSQL, MySQL, Oracle, SQL Server, NewSQL, or the like. The data storage component **42** stores user-specific parameters and characteristics for desired operating modes of the kinetic seat assembly **10**.

[0068] The memory component **44** is communicatively coupled to the processor **38**. As a non-limiting example, the memory component **44** may be one of a shared memory circuit, dedicated memory circuit, or group memory circuit. The memory component **44** stores detection logic **46** and communication logic **48**. The detection logic **46** and the communication logic **48** may each include a plurality of different pieces of logic, each of which may be embodied as a computer program, firmware, and/or software/hardware.

[0069] The detection logic **46** is executable by the processor **38** to detect one or more signals provided by the input/output hardware **40**, such as the user interface **24**. The communication logic **48** is executable by the processor **38** to cause the onboard computing device **26** to execute commands and operations corresponding to the detection logic **46**. In some embodiments, the detection logic **46** and the communication logic **48** communicate with the network **28** through a network interface hardware **50** and/or the transceiver **34** to communicate with the mobile computing device **30**.

[0070] In some embodiments, the memory component **44** is configured as volatile and/or nonvolatile memory and, as such, may include random access memory (SRAM, DRAM, and/or other types of RAM), flash memory, secure digital (SD) memory, registers, compact discs, digital versatile discs (DVD), and/or other types of non-transitory computer readable mediums. Depending on the particular embodiments, these non-transitory computer readable mediums may reside within the onboard computing device **26** and/or external to the onboard computing device **26**. The memory component **44** and the data storage component **42** operate as the memory unit of the electronic control unit **32**.

[0071] As noted above, in some embodiments, the electronic control unit **32** includes a network interface hardware **50**. The network interface hardware **50** may include or be configured to interface with the transceiver **34** to connect to the network **28**. As an example, the network interface hardware **50** is operable to communicate with any wired or wireless network hardware, including an antenna, a modem, a LAN, wireless fidelity (Wi-Fi) card, WiMAX card, mobile communications hardware, and/or other hardware for communicating with other networks and/or devices. From this connection, communication is made through the transceiver **34** using the network interface hardware **50** thereby facilitating communication between the electronic control unit **32** and the mobile computing device **30** through the network **28**.

[0072] It should be understood that while the components discussed above are illustrated as residing within the electronic control unit **32**, this is merely an example thereof. In some embodiments, one or more of the components may reside external to the electronic control unit **32**.

[0073] It should also be understood that while the electronic control unit **32** is illustrated as a single device, this is also merely an example. In some embodiments, the detection logic **46** and the communication logic **48** may reside on different computing devices. As an example thereof, one or more of the functionalities and/or components described herein may be provided by the mobile computing device **30**, which may be coupled to the vehicle **12** through the network **28**.

[0074] Referring now to FIGS. **2-9**, the kinetic seat assembly **10** is schematically shown and generally includes a primary seat cushion frame **52**, a secondary seat cushion frame **54** pivotally connected to the primary seat cushion frame **52**, a primary seat back frame **56**, a secondary seat back frame **58** pivotally connected to the primary seat back frame **56**, a vertical damping mechanism **100**, a lateral damping mechanism **102**, and a linkage assembly **60**. As discussed in more detail herein, the vertical damping mechanism **100** and the lateral damping mechanism **102** provide a damping effect between the secondary seat cushion frame **54** and the secondary seat back frame **58** relative to the primary seat cushion frame **52** and the primary seat back frame **56**.

[0075] As used herein, the term “damping effect” is referred to as a degree of compression. In embodiments, compression may be measured by a length of a biasing member, such as a spring, or resistance to compression by a fluid, such as oil. As such, a damping effect is directly correlated to an amount of travel between ends of the biasing member or resistance provided by the fluid.

[0076] As shown in FIGS. **3**, **27**, and **28**, the linkage assembly **60** interconnects the secondary seat cushion frame **54** and the secondary seat back frame **58**. The linkage assembly **60** is configured to inhibit the secondary seat cushion frame **54** and the secondary seat back frame **58** from moving out of phase with one another. It is to be understood that movement of the secondary seat cushion frame **54** and the secondary seat back frame **58** is caused by rotation of the occupant seated within the kinetic seat assembly **10** due to a force exhibited on the occupant and the vehicle **12** during driving. Thus, it should be appreciated that the movement of the secondary seat cushion frame **54** and the secondary seat back frame **58** is not a result of any motorized or otherwise electronically programmed and controlled operation. However, as discussed in more detail herein, the degree of movement may be controlled by an electronic program or controlled operation.

[0077] Various embodiments of the kinetic seat assembly **10** and the operation of the kinetic seat assembly **10** will be described in more detail herein.

[0078] It should be appreciated that, as shown in FIG. **1**, the secondary seat cushion frame **54** includes padding **11** to support a pelvis, such as a buttocks and thighs, of an occupant, and that the secondary seat back frame **58** includes padding **13** to support a back of the occupant. The padding **11**, **13** on the secondary seat cushion frame **54** and the secondary seat back frame **58** are omitted in the remaining figures to better illustrate the embodiments.

[0079] Referring to FIGS. **6**, **7**, and **9**, the primary seat cushion frame **52** may have a generally rectangular shape. The primary seat cushion frame **52** includes a front member **62** provided proximate a front portion thereof and a rear member **64** provided proximate a rear portion thereof. The rear member **64** traverses between a pair of opposing side members **66**, **68**. The primary seat cushion frame **52** may also include a pair of recliner mechanisms **70** provided on opposite sides of the primary seat cushion frame **52**, proximate the rear member **64**. The primary seat cushion frame **52** may include a pair of rails **81**, **83** for slidably engaging a pair of tracks **85**, **87** mounted to a floor F of the passenger compartment **14** of the vehicle **12**. Sliding the pair of rails **81**, **83** along the tracks **85**, **87** allows the occupant to move the kinetic seat assembly **10** forward or backward in the vehicle longitudinal direction in order to comfortably position the kinetic seat assembly **10** and the occupant with respect to the steering wheel **20** of the vehicle **12**. In addition, it should be appreciated that the primary seat cushion frame **52** may move in a kinetic seat vertical direction so as to be lowered or raise relative to the floor F.

[0080] Referring now to FIGS. **10-13**, the primary seat back frame **56** may have a generally trapezoidal shape. The primary seat back frame **56** includes an upper member **76** provided proximate an upper portion thereof and a lower member **78** provided proximate a lower portion thereof. The lower member **78** traverses between a pair of opposing side members **80**, **82**. The lower member **78** includes a lower plate **79** extending therefrom. The lower plate **79** is provided at a substantially center location between the side members **80**, **82**. A pair of holes **79**A are formed in the lower plate **79**. As described in more detail herein, the pair of holes **79**A are provided to facilitate coupling a lateral damping mechanism **102** to the primary seat back frame **56**. The primary seat back frame **56** also includes a pair of openings **84**, **86** formed in the side members **80**, **82** of the primary seat back frame **56**, proximate the lower member **78**. The recliner mechanisms **70** in the primary seat cushion frame **52** engage the pair of openings **84**, **86** formed in the primary seat back frame **56** in order to allow the primary seat back frame **56** to rotate about a reclining axis Rf with respect to the primary seat cushion frame **52**.

