

ECCENTRIC PIVOTING CAR SEAT**CROSS REFERENCE TO RELATED APPLICATIONS**

This application claims the benefit of U.S. Application No. 63/610,778, filed on December 15, 2023, U.S. Application No. 63/725,337, filed on November 26, 2024, and of U.S. Application No. 63/728,256, filed on December 5, 2024, which is incorporated herein by reference in its entirety.

FIELD

[0001] Embodiments of the present disclosure relate to the art of child restraint systems for use in a vehicle, and more particularly to a support base of a child restraint system.

BACKGROUND

[0002] A child restraint system is designed to protect a child from injury or death during a collision of a vehicle. Existing child restraint systems commonly include a base portion and a seat portion detachably installed on the base portion. When a child restraint system is secured on a vehicle by a lower anchor and/or a vehicle belt, the base portion must be adjusted to a proper reclined angle. In addition, depending on the type of seat that is being used, the seat may be positioned either in a forward-facing or a rearward-facing orientation (e.g., relative to a front of the vehicle). Existing base portions cannot support different types of seats in different orientations and at various angles of recline.

BRIEF DESCRIPTION

[0003] According to some embodiments, a child restraint system includes a child seat and a support base configured to support the child seat thereon. A positioning assembly is operably coupled to the child seat and the support base. The child seat is movable relative to at least a portion of the support base between a plurality of positions via the positioning assembly. The positioning assembly has a first portion associated with the support base and a second portion associated with the child seat. The first portion of the positioning assembly is offset from a centerline of at least one of the child seat and the support base. The child seat is selectively lockable at one or more of the plurality of positions relative to the at least a portion of the support base.

[0004] In addition to one or more of the features described above, or as an alternative, in further embodiments the plurality of positions includes a first rotational position a second

rotational position. The child seat is in a rearward-facing orientation relative to the at least a portion of the support base at the first rotational position and the child seat is in a side-facing orientation relative to the at least a portion of the support base at the second rotational position.

[0005] In addition to one or more of the features described above, or as an alternative, in further embodiments the plurality of positions includes a first rotational position a second rotational position. The child seat is in a rearward facing orientation relative to the at least a portion of the support base at the first rotational position and the child seat is in a forward facing orientation relative to the at least a portion of the support base at the second rotational position.

[0006] In addition to one or more of the features described above, or as an alternative, in further embodiments the plurality of positions includes a third rotational position arranged between the first rotational position and the second rotational position. The child seat is in a side facing orientation relative to the at least a portion of the support base at the third rotational position.

[0007] In addition to one or more of the features described above, or as an alternative, in further embodiments the support base includes an upper base portion and a lower base portion. The upper base portion is rotatable relative to the lower base portion. The child seat is connectable to the upper base portion such that the child seat is rotatable with the upper base portion relative to the lower base portion.

[0008] In addition to one or more of the features described above, or as an alternative, in further embodiments the first portion of the positioning assembly is associated with the upper base portion. The child seat is movable relative to the upper base portion via the positioning assembly.

[0009] In addition to one or more of the features described above, or as an alternative, in further embodiments the first portion of the positioning assembly is associated with the lower base portion and the second portion of the positioning assembly is associated with the upper base portion. The upper base portion is movable relative to the lower base portion via the positioning assembly.

[0010] In addition to one or more of the features described above, or as an alternative, in further embodiments the positioning assembly defines at least one axis and the child seat is rotatable about the at least one axis between the plurality of positions.

[0011] In addition to one or more of the features described above, or as an alternative, in further embodiments the first portion of the positioning assembly includes at least one positioning element and the second portion of the positioning assembly includes at least one

positioning slot. The at least one positioning element is receivable within the at least one positioning slot.

[0012] In addition to one or more of the features described above, or as an alternative, in further embodiments the second portion of the positioning assembly includes at least one engagement pin operable to restrict translation of the at least one positioning element within the at least one positioning slot while the child seat remains coupled to the support base.

[0013] In addition to one or more of the features described above, or as an alternative, in further embodiments an actuator is associated with the at least one positioning element. The actuator is operable to move the at least one positioning element away from the at least one positioning slot.

[0014] In addition to one or more of the features described above, or as an alternative, in further embodiments the second portion of the positioning assembly includes at least one engagement pin operable to restrict separation of the at least one positioning element from the at least one positioning slot.

[0015] In addition to one or more of the features described above, or as an alternative, in further embodiments the at least one engagement pin is movable between an extended position and a retracted position. The at least one engagement pin is arranged within the at least one positioning slot when in the extended position and the at least one engagement pin is separated from the at least one positioning slot when in the retracted position.

[0016] In addition to one or more of the features described above, or as an alternative, in further embodiments an actuator is operably coupled to the at least one engagement pin. The actuator is operable to transform the at least one engagement pin between the extended position and the retracted position.

[0017] In addition to one or more of the features described above, or as an alternative, in further embodiments the at least one positioning element includes a first positioning element and a second positioning element. The at least one axis of the positioning assembly including a first axis defined by the first positioning element and a second axis defined by the second positioning element.

[0018] In addition to one or more of the features described above, or as an alternative, in further embodiments both the first positioning element and the second positioning element are offset from the centerline of the support base.

[0019] In addition to one or more of the features described above, or as an alternative, in further embodiments the at least one engagement pin includes a first engagement pin operable to restrict separation of the first positioning element from a first positioning slot of

the at least one positioning slot and a second engagement pin operable to restrict separation of the second positioning element from a second positioning slot of the at least one positioning slot.

[0020] In addition to one or more of the features described above, or as an alternative, in further embodiments the first engagement pin is movable between the extended position and the retracted position independently from the second engagement pin.

[0021] In addition to one or more of the features described above, or as an alternative, in further embodiments an actuator includes a first handle operable to move the first engagement pin between the extended position and the retracted position and a second handle operable to move the second engagement pin between the extended position and the retracted position. The first handle and the second handle are integrally formed.

[0022] In addition to one or more of the features described above, or as an alternative, in further embodiments a locking mechanism is operable to lock the child seat at one or more of the plurality of positions.

[0023] In addition to one or more of the features described above, or as an alternative, in further embodiments the locking mechanism includes a locking element arranged at one of the child seat and the at least a portion of the support base and a locking slot arranged at the other of the child seat and the at least a portion of the support base. The locking element is receivable within the locking slot. The locking element is arranged within the locking slot when the child seat is locked at the one or more of the plurality of positions relative to the at least a portion of the support base.

[0024] In addition to one or more of the features described above, or as an alternative, in further embodiments the locking mechanism includes at least one lock pin operable to restrict separation of the locking element from the locking slot.

[0025] In addition to one or more of the features described above, or as an alternative, in further embodiments the at least one lock pin is movable between an extended position and a retracted position. The at least one lock pin is arranged within the locking slot when in the extended position and the at least one lock pin being separated from the locking slot when in the retracted position.

[0026] In addition to one or more of the features described above, or as an alternative, in further embodiments a locking mechanism is operable to lock the child seat at one or more of the plurality of positions and an actuator is operably coupled to the both the positioning assembly and the locking mechanism.

[0027] In addition to one or more of the features described above, or as an alternative, in further embodiments application of force to the actuator in a first direction is associated with operation of the positioning assembly and application of a force to the actuator in a second direction is associated with operation of the locking mechanism.

[0028] In addition to one or more of the features described above, or as an alternative, in further embodiments the force applied in the first direction is a pulling force and the force applied in the second direction is a pushing force.

[0029] In addition to one or more of the features described above, or as an alternative, in further embodiments the centerline is arranged at the child seat and extends between lateral sides of the child seat at a position equidistantly spaced between a front and a back of the child seat.

[0030] In addition to one or more of the features described above, or as an alternative, in further embodiments the centerline is arranged at the support base and extends between lateral sides of the support base at a position equidistantly spaced between a front and a back of the support base.

[0031] In addition to one or more of the features described above, or as an alternative, in further embodiments the centerline is perpendicular to a longitudinal axis of the support base and intersects a center of gravity of the child seat when a longitudinal axis of the child seat is aligned with the longitudinal axis of the support base.

[0032] In addition to one or more of the features described above, or as an alternative, in further embodiments the child seat is separable from support base via translation of the child seat toward a lateral side of the support base.

[0033] In addition to one or more of the features described above, or as an alternative, in further embodiments the child seat is movable relative to the support base along an incline path between an upright position and a reclined position.

[0034] In addition to one or more of the features described above, or as an alternative, in further embodiments the child seat is movable along the incline path when the child seat is at any of the plurality of positions.

[0035] In addition to one or more of the features described above, or as an alternative, in further embodiments the child seat is movable along the incline path independently from the positioning assembly.

[0036] In addition to one or more of the features described above, or as an alternative, in further embodiments the support base includes an upper base portion and a lower base portion. The upper base portion includes a first base member and a second base member. The

first base member is rotatably coupled to the lower base portion via the positioning assembly and the second base member is movable relative to the first base member along the incline path.

[0037] According to an embodiment, a child restraint system includes a child seat and a support base configured to support the child seat thereon. The child seat is removably connected to the support base. The child seat is separable from the support base via a translation of the child seat toward a lateral side of the support base.

[0038] In addition to one or more of the features described above, or as an alternative, in further embodiments a positioning assembly is operably coupled to the child seat and the support base. The child seat is translatable relative to the child seat via the positioning assembly.

[0039] In addition to one or more of the features described above, or as an alternative, in further embodiments the positioning assembly has a first portion associated with the support base and a second portion associated with the child seat. The second portion of the positioning assembly is selectively engageable with the first portion of the positioning assembly to couple the child seat to the support base.

[0040] In addition to one or more of the features described above, or as an alternative, in further embodiments engagement between the first portion and the second portion of the positioning assembly defines a path of movement of the child seat relative to the support base.

[0041] In addition to one or more of the features described above, or as an alternative, in further embodiments the child seat is directly couplable to the support base via engagement of the first portion of the positioning assembly and the second portion of the positioning assembly.

[0042] In addition to one or more of the features described above, or as an alternative, in further embodiments the first portion of the positioning assembly includes at least one positioning element and the second portion of the positioning assembly includes at least one positioning slot. The at least one positioning element is receivable within the at least one positioning slot.

[0043] In addition to one or more of the features described above, or as an alternative, in further embodiments an actuator is operably coupled to the at least one positioning slot. The actuator is operable to control separation of the at least one positioning element from the at least one positioning slot.

[0044] In addition to one or more of the features described above, or as an alternative, in further embodiments the second portion of the positioning assembly includes at least one

engagement pin operable to restrict the translation of the at least one positioning element within the at least one positioning slot.

[0045] In addition to one or more of the features described above, or as an alternative, in further embodiments the at least one engagement pin is movable between an extended position and a retracted position. The at least one engagement pin is arranged within the at least one positioning slot when in the extended position and the at least one engagement pin being separated from the at least one positioning slot when in the retracted position.

[0046] In addition to one or more of the features described above, or as an alternative, in further embodiments the actuator is operably coupled to the at least one engagement pin. The actuator is operable to transform the at least one engagement pin from the extended position to the retracted position.

[0047] In addition to one or more of the features described above, or as an alternative, in further embodiments the child seat is translatable relative to the support base when the at least one engagement pin is in the retracted position.

[0048] In addition to one or more of the features described above, or as an alternative, in further embodiments the at least one engagement pin is movable between the extended position and the retracted position in response to application of a force to the child seat.

[0049] In addition to one or more of the features described above, or as an alternative, in further embodiments the child seat is selectively rotatable relative to the support base when the child seat is coupled to the support base.

[0050] In addition to one or more of the features described above, or as an alternative, in further embodiments an axis of rotation of the child seat is offset from a centerline of at least one of the child seat and the support base.

[0051] In addition to one or more of the features described above, or as an alternative, in further embodiments the centerline is arranged at the child seat and extends between lateral sides of the child seat at a position equidistantly spaced between a front and a back of the child seat.

[0052] In addition to one or more of the features described above, or as an alternative, in further embodiments the centerline is arranged at the support base and extends between lateral sides of the support base at a position equidistantly spaced between a front and a back of the support base.

[0053] In addition to one or more of the features described above, or as an alternative, in further embodiments the centerline is perpendicular to a longitudinal axis of the support base

and intersects a center of gravity of the child seat when a longitudinal axis of the child seat is aligned with the longitudinal axis of the support base.

[0054] In addition to one or more of the features described above, or as an alternative, in further embodiments the child seat is translatable out of engagement with the support base in a direction oriented at a non-parallel angle to the axis of rotation.

[0055] According to an embodiment, a child restraint system includes a child seat and a support base configured to support the child seat thereon. The child seat is removably connected to the support base. A positioning assembly directly couples the child seat to the support base. The child seat is rotatable about an axis of rotation relative to the support base via the positioning assembly and the child seat is translatable relative to the child seat via the positioning assembly.

[0056] In addition to one or more of the features described above, or as an alternative, in further embodiments the child seat is translatable relative to the support base in a direction oriented at a non-parallel angle to the axis of rotation.

[0057] In addition to one or more of the features described above, or as an alternative, in further embodiments the positioning assembly has a first portion associated with the support base and a second portion associated with the child seat. The second portion of the positioning assembly is selectively engageable with the first portion of the positioning assembly to couple the child seat to the support base.

[0058] In addition to one or more of the features described above, or as an alternative, in further embodiments the engagement between the first portion and the second portion of the positioning assembly defines a path of movement of the child seat relative to the support base.

[0059] In addition to one or more of the features described above, or as an alternative, in further embodiments the first portion of the positioning assembly includes at least one positioning element and the second portion of the positioning assembly includes at least one positioning slot. The at least one positioning element is receivable within the at least one positioning slot.

[0060] In addition to one or more of the features described above, or as an alternative, in further embodiments an actuator is operably coupled to the at least one positioning slot. The actuator is operable to control separation of the at least one positioning element from the at least one positioning slot.

[0061] In addition to one or more of the features described above, or as an alternative, in further embodiments the second portion of the positioning assembly includes at least one

engagement pin operable to restrict translation of the at least one positioning element within the at least one positioning slot.

[0062] In addition to one or more of the features described above, or as an alternative, in further embodiments the at least one engagement pin is movable between an extended position and a retracted position. The at least one engagement pin is arranged within the at least one positioning slot when in the extended position and the at least one engagement pin is separated from the at least one positioning slot when in the retracted position.

[0063] In addition to one or more of the features described above, or as an alternative, in further embodiments the actuator is operably coupled to the at least one engagement pin. The actuator is operable to transform the at least one engagement pin from the extended position to the retracted position.

[0064] In addition to one or more of the features described above, or as an alternative, in further embodiments the child seat is translatable relative to the support base when the at least one engagement pin is in the retracted position.

[0065] In addition to one or more of the features described above, or as an alternative, in further embodiments the at least one engagement pin is movable between the extended position and the retracted position in response to application of a force to the child seat.

[0066] In addition to one or more of the features described above, or as an alternative, in further embodiments the axis of rotation is offset from a centerline of at least one of the child seat and the support base.

[0067] In addition to one or more of the features described above, or as an alternative, in further embodiments the centerline is arranged at the child seat and extends between lateral sides of the child seat at a position equidistantly spaced between a front and a back of the child seat.

[0068] In addition to one or more of the features described above, or as an alternative, in further embodiments the centerline is arranged at the support base and extends between lateral sides of the support base at a position equidistantly spaced between a front and a back of the support base.

[0069] In addition to one or more of the features described above, or as an alternative, in further embodiments the centerline is perpendicular to a longitudinal axis of the support base and intersects a center of gravity of the child seat when a longitudinal axis of the child seat is aligned with the longitudinal axis of the support base.

[0070] In addition to one or more of the features described above, or as an alternative, in further embodiments the child seat is movable relative to the support base along an incline path between an upright position and a reclined position.

[0071] In addition to one or more of the features described above, or as an alternative, in further embodiments the child seat is movable along the incline path when the child seat is at any of the plurality of positions.

[0072] In addition to one or more of the features described above, or as an alternative, in further embodiments the child seat is movable along the incline path independently from the positioning assembly.

[0073] In addition to one or more of the features described above, or as an alternative, in further embodiments the support base includes an upper base portion and a lower base portion. The upper base portion includes a first base member and a second base member. The first base member is rotatably coupled to the lower base portion via the positioning assembly and the second base member is movable relative to the first base member along the incline path.

[0074] According to an embodiment, a child restraint system includes a child seat and a support base configured to support the child seat thereon. The child seat is rotatably coupled to the support base. The child seat is selectively rotatable relative to at least a portion of the support base about one of a plurality of axes.

[0075] In addition to one or more of the features described above, or as an alternative, in further embodiments the plurality of axes includes a first axis and a second axis. The first axis and the second axis are parallel.

[0076] In addition to one or more of the features described above, or as an alternative, in further embodiment the first axis and the second axis are arranged at opposite sides of a central longitudinal axis of the support base.