[0081] In other embodiments of the kinetic seat assembly **10**, the pair of openings **84**, **86** are instead formed in the primary seat cushion frame **52** and the pair of recliner mechanisms **70** are provided on the primary seat back frame **56**. In some embodiments, both the primary seat cushion frame **52** and the primary seat back frame **56** have mating recliner mechanisms, such as corresponding female and male recliner mechanisms, that engage with one another to facilitate rotation of the primary seat back frame **56** about the reclining axis Rf with respect to the primary seat cushion frame **52**.

[0082] Referring now to FIGS. **8**, **23**, and **24**, the secondary seat cushion frame **54** has a shape contoured to conform to the pelvis of the occupant to provide sufficient support when seated in the kinetic seat assembly **10**. As such, the secondary seat cushion frame **54** includes a front end **88** provided proximate a front portion thereof, a rear end **90** provided proximate a rear portion thereof, and a pair of side ends **92**, **94** interconnecting the front end **88** and the rear end **90**.

[0083] As shown in FIGS. **6** and **7**, the secondary seat cushion frame **54** is suspended above the primary seat cushion frame **52** at a front pivot mechanism **98** to facilitate pivoting and rotation of the secondary seat cushion frame **54** with respect to the primary seat cushion frame **52**. M ore specifically, the front pivot mechanism **98** permits the secondary seat cushion frame **54** to rotate relative to the primary seat cushion frame **52** in a kinetic seat lateral direction as a force is applied in an opposite kinetic seat lateral direction to a person sitting in the kinetic seat assembly **10**. The front pivot mechanism **98** is provided proximate the front portion of the secondary seat cushion frame **54** to facilitate the greatest degree of rotation. Thus, the front end **88** of the secondary seat cushion frame **54** is suspended above the front member **62** of the primary seat cushion frame **52** by the front pivot mechanism **98**.

[0084] The front pivot mechanism **98** is disposed between the primary seat cushion frame **52** and the secondary seat cushion frame **54** proximate front portions thereof in order to suspend the secondary seat cushion frame **54** above the primary seat cushion frame **52**. As shown in greater detail in FIG. **16**, the front pivot mechanism **98** may include a lower front pivot mechanism portion **104** fixed to one of the primary seat cushion frame **52** and the secondary seat cushion frame **54** and an upper front pivot mechanism portion **106** fixed to the other of the primary seat cushion frame **52** and the secondary seat cushion frame **54**. The upper front pivot mechanism portion **106** includes a ball joint **108** received within an end of the lower front pivot mechanism portion **104**. In embodiments, the ball joint **108** may be provided on the lower front pivot mechanism portion **104**, which is received within an end of the upper front pivot mechanism portion **106**.

[0085] Referring now to FIGS. **8** and **9**, in embodiments, the secondary seat cushion frame **54** may also include heating and cooling mechanisms for adjusting a temperature of a surface of the secondary seat cushion frame **54**. More particularly, the secondary seat cushion frame **54** may include a cooling mechanism **116** for cooling a surface of the secondary seat cushion frame **54**. The cooling mechanism **116** may include, for example, a fan or an air conditioning device. A hole **118** may be formed in the secondary seat cushion frame **54** such that air delivered by the cooling mechanism **116** may pass through the secondary seat cushion frame **54**, thereby cooling the occupant seated therein. The cooling mechanism **116** is electronically connected to the electronic control unit **32**, which, upon receiving a signal such as from the user interface **24** or a control device on the kinetic seat assembly **10**, sends a signal to the cooling mechanism **116** to adjust the parameters of the cooling mechanism **116** accordingly such as, for example, a temperature or blowing speed of the cooling mechanism **116**.

[0086] Referring still to FIG. **8**, the secondary seat cushion frame **54** may include a heating mechanism **120** for heating a surface of the secondary seat cushion frame **54**. The heating mechanism **120** may include one or more heating coils **120**A arranged on the secondary seat cushion frame **54**. In some embodiments, the heating coils **120**A of the heating mechanism **120** are positioned between the secondary seat cushion frame **54** and the padding **11**. In other embodiments, the heating coils **120**A may be provided in the secondary seat cushion frame **54** itself. In embodiments, the heating mechanism **120** may include a plurality of separate heating coils **120**A arranged parallel to one another extending in the kinetic seat longitudinal direction along an upward-facing surface of the secondary seat cushion frame **54**. In other embodiments, the heating mechanism **120** may include a single heating coil **120**A formed in a sinusoidal arrangement provided along the upward-facing surface of the secondary seat cushion frame **54**. The heating mechanism **120** is electronically connected to the electronic control unit **32**, which, upon receiving a signal such as from the user interface **24** or a control device on the kinetic seat assembly **10**, sends a signal to the heating mechanism **120** to adjust the parameters of the heating mechanism **120** accordingly such as, for example, a temperature of the heating mechanism **120**.

[0087] Referring to FIGS. **14** and **15** and with respect now to the secondary seat back frame **58**, the secondary seat back frame **58** has a shape contoured to conform to the torso of the occupant to provide sufficient support. As such, the secondary seat back frame **58** includes an upper end **180** provided proximate an upper portion thereof, a lower end **182** provided proximate a lower portion thereof, and a pair of side ends **184**, **186** interconnecting the upper end **180** and the lower end **182**. The upper end **180** may include a head rest **188** integrally formed with and extending upwardly from the upper end **180** in order to provide additional support to the head and neck of the occupant. In some embodiments, a head support frame **190** is provided and extends upwardly from the side ends **184**, **186** of the secondary seat back frame **58**. The head support frame **190** is a generally inverted U-shaped member including a pair of arms **192**, **194** connected to the side ends **184**, **186** of the secondary seat back frame **58**. As discussed in more detail below, an upper pivot mechanism **212** is coupled to the secondary seat back frame **58** below the head support frame **190**.

[0088] As shown in FIGS. **6** and **7**, the secondary seat back frame **58** is suspended in front of the primary seat back frame **56** at the upper pivot mechanism **212** to facilitate pivoting and rotation of the secondary seat back frame **58** with respect to the primary seat back frame **56**. The upper pivot mechanism **212** is positioned proximate the upper end **180** of the secondary seat back frame **58** to facilitate the greatest degree of rotation. Thus, the upper end **180** of the secondary seat back frame **58** is suspended in front of the upper member **76** of the primary seat back frame **56** by the upper pivot mechanism **212**, described in more detail herein.

[0089] Referring again to FIG. **2**, in embodiments, the secondary seat back frame **58** may also include heating and cooling mechanisms for adjusting a temperature of a surface of the secondary seat back frame **58**. More particularly, the secondary seat back frame **58** may include a cooling mechanism **140** for cooling a surface of the secondary seat back frame **58**. The cooling mechanism **140** may include, for example, a fan. A hole **142** may be formed in the secondary seat back frame **58** such that air delivered by the cooling mechanism **140** may pass through the secondary seat back frame **58**, thereby cooling the occupant seated therein. The cooling mechanism **140** is electronically connected to the electronic control unit **32**, which, upon receiving a signal such as from the user interface **24** or a control device on the kinetic seat assembly **10**, sends a signal to the cooling mechanism **140** to adjust the parameters of the cooling mechanism **140** accordingly such as, for example, a temperature or blowing speed of the cooling mechanism **140**.

[0090] Referring still to FIG. **2**, the secondary seat back frame **58** may include a heating mechanism **143** for heating a surface of the secondary seat back frame **58**. The heating mechanism **143** may include one or more heating coils **143**A arranged on or in the secondary seat back frame **58**. Specifically, the heating coils **143**A may be provided at one or more of the upper end **180**, the lower end **182**, or one of the side ends **184**, **186** of the secondary seat back frame **58**. In some embodiments, the heating coils **143**A of the heating mechanism **143** are positioned between the secondary seat back frame **58** and the padding **13**. In other embodiments, the heating coils **143**A may be provided in the secondary seat back frame **58** itself. In embodiments, the heating mechanism **143** may include a plurality of separate heating coils **143**A arranged parallel to one another extending in the kinetic seat vertical direction along a forward-facing surface of the secondary seat back frame **58**. In other embodiments, the heating mechanism **143** may include a single heating coil **143**A formed in a sinusoidal arrangement provided along the forward-facing surface of the secondary seat back frame **58**. The heating mechanism **143** is electronically connected to the electronic control unit **32**, which, upon receiving a signal such as from the user interface **24** or a control device on the kinetic seat assembly **10**, sends a signal to the heating mechanism **143** to adjust the parameters of the heating mechanism **143** accordingly such as, for example, a temperature of the heating mechanism **143**.

[0091] Referring still to FIG. **2**, the secondary seat back frame **58** may include a power lumbar mechanism **138**. The power lumbar mechanism **138** may include a flexible member **138**A and configured to flex away from the primary seat back frame **56** to increase a contour of the power lumbar mechanism **138** and toward the primary seat back frame **56** to decrease the contour of the power lumbar mechanism **138**. The power lumbar mechanism **138** may include one or more actuators **138**B to cause the power lumbar mechanism **138** to flex in the manner discussed herein at one or more locations along the power lumbar mechanism **138**. In embodiments, a plurality of actuators **138**B may be provided to extend along the power lumbar mechanism in the kinetic seat vertical direction to selectively flex corresponding regions of the lumbar mechanism **138**. The power lumbar mechanism **138** is electronically connected to the electronic control unit **32**, which, upon receiving a signal such as from the user interface **24** or a control device on the kinetic seat assembly **10**, sends a signal to the power lumbar mechanism **138**, specifically the flexible member **138**A and/or the one or more actuators **138**B, to adjust the contour of the power lumbar mechanism **138** accordingly. By adjusting the contour of the power lumbar mechanism **138**, the secondary seat back frame **58** may be better configured to more comfortably conform to the shape of the occupant's back. In embodiments, the heating coils **143**A may be provided on the power lumbar mechanism **138**.

[0092] Referring now to FIGS. **18-22**B, the upper pivot mechanism **212** is shown in greater detail. As shown in FIGS. **18** and **19**, the upper pivot mechanism **212** is positioned in a first position to raise the secondary seat back frame **58** relative to the primary seat back frame **56**. As shown in FIGS. **20** and **21**, the upper pivot mechanism **212** is positioned in a second position to lower the secondary seat back frame **58** relative to the primary seat back frame **56**. It should be appreciated that the upper pivot mechanism **212** is also positionable in a plurality of intermediate positions between the first position and the second position to position the secondary seat back frame **58** in a plurality of intermediate vertical positions relative to the primary seat back frame **56**. As shown in FIG. **22**A, the upper pivot mechanism **212** is in the first position in which the secondary seat back frame **58** is moved in a first vertical direction V **1** relative to the primary seat back frame **56** and the secondary seat back frame **58** is moved in a first longitudinal direction P**1** toward the primary seat back frame **56**. Alternatively, as shown in FIG. **22**B, the upper pivot mechanism **212** is in the second position in which the secondary seat back frame **58** is moved in a second vertical direction V **2** relative to the primary seat back frame **56** opposite the first vertical direction V **1** and the secondary seat back frame **58** is moved in a second longitudinal direction P**2** away the primary seat back frame **56** and opposite the first longitudinal direction P**1**.

[0093] Referring now to FIGS. **18-21**, the upper pivot mechanism **212** includes a U-shaped bracket **216** having a first side wall **216**A, an opposite second side wall **216**B, and a medial wall **216**C extending between the first side wall **216**A and the second side wall **216**B. The first side wall **216**A and the second side wall **216**B extend perpendicular to the medial wall **216**C in the kinetic seat longitudinal direction. The medial wall **216**C has an interior surface **216**C**1**, an exterior surface **216**C**2**, and an opening **227** formed therein. A pair of pivotable links **218** are provided on each of the first side wall **216**A and the second side wall **216**B. As shown a pair of pivotable links **218** are provided on each of the first side wall **216**A and the second side wall **216**B. As shown in FIG. **22**A, each pivotable link **218** has a first end **218**A rotatably mounted to the U-shaped bracket **216** and an opposite second end **218**B rotatably mounted to the primary seat back frame **56**.

[0094] The upper pivot mechanism **212** also includes a hollow tubular member **217** extending through the opening **227** in the medial wall **216**C. As shown in FIG. **22**A, the tubular member **217** has an open first end **217**A and an opposite second end **217**B closed off by a backing member **217**C. The backing member **217**C has an interior surface **217**C**1** and an exterior surface **217**C**2**. An opening **217**C**3** is formed in the backing member **217**C, the opening **217**C**3** extends between the interior surface **217**C**1** and the exterior surface **217**C**2**. The tubular member **217** is fixed within the opening **227** formed in the medial wall **216**C of the U-shaped bracket **216**.