[0077] In addition to one or more of the features described above, or as an alternative, in further embodiments the first axis and the second axis are arranged within a plane oriented parallel to an end of the support base.

[0078] In addition to one or more of the features described above, or as an alternative, in further embodiment the child seat is rotatable about the first axis of the plurality of axes when the child seat is in a rearward-facing orientation and the child seat is rotatable about the second axis of the plurality of axes when the child seat is in a forward facing orientation.

[0079] In addition to one or more of the features described above, or as an alternative, in further embodiments the child seat is rotatable about the first axis to arrange a front end of

the child seat at a position laterally offset from a first lateral side of the support base and the child seat is rotatable about the second axis to arrange the front end of the child seat at a position laterally offset from a second lateral side of the support base.

[0080] In addition to one or more of the features described above, or as an alternative, in further embodiments a positioning assembly is operably coupled to the child seat and the at least a portion of the support base. The child seat is connectable to the at least a portion of the support base via the positioning assembly.

[0081] In addition to one or more of the features described above, or as an alternative, in further embodiments the child seat is translatable relative to the at least a portion of the support base via the positioning assembly.

[0082] In addition to one or more of the features described above, or as an alternative, in further embodiments the positioning assembly has a first portion associated with the at least a portion of the support base and a second portion associated with the child seat. The second portion of the positioning assembly is selectively engageable with the first portion of the positioning assembly to couple the child seat to the at least a portion of the support base.

[0083] In addition to one or more of the features described above, or as an alternative, in further embodiments engagement between the first portion and the second portion of the positioning assembly defines at least one path of movement of the child seat relative to the at least a portion of the support base.

[0084] In addition to one or more of the features described above, or as an alternative, in further embodiments the first portion of the positioning assembly includes a first positioning element defining a first axis of rotation of the plurality of axes or rotation and a second positioning element defining a second axis of rotation of the plurality of axes or rotation.

[0085] In addition to one or more of the features described above, or as an alternative, in further embodiments the second portion of the positioning assembly includes a first positioning slot and a second positioning slot. The first positioning element is receivable within the first positioning slot, and the second positioning element is receivable within the second positioning slot.

[0086] In addition to one or more of the features described above, or as an alternative, in further embodiments an actuator operably coupled to the first positioning slot and the second positioning slot is operable to control separation of the first positioning element and the second positioning element from the first positioning slot and the second positioning slot.

[0087] In addition to one or more of the features described above, or as an alternative, in further embodiments the second portion of the positioning assembly includes a first

engagement pin operable to restrict translation of the first positioning element within the first positioning slot and a second engagement pin operable to restrict translation of the second positioning element within the second positioning slot.

[0088] In addition to one or more of the features described above, or as an alternative, in further embodiments each of the first engagement pin and the second engagement pin is movable between an extended position and a retracted position. The first engagement pin is arranged within the first positioning slot when in the extended position and the second engagement pin is arranged within the second positioning slot when in the extended position. The first engagement pin is separated from the first positioning slot when in the retracted position and the second engagement pin is separated from the second positioning slot when in the retracted position.

[0089] In addition to one or more of the features described above, or as an alternative, in further embodiments the actuator is operably coupled to both the first engagement pin and the second engagement pin. The actuator is operable to transform at least one of the first engagement pin and the second engagement pin from the extended position to the retracted position.

[0090] In addition to one or more of the features described above, or as an alternative, in further embodiments the actuator is operable to independently transform the first engagement pin and the second engagement pin from the extended position to the retracted position.

[0091] In addition to one or more of the features described above, or as an alternative, in further embodiments the actuator includes a first handle operable to move the first engagement pin between the extended position and the retracted position and the actuator includes a second handle operable to move the second engagement pin between the extended position and the retracted position.

[0092] In addition to one or more of the features described above, or as an alternative, in further embodiments the actuator includes a third handle operable to simultaneously move the first engagement pin and the second engagement pin from the extended position to the retracted position.

[0093] In addition to one or more of the features described above, or as an alternative, in further embodiments the support base includes an upper portion and a lower portion, the upper portion being rotatable relative to the lower portion.

[0094] In addition to one or more of the features described above, or as an alternative, in further embodiments the child seat is selectively rotatable relative to the upper portion of the support base about one of the plurality of axes.

[0095] In addition to one or more of the features described above, or as an alternative, in further embodiments the child seat is rotatable with the upper portion of the support base relative to the lower portion of the support base.

[0096] In addition to one or more of the features described above, or as an alternative, in further embodiments the child seat is rotatable with the upper portion of the support base relative to the lower portion of the support base about one of the plurality of axes.

[0097] According to an embodiment, a child restraint system includes a child seat and a support base configured to support the child seat thereon. The support base has a rear end and an opposing front end spaced from the rear end in a front direction. The support base defines a centerline that extends substantially perpendicular to the front direction and through a center of the support base located between the front end and the rear end. A positioning assembly is operably coupled to the child seat and the support base. The child seat is movable relative to the support base between a plurality of positions via the positioning assembly. The positioning assembly has a first portion associated with the support base and a second portion associated with the child seat. The first portion of the positioning assembly is offset from the centerline of the support base. The child seat is selectively lockable at one or more of the plurality of positions relative to the support base.

[0098] In addition to one or more of the features described above, or as an alternative, in further embodiments the first portion of the positioning assembly is rotatably connectable to the second portion of the positioning assembly such that the child seat is rotatable relative to the support base between the plurality of positions.

[0099] In addition to one or more of the features described above, or as an alternative, in further embodiments the centerline is a support base centerline. The front direction is a support base front direction. The child seat has a rear end and an opposing front end spaced from the rear end in a seat front direction. The front end of the child seat is adjacent to legs of a child positioned in the child seat. The child seat defines a seat centerline that extends substantially perpendicular to the seat front direction and through a center of the child seat located between the front end and the rear end of the child seat. The second portion of the positioning assembly is located between the seat centerline and the rear end of the child seat.

[0100] The foregoing features and elements may be combined in various combinations without exclusivity, unless expressly indicated otherwise. Features which are described in the

context of separate aspects and embodiments may be used together and/or be interchangeable. Similarly, features described in the context of a single embodiment may also be provided separately or in any suitable subcombination. These features and elements as well as the operation thereof will become more apparent in light of the following description and the accompanying drawings. It should be understood, however, that the following description and drawings are intended to be illustrative and explanatory in nature and non-limiting.

BRIEF DESCRIPTION OF THE DRAWINGS

[0101] The following descriptions should not be considered limiting in any way. With reference to the accompanying drawings, like elements are numbered alike:

[0102] FIG. 1 is a schematic illustration of a child restraint system that may incorporate embodiments of the present disclosure installed therein;

[0103] FIG. 2A is a perspective view of a child restraint system mounted in a vehicle in a rearward facing orientation according to an embodiment;

[0104] FIG. 2B is a perspective view of a support base of the child restraint system of FIG. 2A mounted in a vehicle according to an embodiment;

[0105] FIG. 2C is an exploded perspective view of the child restraint system of FIG. 2A according to an embodiment;

[0106] FIG. 2D is a perspective view of the child restraint system of FIG. 2A mounted in a vehicle according to an embodiment;

[0107] FIG. 3 is a perspective view of the child restraint system of FIG. 2A mounted in a side facing orientation according to an embodiment;

[0108] FIG. 4A is a perspective view of a child restraint system mounted in a vehicle in a rearward facing orientation according to an embodiment;

[0109] FIG. 4B is a plan view of the child restraint system of FIG. 4A according to an embodiment;

[0110] FIG. 5A is a perspective view of a child restraint system mounted in a vehicle in a side facing orientation according to an embodiment;

[0111] FIG. 5B is a top perspective view of the child restraint system of FIG. 5A according to an embodiment;

[0112] FIG. 6 is a top perspective view of the child restraint system of FIG. 5A during separation of the child seat from the support base according to an embodiment;

[0113] FIG. 7A is a perspective view of a child restraint system arranged in a rearward facing orientation according to an embodiment;

[0114] FIG. 7B is an exploded perspective view of the child restraint system of FIG. 7A according to an embodiment;

[0115] FIG. 8A is a plan view of the child restraint system of FIG. 7A according to an embodiment;

[0116] FIG. 8B is a plan view of the child restraint system of FIG. 7A during rotation to a side facing orientation according to an embodiment;

[0117] FIG. 8C is a plan view of the child restraint system of FIG. 7A during separation of the child seat from the support base according to an embodiment;

[0118] FIG. 9A is a perspective view of a child restraint system arranged in a rearward facing orientation according to an embodiment;

[0119] FIG. 9B is a perspective view of a child restraint system of FIG. 9A arranged in a forward facing orientation according to an embodiment;

[0120] FIG. 10A is a perspective view of a child restraint system of FIG. 9A arranged in a side facing orientation according to an embodiment;

[0121] FIG. 10B is a plan view of the child restraint system of FIG. 10A according to an embodiment;

[0122] FIG. 11A is a perspective view of a child restraint system of FIG. 9A arranged in a translated, side facing orientation according to an embodiment;

[0123] FIG. 11B is a plan view of the child restraint system of FIG. 11A according to an embodiment;

[0124] FIG. 12A is a perspective view of a child restraint system of FIG. 9A during separation of the child seat from the support base according to an embodiment;

[0125] FIG. 12B is a plan view of the child restraint system of FIG. 12A according to an embodiment;

[0126] FIG. 13 is an exploded perspective view of a child restraint system arranged in a rearward facing orientation according to an embodiment;

[0127] FIG. 14A is a partial perspective view of the child restraint system of FIG. 13 in a rearward facing orientation according to an embodiment;

[0128] FIG. 14B is a plan view of the child restraint system of FIG. 14A according to an embodiment;

[0129] FIG. 15A is a partial perspective view of the child restraint system of FIG. 13 in a forward facing orientation according to an embodiment;

[0130] FIG. 15B is a plan view of the child restraint system of FIG. 15A according to an embodiment;

[0131] FIG. 16 is a plan view of the child restraint system of FIG. 14A rotated relative to the rearward facing orientation according to an embodiment;

[0132] FIG. 17A is a perspective view of the child restraint system of FIG. 14A in a side facing orientation according to an embodiment;

[0133] FIG. 17B is a perspective view of the child restraint system of FIG. 17A in a translated side facing orientation according to an embodiment;

[0134] FIG. 18 is a perspective view of the child restraint system of FIG. 14A during separation of the child seat from the support base according to an embodiment;

[0135] FIG. 19A is a perspective view of a child restraint system arranged in a rearward facing orientation according to an embodiment;

[0136] FIG. 19B is a perspective view of a child restraint system of FIG. 19A arranged in a forward facing orientation according to an embodiment;

[0137] FIG. 20 is a partial perspective view of the child restraint system of FIG. 19A in a rearward facing orientation according to an embodiment;

[0138] FIG. 21A is a partial perspective view of the child restraint system of FIG. 19B in a forward facing orientation according to an embodiment;

[0139] FIG. 21B is a plan view of the child restraint system of FIG. 21A in a forward facing orientation according to an embodiment;

[0140] FIG. 22 is a plan view of the child restraint system of FIG. 21A rotated relative to the forward facing orientation according to an embodiment;

[0141] FIG. 23A is a perspective view of the child restraint system of FIG. 19B in a side facing orientation according to an embodiment;

[0142] FIG. 23B is a plan view of the child restraint system of FIG. 23A according to an embodiment;

[0143] FIG. 24A is a perspective view of the child restraint system of FIG. 19A in a side facing orientation according to an embodiment;

[0144] FIG. 24B is a plan view of the child restraint system of FIG. 24A according to an embodiment;

[0145] FIG. 25A is a perspective view of the child restraint system of FIG. 24A during separation of the child seat from the support base according to an embodiment;

[0146] FIG. 25B is a plan view of the child restraint system of FIG. 25A according to an embodiment;

[0147] FIG. 26A is a perspective view of the child restraint system in a rearward facing orientation according to another embodiment;

[0148] FIG. 26B is a plan view of the child restraint system of FIG. 26A according to an embodiment;

[0149] FIG. 27A is a perspective view of the support base of the child restraint system of FIG. 26A according to an embodiment;

[0150] FIG. 27B is a plan view of the support base of the child restraint system of FIG. 27A according to an embodiment;

[0151] FIG. 28A is a perspective view of the child restraint system in a side facing orientation according to another embodiment;

[0152] FIG. 28B is a plan view of the child restraint system of FIG. 28A according to an embodiment;

[0153] FIG. 29A is a perspective view of the support base of the child restraint system of FIG. 28A according to an embodiment;

[0154] FIG. 29B is a plan view of the support base of the child restraint system of FIG. 29A according to an embodiment;

[0155] FIG. 30A is a plan view of the support base of FIG. 26A in a rearward facing orientation according to an embodiment;

[0156] FIG. 30B is a plan view of the support base of FIG. 30A rotated from a rearward facing orientation according to an embodiment;

[0157] FIG. 30C is a plan view of the support base of FIG. 30A in a side facing orientation according to an embodiment;

[0158] FIG. 31A is a side view of a child restraint system mounted on a vehicle seat having a child seat in a reclined position according to an embodiment;

[0159] FIG. 31B is a side view of the support system of the child restraint system of FIG. 31A according to an embodiment;

[0160] FIG. 32A is a side view of a child restraint system mounted on a vehicle seat having a child seat in an upright position according to an embodiment; and

[0161] FIG. 32B is a side view of the support system of the child restraint system of FIG. 32A according to an embodiment.

DETAILED DESCRIPTION

[0162] A detailed description of one or more embodiments of the disclosed apparatus and method are presented herein by way of exemplification and not limitation with reference to the Figures.

[0163] Referring to FIG. 1, a schematic illustration of a child restraint system 102 that may incorporate embodiments of the present disclosure are shown. As shown in FIG. 1, the child restraint system 102 may be installed about a vehicle seat 104. The child restraint system 102 includes an infant car seat 106 mounted about a support base 107. The child restraint system 102 is secured, via an anchor system 108 (schematically shown), to the vehicle seat 104. In the illustrated, non-limiting embodiment, the anchor system 108 is arranged at the support base 107. The vehicle seat 104 has a vehicle seat back 110, a vehicle seat pan 112, and a seat bight (i.e., the region of intersection of the vehicle seat back 110 and the vehicle seat pan 112). The anchor system 108 is configured to secure the infant car seat 106 to the vehicle seat 104. The anchor system 108 may help ensure that installation of the infant car seat 106 provides a tight fit to the vehicle seat 104 such that when installed, the infant car seat system 104 will ensure a safe and secure attachment and installation within the vehicle 100.

[0164] As shown in FIG. 1, the infant car seat 106 is secured to the vehicle seat 104 in a rear-facing orientation, in which a front 114 of the infant car seat 106 faces the vehicle seat back 110 and a back 116 of the infant car seat 106 arranged away from the vehicle seat back 110. As such, when a child is seated in the infant car seat 106, the child's feet will be at the front 114 of the infant car seat 106 and the child's head will be at the back 116 of the infant car seat 106. Accordingly, the infant car seat 106 is a rear-facing child car seat.

[0165] Although shown with specific child car seat configurations, embodiments of the present disclosure may be applicable to a variety of different vehicle child seats. For example, the child seats of the present disclosure may be convertible child seats, infant child seats, or the like. As used herein, the term "convertible child seat" refers to a seat that may be used in both a rearward-facing direction and a forward-facing direction, such as suitable for use, for example, by a child between 5 pounds and 65 pounds and/or up to 49 inches in height. The convertible child seat may also be referred to herein as an upright child seat or a toddler seat. As used herein, the term "infant child seat" refers to a seat as would be defined by one of ordinary skill in the art. For example, an infant child seat may be described as a seat for use by an infant or child too small to use a convertible child seat and may include a carrying handle to allow for portability of the infant child seat external to the vehicle. An infant child seat is only suitable for use during movement of a vehicle in a rearward facing orientation relative to a child seat.

[0166] When loading a child into a vehicle, or removing a child from a vehicle, caregivers (e.g., provider, parent, guardian, etc. generally referred to as "caregiver") may find

it difficult to get children into and out of the child restraint system while the child seat is installed in a vehicle. This may be especially true for rearward-facing configurations. For example, it may be difficult for the caregiver to bend over and reach into the vehicle to position and buckle the child into the seat. The space between the sides of the child restraint system and the roof/doors of the vehicle can create a limited space for the caregiver to maneuver. The same difficulty arises when removing the child from the car seat while it is installed in a vehicle. As the child grows, the increased weight of the child increases the difficulty of lifting a seat out of the vehicle. Because of this difficulty the caregiver may need to bend and reach into the vehicle to properly secure the child. In view of this, embodiments of the present disclosure seek to bring the child toward the caregiver, thus limiting the bending and reaching that is required to move the child in and out of the car seat.