[0095] The upper pivot mechanism **212** includes a ball joint **240** including a shaft **220** fixed to the secondary seat back frame **58**, and a ball **222** received within a ball cavity **225** of a connector **224** extending opposite the shaft **220**. The connector **224** is at least partially received within the tubular member **217** and has an internally threaded bore **229** formed therein which is dimensioned to movably extend through the opening **217**C**3** formed in the backing member **217**C. The ball joint **240** permits the secondary seat back frame **58** to rotate about an X, a Y, and a Z-axis with respect to the primary seat back frame **56** in order to move the secondary seat back frame **58** in a roll, a pitch, and a yaw direction. Thus, the secondary seat back frame **58** is movable in the kinetic seat vertical direction due to rotation of the ball **222** of the ball joint **240** within the connector **224** and pivoting of the pivotable links **218** relative to the primary seat back frame **56**. As shown in greater detail in FIG. **17**, the ball joint **240** and the connector **224** are illustrated with the ball joint **240** received within an open end of the connector **224**.

[0096] Referring again to FIG. **22**A, the connector **224** has a hub **224**B defining the ball cavity **225**, and a pin **224**C extending from the hub **224**B. The pin **224**C defines the internally threaded bore **229**. The hub **224**B has an outer diameter greater than an outer diameter of the pin **224**C. The outer diameter of the pin **224**C is less than a diameter of the opening of the backing member **217**C such that the pin **224**C is permitted to move through the opening **217**C**3** of the backing member **217**C. A shoulder **224**A is defined by the difference in diameter between the hub **224**B and the pin **224**C.

[0097] In embodiments, the upper pivot mechanism **212** includes an adjustment device **214** provided at the U-shaped bracket **216** and accessible from the exterior surface **217**C**2** of the backing member **217**C. The adjustment device **214** may include a head **233** having a contact surface **235** and an opposite externally threaded shaft **231** which engages the internally threaded bore **229** of the connector **224**. In embodiments, the adjustment device **214** is a fastener, rotatable knob, button, or the like.

[0098] In embodiments, the upper pivot mechanism **212** further includes an electronic control unit **234**A, a plate **234**B provided within the tubular member **217** and through which the connector **224** extends, and a linear actuator **234**C. The electronic control unit **234**A is in electronic communication with the linear actuator **234**C to cause the plate **234**B to move in the kinetic seat vehicle direction along a length of the connector **224**. In embodiments, the electronic control unit **234**A is communicatively coupled to the adjustment device **214**. The electronic control unit **234**A may be electronically coupled to the electronic control unit **32**.

[0099] The upper pivot mechanism **212** further includes a biasing member **226** provided within the tubular member **217** and extending between the shoulder **224**A formed in the connector **224** and the plate **234**B. Accordingly, as described herein, movement of the plate **234**B in the kinetic seat longitudinal direction will result in an increased or decreased biasing force on the secondary seat back frame **58** by the biasing member **226**.

[0100] In use, rotation of the adjustment device **214** in a first direction results in the linear actuator **234**C being operated in a first mode to move the plate **234**B in a first direction T**1** along the connector **224**, as shown in FIG. **22**A. As the plate **234**B moves in the first direction T**1**, the biasing member **226** is permitted to extend between the plate **234**B and the shoulder **224**A of the connector **224** thereby increasing a damping effect when the secondary seat back frame **58** moves in a first longitudinal direction P**1** toward the primary seat back frame **56** and, specifically, as the connector **224** moves through the opening **217**C**3** formed in the backing member **217**C. The biasing member **226** then provides a biasing force against the secondary seat back frame **58** to move the secondary seat back frame **58** in an opposite second longitudinal direction P**2** such that the connector **224** retracts out of the opening **217**C**3** formed in the backing member **217**C, as shown in FIG. **22**A.

[0101] Alternatively, rotation of the adjustment device **214** in an opposite second direction results in the linear actuator **234**C being operated in a second mode to move the plate **234**B in a second direction T**2** along the connector **224**, as shown in FIG. **22**B. As the plate **234**B moves in the second direction T**2**, the biasing member **226** is compressed between the plate **234**B and the shoulder **224**A of the connector **224** thereby decreasing a damping effect when the secondary seat back frame **58** moves in the first longitudinal direction P**1** toward the primary seat back frame **56** and, specifically, as the connector **224** moves through the opening **217**C**3** formed in the backing member **217**C, as shown in FIG. **22**B. The biasing member **226** then provides a biasing force against the secondary seat back frame **58** to move the secondary seat back frame **58** in the second longitudinal direction P**2** such that the connector **224** retracts out of the opening **217**C**3** formed in the backing member **217**C.

[0102] In embodiments, the plate **234**B may be moved in the first direction T**1** or the second direction T**2** by manual operation of the adjustment device **214** by accessing the adjustment device **214** from a rear side of the primary seat back frame **56** and rotating the adjustment device **214**, or electronically operated by communicating with the electronic control unit **234**A itself. In embodiments in which the plate **234**B is moved by manual operation of the adjustment device **214**, rotation of the adjustment device **214** may be coupled to the plate **234**B by a worm gear, a bevel gear, or the like to convert rotational movement of the adjustment device **214** to linear movement of the plate **234**B in the first direction T**1** and the second direction T**2**.

[0103] As noted above, and shown in FIGS. **27** and **28**, the secondary seat cushion frame **54** and the secondary seat back frame **58** are connected to one another at the rear end **90** and the lower end **182**, respectively, by the linkage assembly **60**. As discussed herein, the linkage assembly **60** ensures that the secondary seat cushion frame **54** and the secondary seat back frame **58** move in phase, i.e., in unison and in the same direction, with one another.

[0104] As shown in FIGS. **23** and **24**, the linkage assembly **60** includes an L-shaped connection bracket **242** having a first end **242**A mounted to the rear end **90** of the secondary seat cushion frame **54** and an opposite second end **242**B. The L-shaped connection bracket **242** also has a rear surface **242**C and an opposite front surface **242**D. The L-shaped connection bracket **242** includes a pair of spaced apart eyelets **244**A, **244**B positioned on opposite sides of the L-shaped connection bracket **242** extending through the rear surface **242**C and the front surface **242**D. The eyelets **244**A, **244**B extend in opposite kinetic seat lateral directions and define holes **245**A, **245**B Referring now to FIGS. **25** and **26**, the linkage assembly **60** includes a connector bracket **244** fixedly attached to the front surface **242**D of the L-shaped connection bracket **242**. The connector bracket **244** includes a base wall **246**B and a pair of side walls **246**C. The pair of side walls **246**C extends substantially perpendicular to the base wall **246**B in the kinetic seat longitudinal direction and an opening **246**D is formed at a distal end of each side wall **246**C opposite the base wall **246**B. The openings **246**D are coaxial with one another to define a reclining axis Rm about which the secondary seat back frame **58** rotates relative to the connector bracket **244**, as discussed herein. As such, the secondary seat cushion frame **54** and the secondary seat back frame **58** are permitted to rotate about the reclining axis Rm.

[0105] Referring now to FIGS. **27** and **28**, the secondary seat back frame **58** is rotatably mounted to the connector bracket **244**. M ore particularly, the lower member **78** of the secondary seat back frame **58** is rotatably mounted to the connector bracket **244** by a fixing member **248**, such as a pin, extending through a cavity **58**A formed in a protrusion **58**B extending from the lower member **78** of the secondary seat back frame **58** and the openings **246**D formed in the side walls **246**C of the connector bracket **244**. Thus, the secondary seat cushion frame **54** is permitted to rotate relative to the secondary seat back frame **58** due to the connector bracket **244** being permitted to rotate relative to the connection bracket **242**.

[0106] Referring now to FIG. **29**, the vertical damping mechanism **100** is shown between the eyelets **244**A, **244**B of the connector bracket **244** and a pair of clamps **360** provided on a rear rod **362** extending between opposite rails **81**, **83** of the primary seat cushion frame **52**. The vertical damping mechanism **100** includes first and second vertical dampers **144**, **146** interconnecting the primary seat cushion frame **52** and the secondary seat cushion frame **54** due to the connection therebetween by the linkage assembly **60**.

[0107] It is to be understood that each vertical damper **144**, **146** is identical in structure and operation and, thus, only the first vertical damper **144** will be described in detail and with reference to FIG. **29**. In some embodiments, the first vertical damper **144** includes an outer tube **148** and an inner tube **154**. The outer tube **148** includes a first end **150** and an opposite second end **152**. The inner tube **154** includes a first end **156** and an opposite second end **158**. In some embodiments, the inner tube **154** and the outer tube **148** are permitted to rotate with respect to one another. Additionally, the inner tube **154** may extend and retract from the outer tube **148**, but the inner tube **154** may be restricted from retracting completely out of the outer tube **148**.

[0108] In some embodiments, as discussed in more detail below, the inner tube **154** slidably moves in and out of the first end **150** of the outer tube **148** in order to adjust the length of the first vertical damper **144** based on the movement of the secondary seat back frame **58** with respect to the primary seat cushion frame **52**. In some embodiments, the first vertical damper **144** also includes a ball joint **145** at one or both ends of the first vertical damper **144** to provide necessary rotation of the first vertical damper **144** with respect to the primary seat cushion frame **52** and/or the secondary seat back frame **58**.

[0109] Although not shown, in some embodiments, the first vertical damper **144** includes a biasing member, such as a spring, for providing a damping effect between the inner tube **154** and the outer tube **148**. In other embodiments, the first vertical damper **144** may include a compressible fluid providing the damping effect between the inner tube **154** and the outer tube **148**. The degree of the damping effect may be manually or electronically adjustable, as discussed in more detail herein.

[0110] It is to be understood that variations of the first vertical damper **144** may be contemplated and within the scope of the present disclosure. For example, in some embodiments, it is to be appreciated that the orientation of the outer tube **148** and the inner tube **154** may be switched such that the outer tube **148** is coupled to the secondary seat back frame **58** and the inner tube **154** is coupled to the primary seat cushion frame **52**.

[0111] In some embodiments, the first vertical damper **144** is a shock absorber. In some embodiments, the first vertical damper **144** is a pneumatic actuator. As such, the first vertical damper **144** includes an inlet **304** for connecting to an air supply. Air is supplied into the first vertical damper **144**, particularly the outer tube **148**, to a predetermined amount to control the degree of damping. In some embodiments, the inlet **304** of the first vertical damper **144** is in fluid communication with an air supply located in the vehicle **12** to add air into the first vertical damper **144**. To release pressure within the first vertical damper **144**, a release valve may be activated in order to reduce the amount of damping. The release valve may be adjusted between an open position, a closed position, and a plurality of intermediate positions. The air released may be recirculated back into the air supply provided in the vehicle **12** or released into the atmosphere. Thus, vertical movement of the secondary seat back frame **58** may be reduced or increased as desired by the occupant by controlling the amount of pressure within the first vertical damper **144**.

[0112] In other embodiments, although not shown, it is understood that each vertical damper **144**, **146** may be an electric actuator, a hydraulic actuator, or any other suitable actuator for damping movement between the primary seat cushion frame **52** and the secondary seat back frame **58**.

[0113] As shown in FIG. **30**, a detailed side view of the first vertical damper **144** is shown coupled between the connector bracket **244** and the clamp **360**. It should be appreciated that components illustrated in FIG. **30** and discussed herein may not be depicted in other figures for sake of simplification of illustration without limiting the scope of the present disclosure. In addition, it should be appreciated that the description of the first vertical damper **144** discussed herein and illustrated in FIG. **30** is equally applicable to the second vertical damper **146**. However, only the connection of the first vertical damper **144** is illustrated and described in detail herein.

[0114] As shown in FIG. **30**, the first vertical damper **144** includes the ball joint **145** provided at the second end **152** of the outer tube **148**, and the ball joint **145** provided at the second end **158** of the inner tube **154**. Each ball joint **145** includes a ball **145**A and a receiver **145**B defining a cavity **145**C for receiving the ball **145**A. As shown, the first vertical damper **144** is spaced apart from the connection bracket **242** in the kinetic seat longitudinal direction. It should be appreciated that the first vertical damper **144** being spaced apart from the connection bracket **242** and, more specifically, the ball joints **145** being spaced apart from the connection bracket **242** allows for unrestricted pivoting movement of the second end **152** of the outer tube **148** and the second end **158** of the inner tube **154**.

[0115] With more particularity, the second end **152** of the outer tube **148** is spaced apart from one of the clamps **360** to which the first vertical damper **144** is coupled. In embodiments, as shown, a ball joint **380** is provided at an upper clamp mount **364**H of the clamp **360**. The ball joint **380** includes a ball **380**A and a receiver **380**B defining a cavity **380**C for receiving the ball **380**A. A shaft **382** extends between the ball joint **145** at the second end **152** of the outer tube **148** and the ball joint **380** at the clamp **360** to space the second end **152** of the outer tube **148** away from the clamp **360**. In embodiments, the shaft **382** may be fixed directly to the clamp **360** without providing the ball joint **380**.

[0116] Additionally, the second end **158** of the inner tube **154** is spaced apart from the connection bracket **242** and specifically the eyelet **244**A of the connection bracket **242** to which the first vertical damper **144** is coupled. In embodiments, as shown, a ball joint **390** is provided at the eyelet **244**A of the connection bracket **242**. The ball joint **390** includes a ball **390**A and a receiver **390**B defining a cavity **390**C for receiving the ball **380**A. A shaft **392** extends between the ball joint **145** at the second end **158** of the inner tube **154** and the ball joint **390** at the eyelet **244**A of the connection bracket **242** to space the second end **158** of the inner tube **154** away from the connection bracket **242**. In embodiments, the shaft **392** may be fixed directly to the connection bracket **242** without providing the ball joint **390**. As such, the first vertical damper **144**, as well as the second vertical damper **146**, are allowed to articulate at the ball joint **380** and the ball joint **390**. This allows for a greater degree of freedom of first vertical damper **144** rotating relative to the connection bracket **242** and the clamp **360**.