[0167] In accordance with embodiments of the present disclosure, in addition to providing rotation of a child seat (e.g., between a forward-facing position and a rearward-facing position and positions therebetween), some embodiments of the present disclosure also provide for additional rotation and/or translation of the child seat. For example, in accordance with some embodiments of the present disclosure, the child seat and supporting structures may be configured to allow movement of the child seat toward the parent for ease of access during securing or removal of the child. Such additional movements may include, for example, sliding, pivoting, translation, tilting, and/or combinations of movements.

[0168] In accordance with a non-limiting embodiment, child restraint systems include a rearward-facing car seat that improves the usability by allowing movement of the child toward the caregiver to allow easier loading and unloading of the child. The child restraint system, for example, may include a lower stationary support base which may be affixed securely to the vehicle using any available method such as LATCH, load leg, tether, vehicle belts, or the like. The portion of the child restraint system which holds the child (e.g., child seat) is placed above the lower portion and secured to the lower portion in a way sufficient to transfer all forces experienced in a vehicle crash. The child seat may include a five-point harness for retaining and restraining the child in the child seat and any adjustments needed to accommodate growth of the child and/or for adjustment between reclining and non-reclining positions. In accordance with some embodiments, there may be a mechanism and various intermediate parts between the child seat (e.g., upper portion) and the support base (e.g., lower stationary portion) of the child restraint system.

[0169] The child seat may be connected to a positioning assembly that allows the child seat to rotate and/or slide (e.g., forward, backward, to the side, etc.) relative to a lower

stationary layer support base. It will be appreciated that the right and left directions are toward a vehicle side and thus toward a door of the vehicle. Accordingly, the child restraint system having rotating capability enables a caregiver to rotate the child seat from a travel position (e.g., forward-facing or rear-facing) to a loading position (e.g., side-facing). In a loading or side-facing orientation, the caregiver may be provided with improved ease of use and access to load and unload a child from the child seat. In accordance with some embodiments of the present disclosure, child restraint systems are provided that allow a child seat to rotate toward a vehicle door, and in some embodiments slide toward a vehicle door, and thus improve the ease of loading/unloading a child to/from the child seat.

[0170] With reference now to FIGS. 2A-3, an example of a child restraint system 220 suitable for use in a vehicle is illustrated. As shown, the vehicle seat 200 includes a vehicle seat back 202, a vehicle seat pan 204, and a seat bight 206 (i.e., the region of intersection of the vehicle seat back and the vehicle seat pan). The child restraint system 220 may be secured to the vehicle seat 200 via an anchor system (not shown). The anchor system may help ensure that installation of the child restraint system 220 provides a tight fit to the vehicle seat 200 such that when installed, the child restraint system 220 will ensure a safe and secure attachment and installation within the vehicle.

[0171] As shown, the child restraint system 220 includes a support base 222 and a child seat 224 positionable about the support base 222. In the illustrated, non-limiting embodiment, the support base 222 is affixed securely to the vehicle seat 200 using any available method such as LATCH (like the anchor system 108 described above), load leg, tether, vehicle belts, or the like. The portion of the child restraint system 220 which holds the child (e.g., child seat 224) is placed above the support base 222 and is secured to the support base 222 in a manner sufficient to transfer all forces experienced in a vehicle crash. The child seat 224 may be permanently coupled to the support base 222, or alternatively, may be removably connectable to the support base 222. In the exemplary embodiments shown in FIGS. 2A-3, the child seat 224 is removably connected to the support base 222. Although not shown, the child seat 224 may include a five-point harness for retaining and restraining the child in the child seat 224 and any adjustments needed to accommodate growth of the child and/or for adjustment between reclining and non-reclining positions. In accordance with some embodiments, there may be a mechanism and various intermediate parts between the child seat (e.g., upper portion) and the support base (e.g., lower stationary portion) of the child restraint system.

[0172] In the embodiment illustrated in FIG. 2A, the child restraint system 220 is secured to the vehicle seat 200 in a rearward-facing orientation, in which a front 226 of the child seat 224 faces the vehicle seat back 202 and a back 228 of the child seat 224 is arranged away from the vehicle seat back 202. As such, when a child is seated in the child seat 224, the child's feet will be at the front 226 of the child seat 224 and the child's head will be at the back 228 of the child seat 224.

[0173] The child restraint system 220, in this exemplary embodiment, includes a positioning assembly 240 configured to allow for adjustment or a change of position and/or orientation of the child seat 224 relative to the support base 222 and/or the vehicle seat 200. The positioning assembly 240 may include one or more positioning elements engageable with a corresponding portion of the child seat 224. In the illustrated, non-limiting embodiment of FIGS. 2A-3, the positioning assembly 240 includes a single positioning element 242. However, embodiments including multiple positioning elements 242 are also within the scope of the disclosure. The positioning element 242 may protrude from a surface 234 of the support base 222 and in some embodiments is offset from a center of the support base 222 in one or more directions.

[0174] A central longitudinal axis L1b (see FIGS. 2B) of the support base 222 extends between the front end 232 to the rear end 230 of the support base 222 and is equidistantly positioned between the opposing lateral sides 229, 231 of the support base 222. As shown, the positioning element 242 may be aligned with a central longitudinal axis L1b of the support base 222. However, it should be understood that embodiments where the at least one positioning element 242 is offset from the central longitudinal axis L1b of the support base 222 are also contemplated herein.

[0175] Further, the positioning element 242 may be offset from a centerline of at least one of the support base 222 and the child seat 224. The child seat 224 has a longitudinal axis L1s extending between the front 226 and the back 228 of the child seat 224, and in an embodiment, the positioning element 242 is offset from a centerline C1a of the child seat 224 that extends between opposing lateral sides 233, 235 of the child seat 224 perpendicularly to longitudinal axis L1s, and is equidistantly spaced from the front end 226 and the rear 228 of the child seat 224 when the longitudinal axis L1s of the child seat 224 is aligned with the central longitudinal axis L1b of the support base 222. Alternatively, or in addition, the positioning element 242 may be offset from a centerline C1b of the support base 222 that extends between opposing lateral sides of the support base 222, perpendicular to the longitudinal axis L1b, and is equidistantly spaced from the rear end 230 and the front end 232

of the support base 222. In such embodiments, the positioning element 242 may be arranged closer to a front end 232 of the support base 222 than a rear end 230 of the support base 222, as shown in the FIGS., or alternatively, the positioning element 242 may be arranged closer to the rear end 230 of the support base 222 than the front end 232.

[0176] A center of gravity CoG1 of the child seat 224 may be arranged near an interface between the seat portion and the back portion of the child seat 224. In yet another embodiment, a centerline C1c of the support base 222 is oriented perpendicular to the central longitudinal axis L1b of the support base 222 and intersects the center of gravity CoG1 of the child seat 224 when the longitudinal axis L1s of the child seat 224 is aligned with the longitudinal axis L1b of the support base 222. Accordingly, the positioning element 242, and an axis of rotation X1 defined thereby, is offset from at least one centerline C1a, C1b, C1c described herein.

[0177] In accordance with embodiments of the present disclosure, the positioning assembly 240, may provide for one or more degrees of movement and adjustment of the child seat 224 relative to the support base 222. The child seat 224 may be rotatably coupled to the at least one positioning element 242 such that the child seat 224 is rotatable between a plurality of positions about an axis of rotation X1 defined by the at least one positioning element 242. In some embodiments, the child seat 224 is freely rotatable 360 degrees about the axis X1. In other embodiments, the rotation of the child seat 224 about the axis X1 may be limited, such as to 90 degrees or 180 degrees for example. For example, one or more engagement members (not shown) may protrude from the support base 222 within the path of rotation of the child seat 224 about the axis X1. Alternatively, as shown in the non-limiting embodiment of FIGS. 2C and 2D, an engagement member 236 extending from the child seat 224 may be arranged within a corresponding slot 238 formed in the support base 222. Contact between the engagement member and an end of the slot defines an end or stop of the rotation of the child seat 224.

[0178] FIG. 2A illustrates the child seat 224 in a first rotational position (relative to the vehicle seat 200) and FIG. 3 illustrates the child seat 224 in a second rotational position (relative to the vehicle seat 200). As shown, the child seat 224 may be in a rearward facing orientation when in the first rotational position and may be in a side-facing position when in the second rotational position. Arranging the child seat 224 at a side-facing orientation may provide for improved ease of use and access for a caregiver when placing a child in the child seat 224 or removing a child therefrom.

[0179] In the illustrated, non-limiting embodiment, the child seat 224 is rotatable approximately 90 degrees about the axis X1 between the first rotational position and the second rotational position. However, it should be understood that embodiments where the first rotational position and the second rotational position are separated by another angle of rotation, such as an angle of rotation between 0 degrees and 180 degrees for example, are also contemplated herein.

[0180] In some embodiments, the child restraint system 220 includes at least one locking mechanism 250 operable to selectively secure one or more elements of the child restraint system 220 together. The at least one locking mechanism 250 may form an interface between the child seat 224 and the support base 222 that restricts rotation of the child seat 224 about the rotational axis X1 of the positioning assembly 240 and/or separation of the child seat 224 from the support base 222. In such embodiments, when movement of the child seat 224 is desired, the at least one locking mechanism 250 may be unlocked to allow relative movement between the child seat 224 and the support base 222. Although the locking mechanism 250 is illustrated as being separate from positioning assembly 240, embodiments where the locking mechanism 250 is associated with or integrated into the positioning assembly 240 are also contemplated herein.

[0181] In the illustrated, non-limiting embodiment, the child seat 224 is an infant car seat and therefore is only suitable for use in the first rotational position associated with a rearward facing orientation. Accordingly, the child seat 224 of FIGS. 2A-3 is not positionable about the support base 222 in a forward-facing orientation and therefore does not need to be rotatable about the axis 180 degrees to a third rotational position associated with a forward-facing orientation. However, in other embodiments, the child seat 224 may be removably connectable to the support base 222 in both the first rotational position and the third rotational position. In such embodiments, the child seat 224 may form a plurality of distinct connections with the positioning element 242. For example, a first positioning slot 244a connectable to the positioning element 242 may be arranged near a rear 228 of the child seat 224 and a second positioning slot 244b connectable to the positioning element 242 may be arranged near a front 226 of the child seat 224. Further, the child seat 224 may be rotatable about the axis X1 of the positioning element 242 regardless of which positioning slot 244a, 244b is connected to the positioning element 242. When the first positioning slot 244a of the child seat 224 is coupled to the positioning element 242, the child seat 224 may be rotatable about the axis X1 in a first direction (counterclockwise in FIG. 3) to the second rotational position associated with a side-facing orientation. Similarly, when the second

positioning slot 244b of the child seat 224 is coupled to the positioning element 242, the child seat 224 may be rotatable about the axis X1 in an opposite, second direction to the second rotational position associated with a side-facing orientation.

[0182] In accordance with embodiments of the present disclosure, in addition to providing rotation of a child seat 224 between a plurality of positions (e.g., a position associated with travel of a vehicle and a side-facing position and positions therebetween), some embodiments of the present disclosure also provide for translation of the child seat 224 relative to the support base 222. For example, in accordance with some embodiments of the present disclosure, the interface between the child seat 224 and the positioning assembly 240 may be configured to allow movement of the child seat 224 toward the parent for ease of access during securing or removal of the child. Such additional movements may include, for example, sliding, pivoting, translation, tilting, and/or combinations of movements.

[0183] In accordance with embodiments of the present disclosure, the child seat 224 may be separable from the support base 222. As will be described in more detail below, such separability may be provided by releasable pins, snaps, clips, slot-engagements, or the like. The child seat 224 may be separable from the support base 222 when arranged at a specific rotational position relative to the vehicle seat 200 or the support base 222, or alternatively, may be separable from the support base 222 at any rotational position.

[0184] A child restraint system 220 having a rotating capability enables a caregiver to rotate the child seat 224 from a travel position (e.g., forward-facing or rear-facing) to a loading position (e.g., side-facing). In the side-facing orientation, the caregiver may be provided with improved ease of use and access to load and unload a child from the child seat 224.

[0185] With reference now to FIGS. 4A-8C, a child restraint system 320 according to another embodiment is illustrated. The child restraint system 320 includes a child seat 324 movably mounted to a support base 322, which may be configured as described herein (e.g., as shown and described above or below). Although the child seat 324 is illustrated as a toddler infant car seat, in other embodiments, the child seat 324 may be a toddler seat. The child restraint system 320 may be releasably secured to the vehicle seat 300 by an anchor mechanism (not shown). In an embodiment, the anchor mechanism engageable with the vehicle seat 300 to couple the child restraint system 320 to the vehicle seat 300 is arranged at the support base 322. When the support base 322 is installed on a vehicle seat 300, the support base 322 may be positioned on the vehicle seat pan 304 such that a back or rear end

330 of the support base 322 is arranged in contact with the vehicle seat back 302, and the front end 332 of the support base 322 may be spaced from the vehicle seat back 302.

[0186] Similar to the child restraint system 220 of FIGS. 2A-3, the child restraint system 320 may have a positioning assembly 340 configured to allow for adjustment or a change of position and/or orientation of the child seat 324 relative to the support base 322 and/or the vehicle seat 300. The positioning assembly 340 may couple the support base 322 and the child seat 324. In some embodiments, a first portion 342 of the positioning assembly 340 is arranged at the support base 322 and a second portion 344 of the positioning assembly 340 is arranged at the child seat 324. In the illustrated, non-limiting embodiment, the first portion 342 of the positioning assembly 340 includes a single positioning element 346, protruding from an upper surface 334 of the support base 322. As shown, the positioning element 346 is a stationary pin, post, or shaft. However, a positioning element 346 having any other suitable another configuration, such as where the positioning element 346 is a rib for example, is also within the scope of the disclosure.

[0187] A central longitudinal axis L2b (see FIGS. 6 and 7B) of the support base 322 extends between the front end 332 to the rear end 330 of the support base 322 and is equidistantly positioned between the opposing lateral sides 329, 331 of the support base 322. As in the previous embodiment, the positioning element 346 may be arranged at the central longitudinal axis L2b (see FIG. 7B) of the support base 322. However, embodiments where the positioning element 346 is offset from the central longitudinal axis L2b of the support base 322 are also contemplated herein.

[0188] Further, the positioning element 346 may be offset from a centerline of at least one of the support base 322 and the child seat 324. As shown in FIG. 8A, the child seat 324 has a longitudinal axis L2s extending between the front 326 and the back 328 of the child seat 324, and in an embodiment, the positioning element 346 is offset from a centerline C2a of the child seat 324 that extends between opposing lateral sides 333, 335 of the child seat 324 perpendicularly to longitudinal axis L2s and is equidistantly spaced from the front end 326 and the rear 328 of the child seat 324 when the longitudinal axis L2s of the child seat 324 is aligned with the central longitudinal axis L2b of the support base 322 (see FIG. 4B). Alternatively, or in addition, the positioning element 346 may be offset from a centerline C2b of the support base 322 that extends between opposing lateral sides of the support base 322, perpendicular to the longitudinal axis L2b, and is equidistantly spaced from the rear end 330 and the front end 332 of the support base 322. In such embodiments, the positioning element 346 may be arranged closer to a front end 332 of the support base 322 than a rear end 330 of

the support base 322, as shown in the FIGS., or alternatively, the positioning element 346 may be arranged closer to the rear end 330 of the support base 322 than the front end 332.

[0189] A center of gravity CoG2 of the child seat 324 may be arranged near an interface between the seat portion and the back portion of the child seat 324. In yet another embodiment, a centerline C2c of the support base 322 is oriented perpendicular to the central longitudinal axis L2b of the support base 322 and intersects the center of gravity CoG2 of the child seat 324 when the longitudinal axis L2s of the child seat 324 is aligned with the longitudinal axis L2b of the support base 322. Accordingly, the positioning element 346, and an axis of rotation X2 defined thereby, is offset from at least one centerline C2a, C2b, C2c described herein.

[0190] The second portion 344 of the positioning assembly 340 is arranged at an underside of the child seat 324, positionable in contact with the upper surface 334 of the support base 322. The second portion 344 may be located between the seat centerline C2a and a rear or back 328 of the child seat 324. In the illustrated non-limiting embodiment, the second portion 344 of the positioning assembly 340 includes a positioning slot 348 formed at a bottom surface 350 of the child seat 324, and the positioning element 346 of the first portion 342 of the positioning assembly 340 arranged at the support base 322 is slidably receivable therein. When the positioning element 346 is arranged within the positioning slot 348, the child seat 324 is rotatably coupled to the support base 322.