[0117] Referring again to FIG. **29**, the first and second vertical dampers **144**, **146** are oriented at an angle relative to one another such that a distance between the second end **158** of the inner tube **154** of each vertical damper **144**, **146** is greater than a distance between the second end **152** of the outer tube **148** of each vertical damper **144**, **146**. Stated another way, a distance between the end of each vertical damper **144**, **146** coupled to the linkage assembly **60** is greater than an opposite end of each vertical damper **144**, **146** coupled to the primary seat cushion frame **52**. This configuration allows the vertical dampers **144**, **146** to absorb vertical shock as the secondary seat cushion frame **54** and the secondary seat back frame **58** move in a kinetic seat vertical direction and to allow the secondary seat cushion frame **54** and the secondary seat back frame **58** to pivot.

[0118] Referring still to FIG. **29**, the lateral damping mechanism **102** includes first and second lateral dampers **258**, **260** interconnecting the primary seat back frame **56** and the secondary seat back frame **58**. It is to be understood that each lateral damper **258**, **260** is identical in structure and operation and, thus, only the first lateral damper **258** will be described in detail. In some embodiments, the first lateral damper **258** includes an outer tube **262** and an inner tube **268**. The outer tube **262** includes a first end **264** and an opposite second end **265**. The inner tube **268** includes a first end **270** and an opposite second end **272**. In some embodiments, the inner tube **268** and the outer tube **262** are permitted to rotate with respect to one another. Additionally, the inner tube **268** may extend and retract from the outer tube **262**, but the inner tube **268** may be restricted from retracting completely out of the outer tube **262**.

[0119] In use, in some embodiments, as discussed in more detail below, the inner tube **268** slidably moves in and out of the first end **264** of the outer tube **262** in order to adjust the length of the first lateral damper **258** based on the movement of the secondary seat back frame **58** with respect to the primary seat back frame **56**. In some embodiments, the first lateral damper **258** includes a ball joint **277** at the second end **265** of the outer tube **262** of the first lateral damper **258** to provide necessary rotation of the first lateral damper **258** with respect to the primary seat back frame **56**. A ball joint **277** is also provided at the second end **272** of the inner tube **268** rotatably fixing the inner tube **268** to the secondary seat back frame **58**.

[0120] In some embodiments, the first lateral damper **258** includes a biasing member, such as a spring, for providing a damping effect between the inner tube **268** and the outer tube **262**. In other embodiments, the first lateral damper **258** may include a compressible fluid providing the damping effect between the inner tube **268** and the outer tube **262**. The degree of the damping effect may be manually or electronically adjustable, as discussed in more detail herein.
[0121] In some embodiments, the first lateral damper **258** is a pneumatic actuator. As such, the first lateral damper **258** includes an inlet **330** for connecting to an air supply. Air is supplied into the first lateral damper **258**, particularly the outer tube **262**, to a predetermined amount to control the degree of damping. In some embodiments, the inlet **330** of the first lateral damper **258** is in fluid communication with an air supply located in the vehicle **12** to add air into the first lateral damper **258**. To release pressure within the first lateral damper **258**, a release valve may be activated in order to reduce the amount of damping. The release valve may be adjusted between an open position, a closed position, and a plurality of intermediate positions. The air released may be recirculated back into the air supply provided in the vehicle **12** or released into the atmosphere. Thus, lateral movement of the secondary seat back frame **58** may be reduced or increased as desired by the occupant by controlling the amount of pressure within the first lateral damper **258**.
[0122] Although not shown, it is appreciated that the lateral dampers **258**, **260** may be in communication with the electronic control unit **32** and operable via the user interface **24** for operating the amount of pressure within the lateral dampers **258**, **260**. As noted above, the display unit **22** may include the user interface **24** and may be located in any suitable location, such as on the dashboard of the vehicle **12**, or otherwise within reach of the occupant such that the occupant may control the degree of damping in the kinetic seat assembly **10**. It is to be appreciated that the lateral dampers **258**, **260** may be operable between a Sport mode and a Comfort mode. When the occupant selects Sport mode, air may be released from the lateral dampers **258**, **260** in order to allow for more extension and retraction of the inner tube **268** with respect to the outer tube **262**. Alternatively, when the occupant selects Comfort mode, additional air is supplied in the lateral dampers **258**, **260** in order to increase the pressure therein and limit the amount of extension and retraction of the inner tube **268** with respect to the outer tube **262**.
[0123] In other embodiments, although not shown, it is understood that each lateral damper **258**, **260** may be an electric actuator, a hydraulic actuator, or any other suitable actuator for damping movement between the primary seat back frame **56** and the secondary seat back frame **58**.
[0124] Referring now to FIGS. **31** and **34**, in embodiments, the kinetic seat assembly **10** includes a seat cushion tilt mechanism **338** for tiling the secondary seat cushion frame **54** relative to the primary seat cushion frame **52**. The seat cushion tilt mechanism **338** includes a tilt bar **340** including a tilt bar front portion **342** and a pair of tilt bar handles **344**, **346** extending rearwardly in the kinetic seat longitudinal direction from opposite ends of the tilt bar front portion **342**. A distal end **344**A, **346**A of each tilt bar handle **344**, **346** opposite the tilt bar front portion **342** is rotatably attached to the side members **66**, **68** of the primary seat cushion frame **52**. The seat cushion tilt mechanism **338** also includes a forward rod **348** extending between side members **66**, **68** of the primary seat cushion frame **52** and is positioned under the tilt bar handles **344**, **346** such that movement of the forward rod **348** in the kinetic seat vertical direction causes the seat cushion tilt mechanism **338** to rotate about the distal end **344**A, **346**A of each tilt bar handle **344**, **346** such that the tilt bar front portion **342** also moves upward in the kinetic seat vertical direction. As shown in FIG. **31**, the front pivot mechanism **98** is received within the tilt bar front portion **342** to be coupled to the front end **88** of the secondary seat cushion frame **54**. Thus, movement of the seat cushion tilt mechanism **338**, specifically the tilt bar front portion **342**, results in similar rotation of the front end **88** of the secondary seat cushion frame **54**.
[0125] Referring again to FIG. **31**, a pair of clamps **360** is provided on the rear rod **362** extending between the rails **81**, **83** of the primary seat cushion frame **52**. As described in more detail herein, the clamps **360** are provided for rotatably coupling the vertical dampers **144**, **146** to the primary

seat cushion frame **52** and maintaining a current degree of damping or extension of the vertical dampers **144**, **146** during movement of the kinetic seat assembly **10** in the kinetic seat vertical direction as the rear rod **362** rotates.

[0126] Referring now to FIGS. **32** and **33**, the clamps **360** are illustrated in more detail separate from the rear rod **362**. Each clamp **360** includes an upper clamp portion **364** and a lower clamp portion **366**. The upper clamp portion **364** has an outer surface **364**A and an inner surface **364**B. The upper clamp portion **364** has an open lower end **364**C and the inner surface **364**B defines a concave upper channel **364**D. The upper clamp portion **364** also has a front wall **364**E and a rear wall **364**F joined to one another and cooperating to define the concave upper channel **364**D. A plurality of upper clamp holes **364**G are formed in the upper clamp portion **364** extending through the front wall **364**E and the rear wall **364**F, and through the outer surface **364**A and the inner surface **364**B. An upper clamp mount **364**H is provided on the outer surface **364**A at the rear wall **364**F for receiving a corresponding one of the vertical dampers **144**, **146**, as discussed in more detail herein. The upper clamp portion **364** further includes a clamp finger **372** extending from a side of the upper clamp portion **364**. As shown, the clamp finger **372** extends from the rear wall **364**F of the upper clamp portion **364**. The clamp finger **372** includes a flange **372**A extending from the rear wall **364**F of the upper clamp portion **364** in a substantially kinetic seat longitudinal direction and a receiver **372**B extending from a distal end of the flange **372**A opposite the rear wall **364**F of the upper clamp portion **364**. The receiver **372**B defines a channel **372**C formed in an end thereof for mating with a portion of the primary seat cushion frame **52** and preventing rotation of the clamp **360** relative to the rear rod **362**, as discussed herein.

[0127] The lower clamp portion **366** has an outer surface **366**A and an inner surface **366**B. The lower clamp portion **366** has an open upper end **366**C and the inner surface **366**B defines a concave lower channel **366**D. The lower clamp portion **366** also has a front wall **366**E and a rear wall **366**F joined to one another and cooperating to define the concave lower channel **366**D. A plurality of lower clamp holes **366**G are formed in the lower clamp portion **366** extending through the front wall **366**E and the rear wall **366**F, and through the outer surface **366**A of the lower clamp portion **366**.

[0128] In assembling the clamp **360**, the lower clamp portion **366** is inserted into the open lower end **364**C of the upper clamp portion **364**. The concave lower channel **366**D and the concave upper channel **364**D cooperate to define a bore **370** for receiving the rear rod **362**, as described in more detail herein. With the lower clamp portion **366** positioned within the upper clamp portion **364**, the lower clamp holes **366**G are coaxial with corresponding upper clamp holes **364**G. The upper clamp portion **364** and the lower clamp portion **366** are secured to one another by one or more fasteners **368**, such as screws, rivets, and the like, extending through the upper clamp holes **364**G and the lower clamp holes **366**G. As shown, a pair of fasteners **368** is provided for securing the upper clamp portion **364** to the lower clamp portion **366**. However, any number of fasteners **368** may be provided for securing the upper clamp portion **364** and the lower clamp portion **366** to one another. When in an assembled state, the upper clamp portion **364** and the lower clamp portion **366** define a bore **370**.

[0129] As shown in FIGS. **29** and **31**, the rear rod **362** is received within the bore **370** formed by the upper clamp portion **364** and the lower clamp portion **366**, and the clamp finger **372** engages the primary seat cushion frame **52** to prevent the clamps **360** from moving along the longitudinal axis of the rear rod **362** and in the kinetic seat lateral direction. The clamps **360** may be rotatably coupled to the vertical dampers **144**, **146** by one of the fasteners **368** extending through the upper clamp portion **364**, the lower clamp portion **366**, and the second end **152** of the outer tube **148** of the vertical dampers **144**, **146**. In other embodiments in which one of the fasteners **368** do not extend entirely through the upper clamp portion **364** and the lower clamp portion **366**, a separate fastener may be used to rotatably couple the clamps **360** to the vertical dampers **144**, **146**, such as a separate fastener extending through the upper clamp mount **364**H of the upper clamp portion **364**.

[0130] As described herein, the kinetic seat assembly **10** is permitted to move in a kinetic seat vertical direction relative to the floor F. As the kinetic seat assembly **10** moves in the kinetic seat vertical direction, the rear rod **362** rotates. To ensure that the vertical dampers **144**, **146** maintain the current amount of compression as the kinetic seat assembly **10** moves, the clamps **360** are permitted to rotate relative to the rear rod **362** and remain rotatably coupled to the vertical dampers **144**, **146**. Alternatively, if the clamps **360** were fixed to the rear rod **362**, the degree of compression of the vertical dampers **144**, **146** would increase or decrease in relation to the overall movement of the kinetic seat assembly **10** in the kinetic seat vertical direction and the rotation of the rear rod **362**.

[0131] Referring again to FIG. **34**, a portion of the seat cushion tilt mechanism **338** is shown in more detail. Particularly, the seat cushion tilt mechanism **338** further includes a fixed plate **350** and a drive member **352** extending from the fixed plate **350**. The drive member **352** may be rotatably coupled to a pivotal plate **354** at an end of the drive member **352** opposite the fixed plate **350** such that extension of the drive member **352** from the fixed plate **350** in a direction E**1** pivots the pivotal plate **354** and thus raises the forward rod **348**, which raises the tilt bar **340** of the seat cushion tilt mechanism **338** and the front end **88** of the secondary seat cushion frame **54**. Alternatively, retraction of the drive member **352** back into the fixed plate **350** in an opposition direction E**2** results in the pivotal plate **354** rotating in an opposite direction to lower the forward rod **348**, thus lowering of the tilt bar **340** of the seat cushion tilt mechanism **338** and the front end **88** of the secondary seat cushion frame **54**. The drive member **352** may be a threaded shaft, actuator, and/or the like operated by a motor. The motor may be controlled by the electronic control unit **32**. The seat cushion tilt mechanism **338** allows the entire secondary seat cushion frame **54** to tilt with respect to the primary seat cushion frame **52**.

[0132] In use, the occupant controls the turning direction of the vehicle **12** by rotating the steering wheel **20**. In doing so, the turning direction side shoulder of the occupant moves downward relative to the counter-turning direction side shoulder, and the turning direction side shoulder moves rearward relative to the counter-turning direction side shoulder. At this time, a steering operation can be comfortably performed if the occupant bends the lumbar spine in the turning direction and shortens a distance between the turning direction side pelvis and the shoulder compared to a distance between the counter-turning direction side pelvis and the shoulder, twists the lumbar spine, and pivotally moves the pelvis in the same direction as the turning direction side shoulder.

[0133] When the occupant directs the vehicle **12** in a turning direction, a force is applied onto the vehicle **12** and, thus, the occupant in the counter-turning direction. In a standard vehicle seat not equipped with moving to compensate for this force and allow the occupant to adjust a pelvis or torso position, the occupant will exhibit strain on these joints, including the knees, waist, and shoulders. In a seat in which the seat cushion frame and the seat back frame rotate in opposite directions, this strain on the occupant's joints is magnified.