[0191] The second portion 344 of the positioning assembly 340 may also include at least one engagement pin 352a, 352b movably mounted to the child seat 324 proximate the positioning slot 348. The at least one engagement pin 352a, 352b is operable to selectively restrict separation of the positioning element 346 from the positioning slot 348. In the illustrated, non-limiting embodiment, the at least one engagement pin includes a first engagement pin 352a movably mounted to the child seat 324 at a first side of the positioning slot 348 and a second engagement pin 352b movably mounted to the child seat 324 at an opposite, second side of the positioning slot 348. In such embodiments, the first and second engagement pins 352a, 352b, in combination, cooperate to selectively restrict movement of the positioning element 346 out of engagement with the positioning slot 348.

[0192] The engagement pins 352a, 352b are transformable, for example translatable, between a first, extended position (FIGS. 7A-8A) in which the child seat 324 is coupled to the support base 322 and is rotatable about the axis X2 defined by the positioning element 346, and a second, retracted position (FIG. 8B) in which the child seat 324 is separable from the support base 22. When the engagement pins 352a, 352b are in the extended position, a

portion of each engagement pin 352a, 352b is arranged within the interior of the positioning slot 348. When the engagement pins 352a, 352b are in the retracted position, the engagement pins 352a, 352b are separated from the positioning slot 348, allowing movement, for example translation, of the positioning element 346 relative to the positioning slot 348. Accordingly, when the engagement pins 352a, 352b are retracted, the child seat 324 is slidable or translatable relative to the support base 322, such as to separate the child seat 324 from the support base 322, or to attach the child seat 324 to the support base 322. As shown, the child seat 324 is slidable in a direction at a non-parallel angle relative to the axis of rotation X2 to separate the child seat 324 from the support base 322.

[0193] A biasing member 354a, 354b, such as a coil spring for example, may be operably coupled to an engagement pin to bias the engagement pin to the first locked position. In the illustrated, non-limiting embodiment, a first biasing member 354a is operably coupled to the first engagement pin 352a and a second biasing member 354b is operably coupled to the second engagement pin 352b.

[0194] An actuator 360 is operably coupled to the at least one engagement pin 352a, 352b. In the illustrated, non-limiting embodiment, the first engagement pin 352a includes a first actuation feature 356a and the second engagement pin 352b includes a second actuation feature 356b. An actuation mechanism 362 of the actuator 360 may be in movable engagement with at least one, and in some embodiments both the first actuation feature 356a and the second actuation feature 356b. A handle 364 arranged at an exterior surface of the child seat 324, such as at a front 326 of the child seat 324 for example, is operably coupled to the actuation mechanism 362. To operate the actuator 360, to decouple the first and second portions 342, 344 of the positioning assembly 340, a user applies a force F1 to the movable handle 364. The force F1 applied to the handle 364 is transmitted to the actuation mechanism 362, such as via a tension member 365, causing the actuation mechanism 362 to translate in the direction of the force. The engagement between the first and second actuation features 356a, 356b of the engagement pins 352a, 352b and the actuation mechanism 362 as the actuation mechanism 362 translates opposes the biasing force of the first biasing member 354a and the second biasing member 354b, respectively. Via this movement of the actuation mechanism 362, the engagement pins 352a, 352b are separated from the positioning slot 348.

[0195] With the actuator 360 operated and the engagement pins 352a, 352b retracted, a user may then slide the child seat 324 relative to the support base 322, such as to decouple the first portion 342 from the second portion 344 of the positioning assembly 340 for example. Upon removal of the force F1 from the handle 364, the biasing forces of the first

and second biasing members 354a, 354b acting on the first and second engagement pins 352a, 352b, respectively, to bias the handle 364 and the actuation mechanism 362 to an unactuated position.

[0196] In the illustrated, non-limiting embodiment, the actuation mechanism 362 has a triangular shape including a first surface 366a arranged at a non-parallel angle relative to direction of the force applied to the actuation mechanism 362 and a second surface 366b arranged at a non-parallel angle relative to direction of the force applied to the actuation mechanism 362. The first surface 366a and the second surface 366b may be arranged at equal but opposite angles relative to the direction of movement of the actuation mechanism 362. A surface of the first actuation feature 356a engaged with the first surface 366a is arranged at a complementary angle to the adjacent first surface 366a and the surface of the second actuation feature 356b engaged with the second surface 366b is arranged at a complementary angle to the adjacent second surface 366b. Accordingly, as the actuation mechanism 362 moves in a direction illustrated by force F1, the actuation features 356a, 356b are translated outwardly, against the bias of the biasing members 354a, 354b, due to the slope of the first and second surfaces 366a, 366b.

[0197] In an embodiment, the child restraint system 320 additionally includes a locking mechanism 370 operable to connect the support base 322 and the child seat 324 to lock the child seat 324 in position relative to the support base 322. In some embodiments, a first portion 372 of the locking mechanism 370 is arranged at the support base 322 and a second portion 374 of the locking mechanism 370 is arranged at the child seat 324. In the illustrated, non-limiting embodiment, the first portion 372 of the locking mechanism 370 includes a single locking element 376, protruding from an upper surface 334 of the support base 322. As shown, the locking element 376 may be a generally elongated rib. However, a locking element 376 having any suitable configuration, such as a post for example, is also within the scope of the disclosure. The locking element 376 may be centered about the central longitudinal axis L2 of the support base 322, and in some embodiments may be positioned proximate the back end 330 of the support base 322.

[0198] The second portion 374 of the locking mechanism 370 is arranged at an underside of the child seat 324, positionable in contact with the upper surface 334 of the support base 322. The second portion 374 of the locking mechanism 370 includes a locking slot 378 and at least one lock pin movably mounted to the child seat 324. The at least one lock pin is operable to selectively restrict rotation of the child seat 324 about the axis X2 defined by the positioning element 346. In the illustrated, non-limiting embodiment, the at

least one lock pin includes a first lock pin 380a movably mounted proximate a first side of the locking slot 378 and a second lock pin 380b movably mounted proximate a second side of the locking slot 378. A distance between the first lock pin 380a and the second lock pin 380b may be greater than or equal to the length of the elongated locking element 376. In embodiments including a first lock pin 380a and a second lock pin 380b, the first and second lock pins 380a, 380b, in combination, may cooperate to selectively restrict rotation of the child seat 324 about the axis X2 relative to the support base 322. In the illustrated, non-limiting embodiment, the first and second lock pins 380a, 380b are mounted at the same side of the locking slot 378, such as at a position between the locking slot 378 and the positioning slot 348, for example.

[0199] As shown, the lock pins 380a, 380b are transformable, for example pivotable, between a first, extended position (FIG. 8A) in which the child seat 324 is rotatably fixed to the support base 322, a second, retracted position (FIG. 8B) in which the child seat 324 is rotatable about the axis X2 relative to the support base 322. When each of the lock pins 380a, 380b is in the first, extended position, a portion of each lock pin interferes with the path of movement defined by the locking slot 378. The lock pins 380a, 380b may extend through openings (not shown) into the interior of the locking slot 378. In the illustrated, non-limiting embodiment, each lock pin 380a, 380b, when in the extended position, is operable to engage a respective end of the locking element 376. When the lock pins 380a, 380b are in the second, unlocked position, the lock pins 380a, 380b are separated from the locking slot 378, allowing relative movement between the locking element 376 and the locking slot 378. Accordingly, when the lock pins 380a, 380b are retracted, the child seat 324 is rotatable relative to the support base 322 about the axis X2, while remaining coupled to the support base 322.

[0200] A biasing member, such as a coil spring or torsion spring for example, may be operably coupled to a lock pin 380a, 380b to bias the lock pin 380a, 380b to the first extended or locked position. In the illustrated, non-limiting embodiment, a first biasing member 382a is operably coupled to the first lock pin 380a and a second biasing member 382b is operably coupled to the second lock pin 380b.

[0201] An actuator 384 is operably coupled to the at least one lock pin 380a, 380b. In the exemplary embodiment, the handle 364 arranged at the exterior surface of the child seat 324 and associated with movement of the engagement pins 352a, 352b is also operable to move the at least one lock pin 380a, 380b of the locking mechanism 370 to an unlocked position. While the engagement pins 352a, 352b and lock pins 380a, 380b are illustrated and described herein as being operated by the same handle 364, in other embodiments a first

handle may be associated with the engagement pins 352a, 352b and a distinct, second handle may be associated with the lock pins 380a, 380b. In the illustrated, non-limiting embodiment, the handle 364 is directly coupled to the first lock pin 380a and the second lock pin 380b. However, embodiments where the handle 364 is indirectly coupled to the first lock pin 380a and the second lock pin 380b are also within the scope of the disclosure.

[0202] To operate the actuator 384, a user applies a force F2 to the handle 364. This force F2 is transmitted to the first lock pin 380a and the second lock pin 380b and is in a direction that opposes the biasing forces of the first and second biasing members 382a, 382b. This movement of the handle 364 causes the first lock pin 380a and the second lock pin 380b to rotate about their respective axes out of the path of the locking slot 378 and/or engagement with the locking element 376. With the actuator 384 operated and the lock pins 380a, 380b separated from the locking slot 378, a user may rotate the child seat 324 relative to the support base 322 about the axis X2 to transform the child seat 324 between the first rotational position and the second rotational position. Upon removal of the force F2 from the handle 364, the first and second biasing members 382a, 382b acting on the first and second lock pins 380a, 380b may bias the handle 364 to an unactuated position.

[0203] In some embodiments, such as those discussed above and shown in the FIGS. 7A-8C, the actuator 360 of the positioning assembly 340 and the actuator 384 of the locking mechanism 370 are integrated into a single mechanism. Accordingly, a single handle 364 is arranged at an exterior of the child seat 324 and is accessible by a user to both unlock the lock pins 380a, 380b and unlock the engagement pins 352a, 352b. In such embodiments, the engagement pins 352a, 352b may be unlocked in response to application of a force F1 in a first direction to the handle 364 and the lock pins 380a, 380b may be unlocked in response to application of a force F2 in a second, opposite direction to the handle 364. For example, the engagement pins 352a, 352b may be unlocked in response to application of a force F1 to the handle 364 in a direction away from the child seat 324, and the lock pins 380a, 380b may be unlocked in response to application of a force F2 to the handle 364 in a direction toward or into the child seat 324. As noted above, the illustrated embodiment is intended as an example only, and embodiments where the engagement pins 352a, 352b and lock pins 380a, 380b are operated via separate handles, and/or separate actuators are within the scope of the disclosure. In such embodiments, the force applied to each handle to move the engagement pins 352a, 352b and lock pins 380a, 380b against their bias may be in the same direction or may be in different directions.

[0204] In FIGS. 4A, 4B, 7A and 8A, the child seat 324 is shown coupled to the support base 322 and locked in a first rotational position. In such a configuration, the first portion 342 of the positioning assembly 340 is locked in engagement with the second portion 344 of the positioning assembly 340 and the first portion 372 of the locking mechanism 370 is locked in engagement with the second portion 374 of the locking mechanism 370. Accordingly, the positioning element 346 is arranged within the positioning slot 348 formed in the child seat 324 and may be retained therein by the engagement pins 352a, 352b of the positioning assembly 340. Similarly, the locking element 376 may be arranged within the locking slot 378 and the first lock pin 380a may be engaged with or arranged at a first side of the locking element 376 and the second lock pin 380b may be arranged at or engaged with a second side of the locking element 376.

[0205] To transform the child seat 324 from the first rotational position to the second rotational position, such as the side facing configurations as shown in FIGS. 5A, 5B, and 8B, a user operates the actuator 384 associated with the locking mechanism 370. In the illustrated, non-limiting embodiment, a user pushes the handle 364 of the actuator 384 inward, causing the lock pins 380a, 380b to pivot away from the locking slot 378, and in some embodiments, out of engagement with the locking element 376. While the lock pins 380a, 380b are in this retracted position, a user additionally applies a rotational force to the child seat 324 causing the child seat 324 to rotate about the axis X2 of the positioning assembly 340. In the illustrated, non-limiting embodiment, the child seat 324 is lockable against rotation about the axis X2 only when in the first rotational position.

[0206] In some embodiments, the lock pins 380a, 380b of the locking mechanism 370 are movable against their bias as the child seat 324 is rotated into the first rotational position. For example, the first lock pin 380a may be moved out of the pathway of the locking slot 378 by the locking element 376 in response to rotation of the child seat 324 in a first direction about the axis X2, and the second lock pin 380b may be moved out of the pathway of the locking slot 378 by the locking element 376 in response to rotation of the child seat 324 in a second direction about the axis X2. As the locking element 376 is rotated into the locking slot 378, the locking element 376 engages and applies a force to the lock pin closest to locking element 376, such as the first lock pin 380a for example. The force opposes the bias acting on the lock pin 380a, causing the lock pin 380a to move out of path of movement defined by the locking slot 378. Once the locking element 376 is rotated beyond the lock pin 380a, the biasing force acting on the respective lock pin 380a will bias the lock pin 380a back into the extended position within the locking slot 378. This lock pin 380a defines a first stop

preventing rotation of the locking element 376 in the opposite direction. The lock pin located furthest from the locking element 376 as it rotates into the locking slot 378, such as the second lock pin 380b for example, is not moved in response to the rotation of the locking element 376. The far lock pin 380b forms a second stop preventing continued rotation of the locking element 376 about the axis X2.

[0207] To separate the child seat 324 from the support base 322, as shown in FIGS. 6 and 8C, a user operates the actuator 360 associated with the positioning assembly 340. In the illustrated, non-limiting embodiment, a user pulls the handle 364 of the actuator 360 outwardly, causing the engagement pins 352a, 352b to translate outwardly away from the path of translation defined by the positioning slot 348. The child seat 324 is then translated relative to the support base 322, causing the positioning element 346 to move along the path of translation and out of the open end of the positioning slot 348. As shown, the translation of the child seat 324 relative to the support base 322 to separate the child seat 324 from the support base 322 is arranged at a non-parallel angle relative to the axis of rotation X2. A vertical force or lift in a direction parallel to the axis X2 is not applied during this separation.

[0208] As noted, separation of the child seat 324 from the support base 322 may be achieved via movement of the child seat 324 relative to the support base 322 in a direction perpendicular to the axis X2. This path along which the child seat 324 is movable, for example slidable or translatable, is defined by the positioning slot 348. However, the child seat 324 may not be separable from the support base 322 at every rotational position of the child seat 324 about the axis X2. For example, when the child seat 324 is in the first rotational position, the back end 330 of the support base 322 and/or the vehicle seat back 302 are arranged within the path of movement of the child seat 324 as the positioning element 346 moves within the positioning slot 348. At such a position, the back end 330 of the support base 322 and/or the vehicle seat back 302 prevents movement of the child seat 324 to a position where the positioning element 346 is aligned with the open end of the positioning slot 348. The child seat 324 may be separable from the support base 322 when the rear end 330 of the support base 322 is not arranged within the path of movement of the child seat 324 defined by the movement of the positioning element 346 within the positioning slot 348.

[0209] To couple the child seat 324 the support base 322, the first portion 342 of the positioning assembly 340 is aligned with the open end of the positioning slot 348 of the second portion 344 of the positioning assembly 340. As the child seat 324 is translated relative to the positioning element 346 and the support base 322, the positioning element 346 engages the portion of the engagement pins 352a, 352b arranged within positioning slot 348.

The portion of the engagement pins 352a, 352b within the positioning slot 348 may be contoured such that the engagement pins 352a, 352b move in response to engagement with the positioning element 346 as the positioning element moves into the positioning slot 34. The positioning element 346 applies a force to and moves the engagement pins 352a, 352b against their bias, away from the positioning slot 348, allowing the positioning element 346 to move past the engagement pins 352a, 352b, to a second end of the positioning slot 348. Once the positioning element 346 is past the engagement pins 352a, 352b, the first and second engagement pins 352a, 352b are biased back into the extended position, thereby restricting translational movement of the child seat 324 relative to the positioning element 346 and support base 322.

[0210] With reference now to FIGS. 9A-18, another embodiment of a child restraint system 420 including a support base 422 and a child seat 424 is illustrated. Although the child seat 424 is illustrated as a toddler seat, in other embodiments, the child seat 424 may be an infant car seat. The child restraint system 420 may be releasably secured to the vehicle seat 400 by an anchor mechanism (not shown). In an embodiment, the anchor mechanism engageable with the vehicle seat 400 to couple the child restraint system 420 to the vehicle seat 400 is arranged at the support base 422. As in the previous embodiments, when the support base 422 is installed on a vehicle seat 400, the support base 422 may be positioned on the vehicle seat pan 404 such that a back end 430 of the support base 422 is proximate the vehicle seat back 402, and the front end 432 of the support base 422 may be spaced from the vehicle seat back 402.

[0211] Similar to the child restraint system 320 of FIGS. 4-8C, the child restraint system 420 may include a positioning assembly 440 configured to allow for adjustment or a change of position and/or orientation of the child seat 424 relative to the support base 422 and/or the vehicle seat 400. As shown, the child seat 424 may be selectively coupled to the support base 422 via the positioning assembly 440. A first portion 442 of the positioning assembly 440 may be arranged at the support base 422 and a second portion 444 of the positioning assembly 440 may be arranged at the child seat 424. In the illustrated, non-limiting embodiment, the first portion 442 of the positioning assembly 440 includes a single positioning element 446, protruding from an upper surface 434 of the support base 422. As shown, the positioning element 446 is a stationary pin, post, or shaft. However, a positioning element 346 having any other suitable another configuration, such as where the positioning element 446 is a rib for example, is also within the scope of the disclosure.

[0212] A central longitudinal axis L3b (see FIGS. 13 and 14B) of the support base 422 extends between the front end 432 to the rear end 430 of the support base 422 and is equidistantly positioned between the opposing lateral sides 429, 431 of the support base 422. As in the previous embodiment, the positioning element 446 may be arranged at the central longitudinal axis L3b of the support base 422. However, embodiments where the positioning element 446 is offset from the central longitudinal axis L3b of the support base 422 are also contemplated herein.

[0213] Further, the positioning element 446 may be offset from a centerline of at least one of the support base 422 and the child seat 424. As shown in FIGS. 14B and 15B, the child seat 424 has a longitudinal axis L3s extending between the front 426 and the back 428 of the child seat 424, and in an embodiment, the positioning element 446 is offset from a centerline C3a of the child seat 424 that extends between opposing lateral sides 433, 435 of the child seat 424 perpendicularly to longitudinal axis L3s and is equidistantly spaced from the front end 426 and the rear 428 of the child seat 424 when the longitudinal axis L3s of the child seat 424 is aligned with the central longitudinal axis L3b of the support base 422. Alternatively, or in addition, the positioning element 446 may be offset from a centerline C3b of the support base 422 that extends between opposing lateral sides of the support base 422, perpendicular to the longitudinal axis L3b, and is equidistantly spaced from the rear end 430 and the front end 432 of the support base 422.

[0214] A center of gravity CoG3 of the child seat 424 may be arranged near an interface between the seat portion and the back portion of the child seat 424. In yet another embodiment, a centerline C3c of the support base 422 is oriented perpendicular to the central longitudinal axis L3b of the support base 422 and intersects the center of gravity CoG2 of the child seat 424 when the longitudinal axis L3s of the child seat 424 is aligned with the longitudinal axis L2b of the support base 422. Accordingly, the positioning element 446, and an axis of rotation X3 defined thereby, is offset from at least one centerline C3a, C3b, C3c described herein.

[0215] The second portion 444 of the positioning assembly 440 is arranged at an underside of the child seat 424 and is connectable to the first portion 442 of the positioning assembly 440 extending from the support base 422. The second portion 444 may be located between the seat centerline C3a and a rear or back 428 of the child seat 424. The second portion 444 of the positioning assembly 440 may include a positioning slot 448 formed at a bottom surface 450 of the child seat 424. In such embodiments, the positioning element 446

is slidably receivable within the positioning slot 448 to couple the child seat 424 to the support base 422.

[0216] At least one engagement pin 452a, 452b is movably mounted to the child seat 424 proximate the positioning slot 448. The at least one engagement pin 452a, 452b may be operable to restrict translation of the positioning element 446 within the positioning slot 448. In the illustrated, non-limiting embodiment, the at least one engagement pin includes a first engagement pin 452a movably mounted to the child seat 424 at a first side of the positioning slot 448 and a second engagement pin 452b movably mounted to the child seat 424 at an opposite, second side of the positioning slot 448. The first and second engagement pins 452a, 452b may cooperate to selectively restrict movement of the positioning element 446 within the positioning slot 448. In an embodiment, the first and second engagement pins 452a, 452b movably extend through an opening into an interior of the positioning slot 448.

[0217] As shown, the engagement pins 452a, 452b may be transformable, for example translatable, between a first, extended position (FIGS. 13-16) in which the child seat 424 is coupled to the support base 422 and is rotatable about an axis X3 defined by the positioning element 446, and a second, retracted position (FIG. 17A) in which the child seat 424 is translatable and rotatable relative to the support base 422. When each of the engagement pins 452a, 452b is in the extended position, a portion of each engagement pin 452a, 452b extends into the pathway defined by the positioning slot 448. When each of the engagement pins 452a, 452b is in the second, retracted position, the engagement pins 452a, 452b are separated from the positioning slot 448, allowing the positioning element to translate freely within the positioning slot 448, and therefore the child seat 424 to translate relative to the support base 422 while remaining coupled thereto. In the illustrated, non-limiting embodiment, a first end 456a, 456b and a second end 458a, 458b of each engagement pin 452a, 452b has a contour complementary to the positioning element 446. These ends 456a, 456b, 458a, 458b may engage the positioning element 446 and oppose movement of the positioning element 446 from an end of the positioning slot 448.

[0218] A biasing member, such as a coil spring for example, may be operably coupled to an engagement pin 452a, 452b to bias the engagement pin 452a, 452b to the first position. In the illustrated, non-limiting embodiment, a first biasing member 454a is operably coupled to the first engagement pin 452a and a second biasing member 454b is operably coupled to the second engagement pin 452b.

[0219] The positioning element 446 arranged within the positioning slot 448, defines an axis X3 about which the child seat 424 is rotatable relative to the support base 422. In an

embodiment, the engagement between the positioning element 446 and the positioning element 446 allows for full 360-degree rotation of the child seat 424 about the axis X3.

[0220] In an embodiment, the positioning assembly 440 additionally defines a translational movement of the child seat 424 relative to the support base 422, while the child seat 424 is coupled to the support base 422. The translational movement may be toward a vehicle door, to improve the loading and unloading of a child from the child seat 424. The bias of the engagement pins 452a, 452b may be operable to restrict movement of the positioning element 446 when a force applied by the positioning element 446 on the engagement pins 452a, 452b is less than the biasing force of the biasing members 454a, 454b. The positioning element 446 may apply a force less than the biasing force of the biasing member 454a, 454b when translation of the child seat relative to the support base 422 is unintended, such as in response to vibration of the child seat 424.

[0221] As previously noted, in the illustrated, non-limiting embodiment, both the first end 456a, 456b and the second end 458a, 458b of each engagement pin 452a, 452b is contoured to engage a corresponding surface of the positioning element 446. These contoured ends 456a, 456b, 458a, 458b of the engagement pin 452a, 452b facilitate movement of the engagement pin 452a, 452b toward the retracted position when a force applied to the engagement pin 452a, 452b by the positioning element 446 exceeds the bias of the biasing members 454a, 454b. Such a force may be generated when a user pulls or pushes on the child seat 324 in a direction aligned with the path of movement defined by the positioning slot 448. In response to this force, illustrated by F3 (see FIG. 16 & 17A), the engagement pins 452a, 452b move outwardly, allowing for translation of the positioning element 446 within the positioning slot 448, and a resulting translation of the child seat 424 relative to the support base 422.

[0222] In an embodiment, an actuator 460 is associated with the separation of the first and second portions 442, 444 of the positioning assembly 440. The actuator 460 may include a handle 462 positioned at the child seat 424 in alignment with the positioning slot 448. In the illustrated, non-limiting embodiment, the handle 462 is arranged directly within the pathway of the positioning slot 448, such as proximate the first, open end 449 thereof. Accordingly, the handle 462, when unactuated, may block the first end 449 of the positioning slot 448, thereby restricting separation of the first and second portions 442, 444 of the positioning assembly 440. Actuation of the handle 462 moves, for example translates, the handle 462 out of the path of movement defined by the positioning slot 448, thereby allowing the positioning element 446 to be decoupled from the positioning slot 448. When the force F4 (see FIGS.

14A and 15A) is removed from the handle 462, the handle 462 may be biased back to a position within the path of movement of the positioning slot 448 by a biasing member 464.

[0223] In an embodiment, the child restraint system 420 additionally includes a locking mechanism 470 operable to connect the support base 422 and the child seat 424. In some embodiments, a first portion 472 of the locking mechanism 470 is arranged at the support base 422 and a second portion 474 of the locking mechanism 470 is arranged at the child seat 424. In the illustrated, non-limiting embodiment, the first portion 472 of the locking mechanism 470 includes a first locking element 476a and a second locking element 476b protruding from the upper surface 434 of the support base 422. The first locking element 476a may be associated with a first locking position (FIGS. 9A, 14A, 14B) of the child seat 424 and the second locking element 476b may be associated with a second locking position (FIGS. 9B, 15A, 15B) of the child seat 424. The child seat 424 is arranged at a first rotational angle relative to the support base 422 when in the first locking position and the child seat 424 may be arranged at a second rotational angle relative to the support base 422 when in the second locking position.

[0224] As shown, each of the first locking element 476a and the second locking element 476b may be a generally elongated rib, and in some embodiments may be curved. The first locking element 476a may be centered about the central longitudinal axis L3 of the support base 422 and in some embodiments is positioned proximate the back end 430 of the support base 422. Similarly, the second locking element 476b may be centered about the central longitudinal axis L3 of the support base 422 and in some embodiments is positioned proximate the front end 432 of the support base 422. However, embodiments where the first and second locking elements 476a, 476b are rotationally separated from one another by less than 180 degrees are also contemplated herein. The first locking element 476a and the second locking element 476b may be substantially identical and may be equidistantly spaced from the axis of rotation X3 defined by the positioning element 446.

[0225] The second portion 474 of the locking mechanism 470 is arranged at the child seat 424, such as at an underside of the child seat 424 positionable in contact with the upper surface 434 of the support base 422. The second portion 474 of the locking mechanism 470 includes at least one locking slot 478a, 478b and at least one lock pin 480a, 480b movably mounted to the child seat 424. The at least one locking slot includes a first locking slot 478a and a second locking slot 478b. The first locking slot 478a and the second locking slot 478b may be substantially identical and as shown, may be equidistantly spaced from a center of the surface of the child seat 424 connectable to the support base 422. In the illustrated, non-

limiting embodiment, the first locking slot 478a is arranged near a front 426 of the child seat 424 (where the child's feet are located) and the second locking slot 478b is arranged near the rear 428 of the child seat 424 (where the child's back is located).

[0226] The at least one lock pin 480a, 480b is operable to selectively restrict rotation of the child seat 424 about the axis X3 defined by the positioning element 446. In the illustrated, non-limiting embodiment, the at least one lock pin 480a, 480b includes a first lock pin 480a movably mounted proximate a first side of the first locking slot 478a and a second lock pin 480b movably mounted proximate a second lateral side of first locking slot 478a. A distance between the first lock pin 480a and the second lock pin 480b may be greater than or equal to the length of the first locking element 476a and/or the second locking element 476b. In embodiments including a first lock pin 480a and a second lock pin 480b, the first and second lock pins 480a, 480b, in combination, may cooperate to selectively restrict rotation of the child seat 424 about the axis X3 relative to the support base 422. In the illustrated, non-limiting embodiment, the first and second lock pins 480a, 480b are arranged at a same side of the first locking slot 478a, such as at a position between the first locking slot 478a and the second locking slot 478b, for example.

[0227] As shown, the lock pins 480a, 480b are transformable, for example pivotable, between a first, extended position (FIGS. 14A-15B) in which the child seat 424 is rotatably fixed to the support base 422 a second, retracted position (FIG. 16) in which the child seat 424 is rotatable about the axis X3 relative to the support base 22. When the lock pins 480a, 480b, are in a locked or extended position, a portion of each lock pin 480a, 480b is arranged within the first locking slot 478a and is engageable with a portion of a locking element 476a, 476b. The lock pins 480a, 480b may extend through openings into the interior of the first locking slot 478a. In the illustrated, non-limiting embodiment, each lock pin 480a, 480b, when in the extended position is operable to engage a respective end of a locking element 476a, 476b. Accordingly, the first lock pin 480a may be operable to restrict rotation of the child seat 424 about the axis X3 in a first direction and the second lock pin 480b may be operable to restrict rotation of the child seat 424 about the axis X3 in a second, opposite direction. When the lock pins 480a, 480b are in the second, unlocked position, the lock pins 480a, 480b are separated from the first locking slot 478a, allowing the child seat 424 to freely rotate about the axis X3 of the positioning assembly 440 relative to the support base 422.

[0228] A biasing member such as a coil spring or torsion spring for example, may be operable to bias a lock pin 480a, 480b to the first extended or locked position. In the illustrated, non-limiting embodiment, a first biasing member 482a is operably coupled to the

first lock pin 480a and a second biasing member 482b is operably coupled to the second lock pin 480b.

[0229] An actuator 484 is operably coupled to the at least one lock pin 480a, 480b. The actuator 484 includes a handle 486 arranged at an exterior surface of the child seat 424, such as near the front end 426 of the child seat 424 for example. The handle 486 is operably coupled to the at least one lock pin 480a, 480b of the locking mechanism 470. In the illustrated, non-limiting embodiment, the handle 486 is indirectly coupled to the first lock pin 480a and the second lock pin 480b such as via one or more tension members, cables, wires, or other suitable elements 488a, 488b. However, embodiments where the handle 486 is directly coupled to the first lock pin 480a and the second lock pin 480b, as in the embodiment of FIGS. 3A-, are also within the scope of the disclosure. To unlock the locking mechanism 470 and allow rotation of the child seat 424, a user applies a force F4 to the handle 486. This force F4 is transmitted to the first lock pin 480a and the second lock pin 480b via the at least one tension member 488a, 488b and is in a direction that opposes the biasing forces of the first and second biasing members 482a, 482b. As a result, the first lock pin 480a and the second lock pin 480b rotate about their respective axes away from the first locking slot 478a and a locking element 476a, 476b arranged therein. While the lock pins 480a, 480b are disengaged from the first locking slot 478a, a user may then rotate the child seat 424 relative to the support base 422 about the axis X3 to transform the child seat 424 between a plurality of positions, including the first locking position and the second locking position.

[0230] In the first locking position, the first locking element 476a is arranged within the first locking slot 478a, and the second locking element 476b is arranged within the second locking slot 478b. In the first locking position, the first and second lock pins 480a, 480b are positionable to restrict rotation of the child seat 424 via engagement with the first locking element 476a. In the illustrated, non-limiting embodiment, when the child seat 424 is in the first locking position, the child seat 424 is in a rearward-facing orientation relative to the support base 422 and the vehicle seat 400. In the second locking position, the first locking element 476a is arranged within the second locking slot 478b, and the second locking element 476b is arranged within the first locking slot 478a. In the second locking position, the first and second locking pins 480a, 480b are operable to restrict rotation of the child seat 424 via engagement with the second locking element 476b. In the illustrated, non-limiting embodiment, when the child seat 424 is in the second locking position, the child seat 424 is in a forward-facing orientation relative to the support base 422 and the vehicle seat 400.

[0231] To change the orientation of the child seat 424, a user operates the actuator 484 associated with the locking mechanism 470. In the illustrated, non-limiting embodiment, a user applies a force F5 (see FIG. 14B and 15B) to the handle 486, such as by pulling the handle forward, away from the child seat 424. This force F5 moves the lock pins 480a, 480b against their bias, out of engagement with first locking element 476a or the second locking element 476b arranged within the first locking slot 478a. With the lock pins 480a, 480b in this retracted position, a user additionally applies a rotational force to the child seat 424 causing the child seat 424 to rotate about the axis X3 of the positioning assembly 440. The child seat 424 is therefore rotatable between the first locking position and the second locking position without separating or decoupling the child seat 424 from the support base 422. In the illustrated, non-limiting embodiment, the child seat 424 is lockable against rotation only when in one of the first locking position and the second locking position.

[0232] As in the previously described embodiment, the lock pins 480a, 480b of the locking mechanism 470 may be moved against their bias as the child seat 424 is rotated into one of the first locking position the second locking position. The first lock pin 480a may be moved out of the first locking slot 478a via engagement with a locking element 476a, 476b in response to rotation of the child seat 424 in a first direction. Similarly, the second lock pin 480b may be moved out of the first locking slot 478a via engagement with a locking element 476a, 476b in response to rotation of the child seat 424 in a second direction.

[0233] It should be understood that the child seat 424 may be positionable at any position between the first locking position and the second locking position. The child seat 424 illustrated in FIGS. 10A-11B, 16, 17A and 17B is arranged at a translating position. When in the translating position, the child seat 424 is arranged at a third rotational position relative to the support base 422 and may be considered to be in a side-facing orientation where the front 426 of the child seat 424 is located closest to an adjacent vehicle door. The translating position of the child seat 424 may be arranged at any position along the path of movement of the child seat 424 between the first locking position and the second locking position. In the exemplary embodiment, the translating position is rotated about 90 degrees relative to both the first locking position and the second locking position. When the child seat 424 is in the translating position, neither the first locking element 476a nor the second locking element 476b may be arranged within one of the first locking slot 478a and the second locking slot 478b.