[0134] The present disclosure seeks to eliminate these joint stresses by permitting the occupant seated in the kinetic seat assembly **10** to rotate with the force exhibited on the vehicle **12** during a turn. Thus, the present kinetic seat assembly **10** allows the pelvis and the torso of the occupant to rotate in order to maintain a center of gravity within the vehicle **12** in the direction of the turn.

[0135] As the occupant turns the vehicle **12** to the right, the occupant lowers the right shoulder and uses the trunk muscle so as to bend the lumbar spine to the right. This causes the occupant to pivotally move the pelvis counterclockwise in the rolling direction and clockwise in the yaw direction. In addition, the occupant pivotally moved the torso counterclockwise in the rolling direction and clockwise in the yaw direction. During a turn to the right, force is applied onto the occupant to the left. This further facilitates rotation of the torso and pelvis of the occupant to the left due to the momentum of the vehicle **12**. As such, the secondary seat cushion frame **54** and the secondary seat back frame **58** move in phase with one another to the left due to their connection by the linkage assembly **60**. Specifically, as shown in FIG. **8**, during a right turn operation, the rear

end **90** of the secondary seat cushion frame **54** moves in a first seat cushion direction X **1** and the lower end **182** of the secondary seat back frame **58** moves in a first seat back direction Y **1**. The first seat cushion direction X**1** and the first seat back direction Y **1** are each directed along the same kinetic seat lateral direction. As the secondary seat cushion frame **54** and the secondary seat back frame **58** move to the left, the lateral damping mechanism **102** provides a controlled damping effect to reduce the force at which the secondary seat cushion frame **54** and the secondary seat back frame **58** move to the left. Alternatively, as the occupant turns the vehicle **12** to the left, the secondary seat cushion frame **54** and the secondary seat back frame **58** move in phase with one another to the right. Specifically, as shown in FIG. **8**, during a right turn operation, the rear end **90** of the secondary seat cushion frame **54** moves in a second seat cushion direction X **2** opposite the first seat cushion direction X **1** and the lower end **182** of the secondary seat back frame **58** moves in a second seat back direction Y **2** opposite the first seat back direction Y **1**. The second seat cushion direction X **2** and the second seat back direction Y **2** are each directed along the same kinetic seat lateral direction. As the secondary seat cushion frame **54** and the secondary seat back frame **58** move to the right, the lateral damping mechanism **102** provides a controlled damping effect to reduce the force at which the secondary seat cushion frame **54** and the secondary seat back frame **58** move to the right.
[0136] Referring again to FIG. **1**, an imaginary line L extends from the front pivot mechanism **98** to the upper pivot mechanism **212**. With respect to an occupant seated in the kinetic seat assembly **10**, the line L generally extends through the shoulders of the occupant and the knees of the occupant. Thus, during use of the kinetic seat assembly **10**, when undergoing movement during a right turn or a left turn, the kinetic seat assembly **10** ensures that the shoulders of the occupant and the knees of the occupant remain generally aligned with one another while allowing the occupant's waist to move in respective left and right directions in accordance with the above disclosure.
[0137] From the above, it is to be appreciated that defined herein is a new and unique kinetic seat assembly in which a seat cushion frame and a seat back frame rotate in phase with one another during movement of a vehicle, such as a turn. In doing so, the driver of the vehicle, or other occupant when the kinetic vehicle seat replaces a seat of a vehicle other than the driver seat, experiences a more comfortable driving experience in which the occupant's torso and waist move together.

Claims

1. A kinetic seat assembly comprising: a primary seat cushion frame; a secondary seat cushion frame movable relative to the primary seat cushion frame; a primary seat back frame; a secondary seat back frame movable relative to the primary seat back frame; and at least one of a cooling mechanism and a heating mechanism provided on at least one of the secondary seat back frame and the secondary seat cushion frame.
2. The kinetic seat assembly of claim 1, further comprising the cooling mechanism provided on one of the secondary seat back frame and the secondary seat cushion frame.
3. The kinetic seat assembly of claim 2, wherein the cooling mechanism comprises a fan directing cooled air through a hole formed in the one of the secondary seat back frame and the secondary seat cushion frame toward an occupant seated in the kinetic seat assembly.
4. The kinetic seat assembly of claim 2, wherein: the cooling mechanism is electronically connected to an electronic control unit; and upon receiving a signal from the electronic control unit, the cooling mechanism is operated to adjust at least one of a temperature and blowing speed of the cooling mechanism.
5. The kinetic seat assembly of claim 1, further comprising the heating mechanism provided on one of the secondary seat back frame and the secondary seat cushion frame, wherein the heating mechanism comprises one or more heating coils.

6. The kinetic seat assembly of claim 5, wherein the heating mechanism comprises a plurality of heating coils extending along a surface of the one of the secondary seat back frame and the secondary seat cushion frame.
7. The kinetic seat assembly of claim 6, wherein the plurality of heating coils extend parallel to one another and along a longitudinal direction of the one of the secondary seat back frame and the secondary seat cushion frame.
8. The kinetic seat assembly of claim 3, wherein: the heating mechanism is electronically connected to an electronic control unit; and upon receiving a signal from the electronic control unit, the heating mechanism is operated to adjust a temperature of the heating mechanism.
9. A vehicle comprising: a passenger compartment; and a kinetic seat assembly within the passenger compartment, the kinetic seat assembly including: a primary seat cushion frame; a secondary seat cushion frame movable relative to the primary seat cushion frame; a primary seat back frame; a secondary seat back frame movable relative to the primary seat back frame; and at least one of a cooling mechanism and a heating mechanism provided on at least one of the secondary seat back frame and the secondary seat cushion frame.
10. The vehicle of claim 9, further comprising the cooling mechanism provided on one of the secondary seat back frame and the secondary seat cushion frame.
11. The vehicle of claim 10, wherein the cooling mechanism comprises a fan directing cooled air through a hole formed in the one of the secondary seat back frame and the secondary seat cushion frame toward an occupant seated in the kinetic seat assembly.
12. The vehicle of claim 10, wherein: the cooling mechanism is electronically connected to an electronic control unit; and upon receiving a signal from the electronic control unit, the cooling mechanism is operated to adjust at least one of a temperature and blowing speed of the cooling mechanism.
13. The vehicle of claim 9, further comprising the heating mechanism provided on one of the secondary seat back frame and the secondary seat cushion frame, wherein the heating mechanism comprises one or more heating coils.
14. The vehicle of claim 13, wherein the heating mechanism comprises a plurality of heating coils extending along a surface of the one of the secondary seat back frame and the secondary seat cushion frame.
15. The vehicle of claim 14, wherein the plurality of heating coils extend parallel to one another and along a longitudinal direction of the one of the secondary seat back frame and the secondary seat cushion frame.
16. The vehicle of claim 11, wherein: the heating mechanism is electronically connected to an electronic control unit; and upon receiving a signal from the electronic control unit, the heating mechanism is operated to adjust a temperature of the heating mechanism.