[0234] When the child seat 424 is arranged at the translating position, or another rotational position where the first and second locking elements 476a, 476b are not arranged

within the first and second locking slots 478a, 478b, the child seat 424 is translatable relative to the support base 422. To translate the child seat 424, a user applies a force F3 (see FIG. 17A) to the child seat 424, such as to the front 426 of the child seat 424 or the back 428 of the child seat 424. In response to this force F3, the positioning element 446 may engage and move the engagement pins 452a, 452b of the positioning assembly 440 outwardly, against their bias. With the engagement pins 452a, 452b retracted, the positioning element 446 is free to translate within the positioning slot 448 toward the first end 449 thereof (see FIGS. 17A and 17B). As the positioning element 446 translates toward the first end 449 of the positioning slot 448, the distance between a front end 426 of the child seat 424 and the adjacent lateral side of the support base 422 increases.

[0235] Separation of the child seat 424 from the support base 422 similarly requires translation or sliding movement of the child seat 424 relative to the support base 422. As previously described, in an embodiment, separation of the child seat 424 from the support base 422 may occur only when the locking elements 476a, 476b are not arranged within the locking slots 478a, 478b. Therefore, the child seat 424 may not be separable from the support base 422 when in one of the first locking position or the second locking position. When the child seat 424 is at a suitable position, a user translates the child seat 424 relative to the positioning element 446 as previously described. However, a user additionally applies a force F4 to the handle 462 associated with the positioning assembly 440. In the illustrated, non-limiting embodiment, a user applies an upward force F4 to the handle 462 to move the handle 462 out of the path of the positioning slot 448. With the first, open end 449 of the positioning slot 448 exposed, the positioning element 446 may pass therethrough, allowing the child seat 424 to be lifted away from the support base 422. The translation of the child seat 424 relative to the support base 422 to separate the child seat 424 from the support base 422 is arranged at a non-parallel angle relative to the axis of rotation X3. A vertical force or lift in a direction parallel to the axis X3 is not applied during this separation.

[0236] The translation of the positioning element 446 within the positioning slot 448 at the child seat 424 also occurs during the connection of the child seat 424 to the support base 422. As the positioning element 446 is moved toward the first end 449 of positioning slot 448, the positioning element 446 may engage and apply a force to the handle 462 of the actuator 460 in a direction opposite a bias of the handle 462, thereby exposing the open end 449 of the positioning slot 448. Similarly, the force applied to the engagement pins 452a, 452b by the positioning element 446 as the child seat 424 slides or translates relative to the support base 422 causes the engagement pins 452a, 452b to move outwardly. Upon

movement of the positioning element 446 out of engagement with the handle 462, the handle 462 is biased back into an unactuated position. Similarly, once the positioning element 446 reaches the second end of the positioning slot 448, the engagement pins 452a, 452b are biased to the extended position within the positioning slot 448, thereby restricting unintended movement of the child seat 424 relative to the support base 422.

[0237] With reference now to FIGS. 19A-25B, another embodiment of a child restraint system 520 including a support base 522 and a child seat 524 is illustrated. Although the child seat 524 is illustrated as a toddler seat, in other embodiments, the child seat 524 may be an infant car seat. The child restraint system 520 may be releasably secured to the vehicle seat 500 by an anchor mechanism (not shown). In an embodiment, the anchor mechanism engageable with the vehicle seat 500 to couple the child restraint system 520 to the vehicle seat 500 is arranged at the support base 522. As in the previous embodiments, when the support base 522 is installed on a vehicle seat 500, the support base 522 may be positioned on the vehicle seat pan 504 such that a back end 530 of the support base 522 is proximate the vehicle seat back 502, and the front end 532 of the support base 522 may be spaced from the vehicle seat back 502.

[0238] In the illustrated, non-limiting embodiment, a portion of the support base 522, such as a carriage or upper base portion 536 of the support base 522 is rotatable relative to the remainder or lower base portion 535 of the support base 522 about an axis (not shown). The upper base portion 536 may be arranged at and/or define at least a portion of an upper surface 534 of the support base 522. Although not shown, the support base 522 may include any suitable spin lock mechanism operable to selectively lock the upper base portion 536 relative to the lower base portion 535 in each of the plurality of positions. For example, the upper base portion 536 may be lockable in a first position (see FIGS. 19A and 20) in which the upper base portion 536 has a rearward-facing orientation and a second position (see FIGS. 19B and 21A-21B) in which the upper base portion 536 has a forward-facing orientation.

[0239] Although not shown, a spin lock mechanism of the support base 522 may include one or more movable lock pins associated with the upper portion 536 of the support base 522. The lower portion 535 of the support base 522 may include a plurality of lock sections, for example openings, formed therein. The lock pins are transformable between a first, locked position in which the upper portion 536 of the support base 522 is not rotatable relative to the lower portion 535 of the support base 522, and a second, unlocked position in which the upper portion 536 of the support base 522 is freely rotatable relative to the lower portion 535 of the support base 522. When each of the lock pins is in a locked position, a

portion of each lock pin is received within or is coupled to a corresponding lock section. When the lock pins are in the second, unlocked position, the lock pins are separated from the lock sections, allowing the upper portion 536 to be rotated relative to the lower portion 535 of the support base 522. In an embodiment, a biasing member (not shown), such as a torsion spring for example, is operable to bias the lock pins to the first locked position. Further, an actuator, not shown, is operably coupled to the lock pins to transform the lock pins from the locked position to the unlocked position. It should be understood that the spin lock mechanism described herein is intended as an example only and any suitable mechanism that allows selective rotation of the upper portion 536 of the support base 522 to the lower portion 535 of the support base 522 is contemplated herein.

[0240] Similar to the child restraint system 320 and 420, in an embodiment, the child restraint system 520 may have a positioning assembly 540 to allow for adjustment or a change of position and/or orientation of the child seat 524 relative to the support base 522 and/or the vehicle seat 500. For example, the positioning assembly may define at least one axis about which the child seat 524 is rotatable relative to the support base 522. As shown, the child seat 524 may be selectively coupled to the support base 522 via the positioning assembly 540. A first portion 542 of the positioning assembly 540 is arranged at the support base 522 and a second portion 544 of the positioning assembly 540 is arranged at the child seat 524. In the illustrated, non-limiting embodiment, the first portion 542 of the positioning assembly 540 includes a first positioning element 546a and a second positioning element 546b extending from the support base 522. However, embodiments including more than two positioning elements, such as three positioning elements, four positioning elements, or more than four positioning elements for example are also within the scope of the disclosure.

[0241] Each positioning element 546a, 546b is illustrated as a stationary pin, post, or shaft. Embodiments where one or both positioning elements 546a, 546b have any other suitable another configuration, are also within the scope of the disclosure. Further, although the first and second positioning elements 546a, 546b are illustrated as being substantially identical, embodiments where a size and or shape of the first positioning element 546a is different from a size and/or shape of the second positioning element 546b are also contemplated herein. In an embodiment, the child seat 524 is rotatable relative to the support base 522 about a plurality of axes. The first positioning element 546a may define a first axis of rotation X4 about which the child seat 524 may rotate relative to the support base 522, and the second positioning element 546b may define a second axis of rotation X5 about which the child seat 524 may rotate relative to the support base 522. In an embodiment, both the first

positioning element 546a and the second positioning element 546b are arranged at the upper base portion 536, and therefore are rotatable with the upper base portion 536 relative to the lower base portion 535 of the support base 522.

[0242] A central longitudinal axis L4b (see FIG. 21B) of the support base 522 extends between the front end 532 to the rear end 530 of the support base 522 and is equidistantly positioned between the opposing lateral sides 529, 531 of the support base 522. In the illustrated, non-limiting embodiment, the first positioning element 546a and the second positioning element 546b are laterally offset from the central longitudinal axis L4b of the support base 522. However, embodiments where one or more of the first positioning element 546a and the second positioning element 546b is aligned with the central longitudinal axis L4b of the support base 522 are also contemplated herein. As shown, when the upper base portion 536, and therefore the child seat 524 coupled thereto, is in the rearward-facing orientation, the first positioning element 546a may be arranged near a first lateral side 529 of the upper base portion 536 and the second positioning element 546b may be arranged adjacent to a second, opposite lateral side 531 of the upper base portion 536.

[0243] Further, the at least one positioning element 546a, 546b may be offset from a centerline of at least one of the support base 522 and the child seat 524. As shown in FIGS. 21B, the child seat 524 has a longitudinal axis L4s extending between the front 526 and the back 528 of the child seat 524. In an embodiment, at least one of the first positioning element 546a and the second positioning element 546b, in some embodiments both positioning elements 546a, 546b are offset from a centerline C4a of the child seat 524 that extends that extends between opposing lateral sides 537, 539 of the child seat 524 perpendicularly to longitudinal axis L4s and is equidistantly spaced from the front end 526 and the rear 528 of the child seat 524 when the longitudinal axis L4s the child seat 524 is aligned with the central longitudinal axis L4b of the support base 522. Alternatively, or in addition, the positioning element 546 may be offset from a centerline C4b of the support base 522 that extends between opposing lateral sides of the support base 522, perpendicular to the longitudinal axis L4b, and is equidistantly spaced from the rear end 530 and the front end 532 of the support base 522.

[0244] A center of gravity CoG4 of the child seat 524 may be arranged near an interface between the seat portion and the back portion of the child seat 524. In yet another embodiment, a centerline C4c of the support base 522 is oriented perpendicular to the central longitudinal axis L4b of the support base 522 and intersects the center of gravity CoG3 of the child seat 524 when the longitudinal axis L4s of the child seat 524 is aligned with the

longitudinal axis L4b of the support base 522. Accordingly, the at least one positioning element 546a, 546b, and an axis of rotation X4, X5 defined thereby, is offset from at least one centerline C4a, C4b, C4c described herein.

[0245] In the illustrated, non-limiting embodiment, when the upper base portion 536 is in the first rotational position, such as having a rearward-facing orientation for example, both the first and second positioning elements 546a, 546b may be arranged near the front end 532 of the support base 522. Similarly, when the upper base portion 536 is in the second rotational position, such as having a forward-facing orientation for example, both the first and second positioning elements 546a, 546b may be arranged near the rear end 530 of the support base 522. In an embodiment, the first and second positioning elements 546a, 546b are aligned along an axis oriented parallel to at least one of the front end 532 and the rear end 530 of the support base. However, embodiments where the first positioning element 546a is located near the back end 530 of the support base 522 and the second positioning element 546b is arranged near the front end 532 of the support base 522 are also within the scope of the disclosure.

[0246] The second portion 544 of the positioning assembly 540 is arranged at the child seat 524 and is connectable to the first portion 542 of the positioning assembly 540 extending from the support base 522. The second portion 544 may be located between the seat centerline C4a and a rear or back 528 of the child seat 524. The second portion 544 of the positioning assembly 540 includes at least one positioning slot for receiving the at least one positioning element. In an embodiment, the second portion 544 includes a first positioning slot 548a and a second positioning slot 548b, such as formed at a bottom surface 550 of the child seat 524. The first positioning element 546a is slidably receivable within the first positioning slot 548a and the second positioning element 546b is slidably receivable within the second positioning slot 548b to couple the child seat 524 to the support base 522.

[0247] In the illustrated, non-limiting embodiment, a first engagement pin 552a is movably mounted to the child seat 524 proximate the first positioning slot 548a and a second engagement pin 552b is movably mounted to the child seat 524 proximate the second positioning slot 548b. The first engagement pin 552a is operable to selectively restrict translation of the positioning element 546a within the first positioning slot 548a. Similarly, the second engagement pin 552b is operable to selectively restrict translation of the positioning element 546b within the second positioning slot 548b.

[0248] The first engagement pin 552a may be transformable between a first extended position (FIGS. 21A-21B) in which the child seat 524 is coupled to the support base at the

first positioning element 546a, and a second, retracted position (FIGS. 22 and 25B), in which the first positioning element 546a is translatable relative to the first positioning slot 548a. The second engagement pin 552b may also be transformable between a first extended position (FIGS. 21A-21B) in which the child seat 524 is coupled to the support base at the second positioning element 546b, and a second, retracted position (FIG. 25B), in which the second positioning element 546b is translatable relative to the second positioning slot 548b. When one of the first engagement pin 552a and the second engagement pin 552b is retracted, the child seat 524 may be rotatable relative to the support base 522, including the upper base portion 536 thereof. When both the first engagement pin 552a and the second engagement pin 552b are retracted, the child seat 524 may be translatable relative to the support base 522 including the upper base portion 536.

[0249] A biasing member, such as a coil spring for example, may be operably coupled to each engagement pin 552a, 552b to bias the engagement pins 552a, 552b to the extended position. In the illustrated, non-limiting embodiment, a first biasing member 554a is operably coupled to the first engagement pin 552a and a second biasing member 554b is operably coupled to the second engagement pin 552b. In the illustrated, non-limiting embodiment, the first biasing member 554a and the second biasing member 554b are operable to bias the first and second engagement pins 552a, 552b in away from one another, such as toward opposing lateral sides of the child seat 524.

[0250] In an embodiment, the first engagement pin 552a is transformable between the extended position and the retracted position independently from the transformation of the second engagement pin 552b between the extended position and the retracted position. When the first positioning element 546a is contained within the first positioning slot 548a by the first engagement pin 552a and the second positioning element 546b is freely movable relative to the second positioning slot 548b, such as when the second engagement pin 552b is in the retracted position, the child seat 524 is rotatable relative to both the upper base portion 536 and the support base 522 about the axis of rotation X4 defined by the first engagement pin 552a. Similarly, when the second positioning element 546b is contained within the second positioning slot 548b by the second engagement pin 552b and the first positioning element 546a is freely movable relative to the first positioning slot 548a, such as when the first engagement pin 552a is in the retracted position, the child seat 524 is rotatable relative to both the upper base portion 536 and the support base 522 about the axis of rotation X5 defined by the second engagement pin 552b. A user may elect which axis X4, X5 about which to rotate the child seat 524 based on a position of the child restraint system 520 within

a vehicle. For example, a user may elect to rotate the child seat 524 about the axis of rotation X4, X5 located closest to an adjacent vehicle door.

[0251] A first actuator may be operable to transform the first engagement pin 552a to a retracted position and a separate second actuator may be operable to transform the second engagement pin 552b to a retracted position. However, in the illustrated, non-limiting embodiment, a single actuator 560 is operably coupled to both the first engagement pin 552a and the second engagement pin 552b. As shown, the first engagement pin 552a may include a first actuation feature 556a and the second engagement pin 552b may include a second actuation feature 556b. In the illustrated, non-limiting embodiment, these actuation features 556a, 556b protrude beyond a surface of the engagement pins 552a, 552b. An actuation mechanism 562 of the actuator 560 is in movable engagement with both the first actuation feature 556a and the second actuation feature 556b.

[0252] A plurality of handles may be operably coupled to the actuation mechanism 562 and are located at various locations about the child seat 524. For example, a first handle 564a may be arranged at a first lateral side of the child seat 524 and a second handle 564b may be arranged at a second lateral side of the child seat 524, opposite the first lateral side. In an embodiment, the first handle 564a is arranged at the lateral side of the child seat 524 near the first positioning slot 548a and the second handle 564b is arranged at the lateral side of the child seat 524 proximate the second positioning slot 548b. In the illustrated, non-limiting embodiment, the plurality of handles 564a, 564b are illustrated as being integrally formed as a unitary body. Further, in an embodiment, the plurality of handles 564a, 564b are integrally formed with the actuation mechanism 562. However, embodiments including a plurality of separate handles 564a, 564b and/or embodiments where one or more handles are separated from and operably coupled to the actuation mechanism 562 are also within the scope of the disclosure.

[0253] If a user applies a force F6 (see FIG. 20) to the first handle 564a arranged at the first side of the child seat 524, such as a pulling force away from the child seat 524 for example, the actuation mechanism 562 translates relative to the child seat 524 toward the first side of the child seat 524. This movement of the actuation mechanism applies a force to the second engagement pin 552b opposite the bias of the biasing member 554b. Accordingly, application of a force F6 to the first handle 564a causes the second engagement pin 552b to retract and separate from the second positioning slot 548b. Because the first positioning slot 548a remains blocked by the first engagement pin 552a, continued force F6 applied to the first handle 564a will cause the child seat 524 to rotate about the axis X5 of the first

positioning element 546a. As the child seat 524 rotates, the second positioning element 546b translates or slides out of engagement with the second positioning slot 548b.

[0254] If a user similarly applies a force F7 (see FIG. 20) to the second handle 564b arranged at the second side of the child seat 524, the actuation mechanism 562 will translate relative to the child seat 524 toward the second side of the child seat 524. This translation of the actuation mechanism 562 opposes the bias acting on the first engagement pin 552a causing the first engagement pin 552a to retract and separate from the first positioning slot 548a. The second engagement pin 552b remains within the second positioning slot 548b and continued force F7 applied to the second handle 564b will cause the child seat 524 to rotate about the axis X6 of the second positioning element 546b, allowing the first positioning element 546b to separate from the first positioning slot 548a.

[0255] In an embodiment, a third handle 564c is also operably coupled to the actuation mechanism 562. The third handle 564c may be arranged at a front 526 of the child seat 524, or at another location about the child seat 524 different from the location of the first and second handles 564a, 564b. The third handle 564c may be integrally formed with another handle 564a, 564b of the actuator 560 or may be separate therefrom. Application of a force F8 to the third handle 564a may be operable to simultaneously decouple the first and second positioning elements 546a, 546b from the first and second positioning slots 548a, 548b, respectively.

[0256] The force F8 (see FIG. 21B) applied to the third handle 564c by a user is transmitted to the actuation mechanism 562 and may cause the actuation mechanism 562 to translate in the direction of the force. The engagement between the first and second actuation features 556a, 556b of the engagement pins 552a, 552b and the actuation mechanism 562 as the actuation mechanism 562 translates opposes the biasing forces acting on the first engagement pin 552a and the second engagement pin 552b. Accordingly, the engagement pin 552a is retracted, and therefore separated from the first positioning slot 548a and the second engagement pin 552b is retracted, and therefore separated from the second positioning slot 548b. With both engagement pins 552a, 552b retracted, a user may then slide the child seat 524 relative to the support base 522, causing the first and second positioning elements 546a, 546b to separate from the first and second positioning slots 548a, 548b, respectively. Upon removal of the force F8 from the handle 564, a biasing force acting on the actuation mechanism 562 will bias the actuation mechanism back to a default or normal position. Similarly, the biasing forces of the first and second biasing members 554a, 554b will bias the

first and second engagement pins 352a, 352b, respectively, to the extended position arranged within the first positioning slot 548a and the second positioning slot 548b.

[0257] In the illustrated, non-limiting embodiment, the actuation mechanism 562 has a first surface 566a arranged at a non-parallel angle relative to a direction of the axial movement of the actuation mechanism 562 and a second surface 566b arranged at a non-parallel angle relative to the direction of axial movement of the actuation mechanism 562. The first surface 566a and the second surface 566b may be arranged at equal but opposite angles relative to the direction of axial movement of the actuation mechanism 562. The first actuation feature 556a has a surface complementary to and engaged with the first surface 566a and the second actuation feature 556b has a surface complementary to and engaged with the second surface 566b. Accordingly, as the actuation mechanism 562 moves in a direction illustrated by force F8, the actuation features 556a, 556b are translated inwardly, against the bias of the biasing members 554a, 554b, due to the slope of the first and second surfaces 566a, 566b.

[0258] In an embodiment, the child restraint system 520 additionally includes a locking mechanism 570 operable to selectively couple the support base 522 and the child seat 524. In some embodiments, a first portion 572 of the locking mechanism 570 is arranged at the support base 522 and a second portion 574 of the locking mechanism 570 is arranged at the child seat 524. In the illustrated, non-limiting embodiment, the first portion 572 of the locking mechanism 570 includes a locking element 576 extending from the support base 522. In an embodiment, the locking element 576 is arranged at the upper base portion 536 and is rotatable with the upper base portion 536 relative to the lower base portion 535 of the support base 522. As shown, the locking element 576 may be a pin or shaft. The locking element 576 may be arranged opposite the first and second positioning elements 546a, 546b relative to the axis of rotation of the upper base portion 536. As shown, when the upper base portion 536, and therefore the child seat 524 connectable thereto is in the rearward-facing orientation, the locking element 576 is proximate the front end 532 of the support base 522. In the illustrated, non-limiting embodiment, the locking element 576 is aligned with the longitudinal axis L4b of the support base 522 when the upper base portion 536 is in both the rearward-facing orientation and the forward-facing orientation. Further, the locking element 576 may be aligned with the clearance between the first and second positioning elements 546a, 546b.

[0259] The second portion 574 of the locking mechanism 570 is arranged at an underside of the child seat 524, positionable in contact with the upper surface 534 of the support base 522. In an embodiment, the second portion 574 of the locking mechanism 570 is

positioned to engage an upper surface 534 of the upper base portion 536. The second portion 574 of the locking mechanism 570 includes a locking slot 578. In the illustrated, non-limiting embodiment, the locking slot 578 is arranged near a front of the child seat 524 (where the child's feet are located). The interface between the locking slot 578 and the locking element 576 of the locking mechanism 570 defines a path of the movement of the child seat 524 in response to application of a force to at least one handle, such as the first handle 564a arranged at the first side of the child seat 524 and the second handle 564b arranged at the second side of the child seat 524. When a force F6, F7 is applied to one of these handles 564a, 564b, the locking slot 578 moves relative to the locking element 576. In the illustrated, non-limiting embodiment, the locking slot 578 is contoured to facilitate rotate the child seat 524 in response to continued application of a lateral force, such as force F6 or F7 for example, to the child seat 524.

[0260] To transform the child seat 524 from the first rotational position (FIG. 20) to the second rotational position (FIGS. 21A and 21B), a user disengages the spin lock associated with the upper base portion 536 of the support base 522. In the illustrated, non-limiting embodiment, the child seat 524 is rotatable 180 degrees between the first rotational position and the second rotational position. The child seat 524 may not move relative to the upper base portion 536 of the support base 522 during this transformation between the first rotational position and the second rotational position. To move the child seat 524 to a third rotational position, such as at an intermediate angle of rotation between the first rotational position and the second rotational position, the upper base portion 536 remains fixed relative support base 522 and the child seat 524 is rotatable relative to the upper base portion 536 of the support base 522. The third rotational position may be oriented 90 degrees from the first rotational position and/or the second rotational position. In an embodiment, when the child seat is in the third rotational position, the child seat 524 is in a side-facing orientation with the front end 526 of the child seat 524 positioned closest to an adjacent vehicle door.

[0261] In the illustrated, non-limiting embodiment, the child seat 524 is rotatable relative to the upper base portion 536 about the axis of either the first positioning element 546a or the second positioning element 546b. The axis of rotation X4, X5 may be selected based on the rotational position of the child seat 524 prior to movement to the third rotational position. For example, if the child seat 524 is in the first rotational position, i.e., a rearward-facing orientation, the child seat 524 may be rotatable about the axis X4 of the first positioning element 546a to the third rotational position. In the illustrated, non-limiting embodiment, the child seat 524 is rotatable in a counterclockwise direction about the axis X4

from the first rotational position to the third rotational position. However, if the child seat 524 is in the second rotational position, i.e., a forward-facing orientation, the child seat 524 may be rotatable about the axis X5 of the second positioning element 546b to the third rotational position. As shown, the child seat 524 may be rotatable about the axis X5 in a clockwise direction from the second rotational position to the third rotational position.

[0262] The child seat 524 is separable from the support base 522 when the child seat 524 is arranged at a rotational position where the locking element 576 is separated from the locking slot 578. When the locking element 576 is separated from the locking slot 578, the child seat 524 is coupled to the support base 522 via engagement between only one positioning element 546a, 546b and one positioning slot 548a, 548b. As previously described, the separation of one of the positioning elements 546a, 546b from a corresponding positioning slot 548a, 548b is performed by either applying a force F6 to the first handle 564a or by applying a force F7 to the second handle 564b. With the locking element 576 separated from the locking slot 578, to separate the child seat 524 from the support base 522, a user operates the actuator 560 associated with the positioning assembly 540. In the illustrated, non-limiting embodiment, a user pulls the third handle 564c of the actuator 560 outwardly (see F8), away from the front end 526 of the child seat 524. The resulting translational movement of the actuation mechanism 562 causes each engagement pin 552a, 552b to retract or translate inwardly. With one of the positioning elements 546a, 546b decoupled from a corresponding positioning slot 548a, 548b, and the other positioning element 546a, 546b freely movable relative to the other positioning slot 548a, 548b, the child seat 524 is movable, for example slidable, to separate the child seat 524 from the upper base portion 536 of the support base 522. The translation of the child seat 524 relative to the support base 522 to separate the child seat 524 from the support base 522 is arranged at a non-parallel angle relative to the axes of rotation X4 and X5. A vertical force or lift in a direction parallel to either axis X4 and X5 is not required to be applied during this separation.

[0263] With reference now to FIGS. 26A-30C, another embodiment of a child restraint system 620 including a support base 622 and a child seat 624 is illustrated. Although the child seat 624 is illustrated as an infant car seat, it should be understood that in other embodiments, the child seat 624 may be a toddler seat. The child restraint system 620 may be releasably secured to the vehicle seat 600 by an anchor mechanism (not shown). In an embodiment, the anchor mechanism engageable with the vehicle seat 600 to couple the child restraint system 620 to the vehicle seat 600 is arranged at the support base 622. As in the previous embodiments described herein, when the support base 622 is installed on a vehicle

seat 600, the support base 622 may be positioned on the vehicle seat pan 604 such that a back end 630 of the support base 622 is proximate the vehicle seat back 602, and the front end 632 of the support base 622 may be spaced from the vehicle seat back 602. In the illustrated, non-limiting embodiment, the support base 622 includes a carriage or upper base portion 636 that is movable relative to the remainder or lower base portion 635 of the support base 622 as will be described in more detail below. The child seat 624 may be permanently or removably connectable to the upper base portion 636. The child seat 624 is movable with the upper base portion 636 relative to the lower base portion 635.

[0264] In an embodiment, the child restraint system 620 has a positioning assembly 640 that connects the upper base portion 636 to the lower base portion 635 of the support base 622. The positioning assembly 640 may rotatably couple the upper base portion 636 and the lower base portion 635. In the illustrated, non-limiting embodiment, one of the upper base portion 636 and the lower base portion 635 of the support base 622 includes a positioning element 646 and the other of the upper base portion 636 and the lower base portion 635 of the support base 622 defines an opening or positioning slot 648 within which the positioning element 646 is arranged. The positioning element 646 may be a stationary pin, post, or shaft. However, a positioning element 646 having any other suitable another configuration, such as where the positioning element 646 is a rib for example, is also within the scope of the disclosure.

[0265] A central longitudinal axis L5b (see FIG. 27B) of the support base 622 extends between the front end 632 to the rear end 630 of the support base 622 and is equidistantly positioned between the opposing lateral sides 629, 631 of the support base 622. The positioning element 646 may be arranged at the central longitudinal axis L5b of the support base 622. However, embodiments where the positioning element 646 is offset from the central longitudinal axis L5b of the support base 622 are also contemplated herein.

[0266] Further, the positioning element 646 may be offset from a centerline of at least one of the support base 622 and the child seat 624. As shown in FIG. 26B, the child seat 624 has a longitudinal axis L5s extending between the front 626 and the back 628 of the child seat 624, and in an embodiment, the positioning element 646 is offset from a centerline C5a of the child seat 624 that extends between opposing lateral sides 637, 639 of the child seat 624 perpendicularly to longitudinal axis L5s and is equidistantly spaced from the front end 626 and the rear 628 of the child seat 624 when the longitudinal axis L5s of the child seat 624 is aligned with the central longitudinal axis L5b of the support base 622. Alternatively, or in addition, the positioning element 646 may be offset from a centerline C5b of the support base

622 that extends between opposing lateral sides of the support base 622, perpendicular to the longitudinal axis L5b, and is equidistantly spaced from the rear end 630 and the front end 632 of the support base 622. In such embodiments, the positioning element 646 may be arranged closer to a front end 632 of the support base 622 than a rear end 630 of the support base 622, as shown in the FIGS., or alternatively, the positioning element 646 may be arranged closer to the rear end 630 of the support base 622 than the front end 632.

[0267] A center of gravity CoG5 of the child seat 624 may be arranged near an interface between the seat portion and the back portion of the child seat 624. In yet another embodiment, a centerline C5c of the support base 622 is oriented perpendicular to the central longitudinal axis L5b of the support base 622 and intersects the center of gravity CoG5 of the child seat 624 when the longitudinal axis L5s of the child seat 624 is aligned with the longitudinal axis L5b of the support base 622. Accordingly, the positioning element 646, and an axis of rotation X6 defined thereby, is offset from at least one centerline C5a, C5b, C5c described herein.

[0268] The child restraint system 620 additionally includes a locking mechanism 670 operable to connect the upper and lower portions of the support base 622. In some embodiments, a first portion 672 of the locking mechanism 670 is arranged at the lower base portion 635 of the support base 622 and a second portion 674 of the locking mechanism 670 is arranged at the upper base portion 636. In the illustrated, non-limiting embodiment, the first portion 672 of the locking mechanism 670 includes a contoured surface 675 including a locking groove 676.

[0269] The second portion 674 of the locking mechanism 670 is arranged at the upper base portion 636 of the support base 622. The second portion 674 of the locking mechanism 670 includes a locking element 680 selectively engageable with the locking groove 676 to lock the upper base portion 636 of the support base 622 against rotation relative to the lower base portion 635 of the support base 622 about the axis X6 of the positioning assembly 640.

[0270] In the illustrated, non-limiting embodiment, the locking element 680 is movably mounted to the upper base portion 636 proximate an end thereof. As shown, the locking element 680 is transformable, for example translatable between a first, extended position (FIGS. 30A and 30C) in which the locking element 680 protrudes from the upper base portion 636 of the support base and a second, retracted position (FIG. 30B) in which the locking element 680 does not protrude at an exterior of the upper base portion 636. When the locking element 680 is extended, the locking element 680 is engageable with the locking groove 676 to restrict movement of the upper base portion 636 of the support base 622

relative to the lower base portion 635 of the support base 622. The locking element 680 is receivable within the locking groove 676 when the upper base portion 636 is arranged at a first rotational position relative to the lower portion. In the illustrated, non-limiting embodiment, the locking element 680 is receivable within the locking groove 676 when the upper base portion 636 and the lower base portion 635 are aligned along the central longitudinal axis L5b, such as when the child seat 624 coupled to the upper base portion 636 is in a rearward-facing orientation for example.

[0271] When the locking element 680 is in the second, retracted position, the locking element 680 is retracted toward an interior of the upper base portion 636 of the support base 622, and therefore is disengaged from the locking groove 676. In this retracted position, the upper base portion 636 is not rotationally locked relative to the lower portion of the support base 622. Accordingly, when the locking element 680 is retracted, the upper base portion 636 of the support base 622, and therefore the child seat 624 connected thereto, is rotatable about the axis X6 of the positioning assembly 640 relative to the lower base portion 635 of the support base 622. A biasing member 682, such as a coil spring or torsion spring for example, may be operably coupled to a locking element 680 to bias the locking element 680 to the extended or locked position.

[0272] An actuator 690 is operably coupled to the locking element 680. The actuator 690 includes an actuation mechanism 692 and at least one handle 694a, 694 operably coupled to the actuation mechanism 692 and arranged at an exterior surface of the upper base portion 636 of the support base 622. In the illustrated, non-limiting embodiment, the actuator 690 includes a first handle 694a arranged at a first location about the upper base portion 636, such as a first lateral side thereof, and a second handle 694b arranged at a second location about the upper base portion 636, such as at an opposite, second lateral side thereof. In the illustrated, non-limiting embodiment, the handles 694a, 694b are integrally formed with the actuation mechanism 692. However, embodiments where one or more of the handles 694a, 694b are separate from and operably coupled to the actuation mechanism 692 are also contemplated herein.

[0273] In an embodiment, the locking element 680 includes an actuation feature 684 in movable engagement with actuation mechanism 692. To operate the actuator 690, to decouple the locking element 680 from the locking groove 676, a user applies a force F9 or F10 to the at least one handle 694a, 694b. The force F9 or F10 applied to the handle 694a, 694b is transmitted to the actuation mechanism 692, causing the actuation mechanism 692 to translate in the direction of the force. The engagement between the actuation feature 684 of

the locking element 680 and the actuation mechanism 692 as the actuation mechanism 692 opposes the biasing force of the biasing member 682. Via this movement of the actuation mechanism 692, the locking element 680 is separated from the locking groove 676. With the actuator 690 operated and the locking element 680 retracted, a user may then rotate the upper base portion 636 of the support base 622 relative to the lower base portion 635 of the support base 622 about the axis X6 defined by the positioning assembly 640. Upon removal of the force F9 or F10 from the handle 694a, 694b the biasing forces of the biasing member 682 acting on the locking element 680 biases the locking element 680 to an extended or unactuated position via the actuation mechanism 692.

[0274] In the illustrated, non-limiting embodiment, the actuation mechanism 692 has a triangular hole formed therein and the actuation feature has a complementary triangular shape arranged within the triangular hole. As the actuation mechanism 692 moves in a first direction, such as via application of a force F9 to the first handle 694a, the actuation feature 684 is translated against the bias of the biasing member 682, due to the slope of the engaged surfaces of the actuation feature 684 and the actuation mechanism 692. Similarly, as the actuation mechanism 692 moves in a second direction, such as via application of a force F10 to the second handle 694b, the actuation feature 684 is translated against the bias of the biasing member 682 due to the slope of the engaged surfaces of the actuation feature 684 and the actuation mechanism 692.

[0275] In an embodiment, the first portion 672 of the locking mechanism 670 additionally includes a second locking groove 678 extending about the axis X6 positioning assembly 640 and a portion of the locking element 680, such as an end 686 thereof may be movably coupled to the second locking groove 678. As the upper base portion 636 of the support base 622 rotates about the axis X6, the end 686 of the locking element 680 translates along the arcuate path of the second locking groove 678 in either a first direction or a second direction. In an embodiment, the end 686 of the locking element 680 cooperates with the second locking groove 678 to define an allowable rotation of the upper base portion 636 relative to the lower base portion 635 of the support base 622.

[0276] In an embodiment, the second locking groove 678 includes one or more features, such as contours for example, operable to lock the locking element 680, and therefore the upper base portion 636 of the support base 622 against rotation about the axis X6. In the illustrated, non-limiting embodiment, a first feature 679a is formed at the second locking groove 678 to lock the upper base portion 636 at a second rotational position relative to the lower base portion 635 of the support base 622. Alternatively, or in addition, a second

feature 679b may be formed at the second locking groove 678 to lock the upper base portion 636 at a third rotational position relative to the lower base portion 635 of the support base 622. As shown, the upper base portion 636 is rotated in a first direction about the axis X6 to the second rotational position and the upper base portion 636 is rotated in a second, opposite direction about the axis X6 to the third rotational position. The second rotational position and the third rotational position may be equidistantly spaced from the first rotational position. The child seat 624 may be arranged in a side facing orientation when the upper base portion 636 is in one of the second rotational position and the third rotational position. A user will determine which direction to rotate the upper base portion 636 about the axis X6 based on a location of the support base 622 relative to an adjacent vehicle door.

[0277] When the end 686 of the locking element 680 is engaged with either the first feature 679a or the second feature 679b is, the locking element 680 may be biased outwardly by the biasing member 682. Application of a force in a direction opposing the bias of the biasing member 682 may be required to reposition the locking element 680 within the second locking groove 678 for rotation about the axis X6. To unlock the upper base portion 636 from the second rotational position and/or the third rotational position, a user may apply a force to portion of the locking element 680 exposed at an exterior of the upper base portion 636 to oppose the biasing force of the biasing member 682 acting thereon.

[0278] With reference now to FIGS. 31A-32B, in an embodiment, the child seat 624 may alternatively or additionally be movable relative to the support base 622 to adjust an incline of the child seat 624. The child seat 624 may be movable along an incline path between a first position, such as a reclined position (FIG. 31A), and a second position, such as an upright position (FIG. 31B). However, it should be appreciated that the first position and the second position may both be positions arranged at an incline, the positions having varying degrees of incline. Further, embodiments where the child seat 624 may be arranged in any of a plurality of positions between the upright position and the reclined position are also contemplated herein.

[0279] In an embodiment, at least part of the upper base portion 636, and therefore a child seat 624 couplable thereto, is translatable relative to the lower base portion 635 to control an incline or recline of the child seat 624. In the illustrated, non-limiting embodiment, the upper base portion 636 includes a first base member 700, such as proximate the lower base portion 635, and a second base member 702 proximate an upper surface of the first base member 700. The child seat 624 is removably couplable to the second base member 702. As

shown, the second base member 702 may include a plurality of latches 704 operable to engage a corresponding bar (not shown) arranged at a bottom of the child seat 624.

[0280] The first base member 700 may be rotatably coupled to the lower base portion 635 via the positioning assembly 640 (see FIGS. 30A-30C). The second base member 702 is rotatably fixed to the first base member 700 and therefore the second base member 702 is rotatable with the first base member 700 relative to the lower base portion 635.

[0281] The second base member 702 may be translatable relative to the first base member 700 and the lower base portion 635 to control the incline or recline of the child seat 624. Although not shown, the first base member 700 may have a slot or groove defining the incline path of the child seat 624, and the second base member 702 may have an engagement member such as a post or pin for example, slidably arranged within the slot to control movement of the second base member 702 relative to the first base member 700. It should be appreciated that in other embodiments, the slot may be formed in the second base member 702, and the engagement member may extend from the first base member 700. Further, the interface between the first and second base members 700, 702 to define the incline path as described herein is intended as an example only and that any suitable connection between the first base member 700 and the second base member 702 is within the scope of the disclosure. As described herein, the movement of the second base member 702 relative to the first base member 700 is independent from the positioning assembly 640, and therefore is independent from the rotation of the upper base portion 636 relative to the lower base portion 635. Accordingly, in some embodiments, the incline or recline of the second base member 702 and child seat 624 may be adjusted when the upper base portion 636 is at any rotational position relative to the lower base portion 635.

[0282] A recline lock mechanism (not shown) may be operable to lock the second base member 702 and the child seat 624 in a position along the incline path. The recline lock mechanism may include at least one lock pin coupled to one of the first base member 700 and the second base member 702 and biased into engagement with the other of the first base member 700 and the second base member 702. For example, a lock pin may be arranged at the second base member 702 and is movable between a first, locked position in which the second base member 702 is not movable relative to the first base member 700 and a second, unlocked position in which the second base member 702 is freely movable relative to the first base member 700 to adjust an incline of the second base member 702 and the child seat 624.

[0283] In such embodiments, a plurality of lock openings may be formed in a portion of the first base member 700, such as at a sidewall thereof. Each lock opening may be associated

with a different position of the second base member 702 along the incline path. When the lock pin is in a locked position, an end of the lock pin is engaged with a corresponding lock opening of the first base member 700. When the lock pin is in the second, unlocked position, the end of the lock pin is separated or disengaged from the lock openings, allowing the second base member 702, and a child seat 624 coupled to the second base member 702 to be inclined or reclined along the incline path.

[0284] An actuator (not shown) may be operably coupled to the recline lock mechanism, such as to the lock pin. Operation of the actuator will apply a force to the lock pin, causing the lock pin to transform from the locked position to the unlocked position. While the lock pin is held in the unlocked position via the actuator, the second base member 702 may be movable relative to the first base member 700 to achieve a desired angle of recline or incline. In an embodiment, the actuator 690 associated with rotation of the upper base portion 636 relative to the lower base portion 635 via the positioning assembly is also operably coupled to the recline lock mechanism to selectively unlock the second base member 702 from the first base member 700. However, embodiments where separate actuators are associated with operation of the positioning assembly and the recline lock mechanism are also contemplated herein.

[0285] The recline lock mechanism and corresponding actuator associated therewith are described herein as an example only and any suitable mechanism and actuator are within the scope of the disclosure. Further, it should be appreciated that the child seat 224, 324, 424, 524, 624 of any of the child restraint systems 220, 320, 420, 520, 620 illustrated and described herein may be similarly movable relative to a corresponding support base 222, 322, 422, 522, 622 to adjust an incline of the child seat 224, 324, 424, 524, 624 relative thereto.

[0286] Advantageously, embodiments of the present disclosure provide for improved child seats and/or child restraint systems for use in vehicles. The child restraint systems described herein include a child seat that is movably mounted to a support base. The support base can provide multiple degrees of freedom or movement, including, but not limited to rotating and sliding movement of the child seat. The multiple degrees of movement may be provided by a multi-layer support base. As such, a child seat may be rotated and moved, even when the support base is fixedly attached to a vehicle (or vehicle seat). As such, improved use and ease of use are provided for caregivers when putting a child into the child seat or removing the child from the child seat. In accordance with some embodiments of the present disclosure, a support base of a child restraint system may include multiple layers that are moveable relative to each other. The layers can provide both rotational movement and

translational movement to provide a greater range of motion as compared to conventional child restraint systems.

[0287] The term “about” is intended to include the degree of error associated with measurement of the particular quantity based upon the equipment available at the time of filing the application. As used herein, the term “substantially” and derivatives thereof, and words of similar import, when used to describe a size, shape, orientation, distance, spatial relationship, or other parameter includes the stated size, shape, orientation, distance, spatial relationship, or other parameter, and can also include a range up to 10% more and up to 10% less than the stated parameter, including 5% more and 5% less, including 3% more and 3% less, including 1% more and 1% less.

[0288] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the present disclosure. As used herein, the singular forms “a,” “an” and “the” are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms “comprises” and/or “comprising,” when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, element components, and/or groups thereof.

[0289] While the present disclosure has been described with reference to an exemplary embodiment or embodiments, it will be understood by those skilled in the art that various changes may be made, and equivalents may be substituted for elements thereof without departing from the scope of the present disclosure. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the present disclosure without departing from the essential scope thereof. Therefore, it is intended that the present disclosure not be limited to the particular embodiment disclosed as the best mode contemplated for carrying out this present disclosure, but that the present disclosure will include all embodiments falling within the scope of the claims.

What is claimed is:

1. A child restraint system comprising:
a child seat;
a support base configured to support the child seat thereon;
a positioning assembly operably coupled to the child seat and the support base, the child seat being movable relative to at least a portion of the support base between a plurality of positions via the positioning assembly, the positioning assembly having a first portion associated with the support base and a second portion associated with the child seat, the first portion of the positioning assembly being offset from a centerline of at least one of the child seat and the support base; and
wherein the child seat is selectively lockable at one or more of the plurality of positions relative to the at least a portion of the support base.
2. The child restraint system of claim 1, wherein the plurality of positions includes a first rotational position a second rotational position, the child seat being in a rearward-facing orientation relative to the at least a portion of the support base at the first rotational position and the child seat being in a side-facing orientation relative to the at least a portion of the support base at the second rotational position.
3. The child restraint system of claim 1, wherein the plurality of positions includes a first rotational position a second rotational position, the child seat being in a rearward facing orientation relative to the at least a portion of the support base at the first rotational position and the child seat being in a forward facing orientation relative to the at least a portion of the support base at the second rotational position.
4. The child restraint system of claim 3, wherein the plurality of positions includes a third rotational position arranged between the first rotational position and the second rotational position, the child seat being in a side facing orientation relative to the at least a portion of the support base at the third rotational position.
5. The child restraint system of claim 1, wherein the support base includes an upper base portion and a lower base portion, the upper base portion being rotatable relative to the lower base portion, wherein the child seat is connectable to the upper base portion such that the child seat is rotatable with the upper base portion relative to the lower base portion.
6. The child restraint system of claim 5, wherein the first portion of the positioning assembly is associated with the upper base portion, the child seat being movable relative to the upper base portion via the positioning assembly.

7. The child restraint system of claim 5, wherein the first portion of the positioning assembly is associated with the lower base portion and the second portion of the positioning assembly is associated with the upper base portion, the upper base portion being movable relative to the lower base portion via the positioning assembly.

8. The child restraint system of claim 1, wherein the positioning assembly defines at least one axis and the child seat is rotatable about the at least one axis between the plurality of positions.

9. The child restraint system of claim 8, wherein the first portion of the positioning assembly includes at least one positioning element and the second portion of the positioning assembly includes at least one positioning slot, the at least one positioning element being receivable within the at least one positioning slot.

10. The child restraint system of claim 9, wherein the second portion of the positioning assembly includes at least one engagement pin operable to restrict translation of the at least one positioning element within the at least one positioning slot while the child seat remains coupled to the support base.

11. The child restraint system of claim 10, further comprising an actuator associated with the at least one positioning element, wherein the actuator is operable to move the at least one positioning element away from the at least one positioning slot.

12. The child restraint system of claim 9, wherein the second portion of the positioning assembly includes at least one engagement pin operable to restrict separation of the at least one positioning element from the at least one positioning slot.

13. The child restraint system of claim 12, wherein the at least one engagement pin is movable between an extended position and a retracted position, the at least one engagement pin being arranged within the at least one positioning slot when in the extended position and the at least one engagement pin being separated from the at least one positioning slot when in the retracted position.

14. The child restraint system of claim 13, further comprising an actuator operably coupled to the at least one engagement pin, the actuator being operable to transform the at least one engagement pin between the extended position and the retracted position.

15. The child restraint system of claim 13, wherein the at least one positioning element includes a first positioning element and a second positioning element, the at least one axis of the positioning assembly including a first axis defined by the first positioning element and a second axis defined by the second positioning element.

16. The child restraint system of claim 15, wherein both the first positioning element and the second positioning element are offset from the centerline of the support base.

17. The child restraint system of claim 15, wherein the at least one engagement pin includes a first engagement pin operable to restrict separation of the first positioning element from a first positioning slot of the at least one positioning slot and a second engagement pin operable to restrict separation of the second positioning element from a second positioning slot of the at least one positioning slot.

18. The child restraint system of claim 17, wherein the first engagement pin is movable between the extended position and the retracted position independently from the second engagement pin.

19. The child restraint system of claim 18, further comprising an actuator including a first handle operable to move the first engagement pin between the extended position and the retracted position, and a second handle operable to move the second engagement pin between the extended position and the retracted position, the first handle and the second handle being integrally formed.

20. The child restraint system of claim 1, further comprising a locking mechanism operable to lock the child seat at one or more of the plurality of positions.

21. The child restraint system of claim 20, wherein the locking mechanism includes:
a locking element arranged at one of the child seat and the at least a portion of the support base;

a locking slot arranged at the other of the child seat and the at least a portion of the support base, the locking element being receivable within the locking slot; and

wherein the locking element is arranged within the locking slot when the child seat is locked at the one or more of the plurality of positions relative to the at least a portion of the support base.

22. The child restraint system of claim 21, wherein the locking mechanism includes at least one lock pin operable to restrict separation of the locking element from the locking slot.

23. The child restraint system of claim 22, wherein the at least one lock pin is movable between an extended position and a retracted position, the at least one lock pin being arranged within the locking slot when in the extended position and the at least one lock pin being separated from the locking slot when in the retracted position.

24. The child restraint system of claim 1, further comprising:

a locking mechanism operable to lock the child seat at one or more of the plurality of positions; and

an actuator operably coupled to the both the positioning assembly and the locking mechanism.

25. The child restraint system of claim 24, wherein application of force to the actuator in a first direction is associated with operation of the positioning assembly and application of a force to the actuator in a second direction is associated with operation of the locking mechanism.

26. The child restraint system of claim 25, wherein the force applied in the first direction is a pulling force and the force applied in the second direction is a pushing force.

27. The child restraint system of claim 1, wherein the centerline is arranged at the child seat, the centerline extending between lateral sides of the child seat at a position equidistantly spaced between a front and a back of the child seat.

28. The child restraint system of claim 1, wherein the centerline is arranged at the support base, the centerline extending between lateral sides of the support base at a position equidistantly spaced between a front and a back of the support base.

29. The child restraint system of claim 1, wherein the centerline is perpendicular to a longitudinal axis of the support base and intersects a center of gravity of the child seat when a longitudinal axis of the child seat is aligned with the longitudinal axis of the support base.

30. The child restraint system of claim 1, wherein the child seat is separable from support base via translation of the child seat toward a lateral side of the support base.

31. The child restraint system of claim 1, wherein the child seat is movable relative to the support base along an incline path between an upright position and a reclined position.

32. The child restraint system of claim 31, wherein the child seat is movable along the incline path when the child seat is at any of the plurality of positions.

33. The child restraint system of claim 31, wherein the child seat is movable along the incline path independently from the positioning assembly.

34. The child restraint system of claim 31, wherein the support base includes an upper base portion and a lower base portion, the upper base portion including a first base member and a second base member, the first base member being rotatably coupled to the lower base portion via the positioning assembly, and the second base member being movable relative to the first base member along the incline path.

35. A child restraint system comprising:
a child seat;
a support base configured to support the child seat thereon, the child seat being removably connected to the support base; and

wherein the child seat is separable from the support base via a translation of the child seat toward a lateral side of the support base.

36. The child restraint system of claim 35, further comprising a positioning assembly operably coupled to the child seat and the support base, wherein the child seat is translatable relative to the child seat via the positioning assembly.

37. The child restraint system of claim 36, the positioning assembly having a first portion associated with the support base and a second portion associated with the child seat, the second portion of the positioning assembly being selectively engageable with the first portion of the positioning assembly to couple the child seat to the support base.

38. The child restraint system of claim 37, wherein engagement between the first portion and the second portion of the positioning assembly defines a path of movement of the child seat relative to the support base.

39. The child restraint system of claim 37, wherein the child seat is directly couplable to the support base via engagement of the first portion of the positioning assembly and the second portion of the positioning assembly.

40. The child restraint system of claim 37, wherein the first portion of the positioning assembly includes at least one positioning element and the second portion of the positioning assembly includes at least one positioning slot, the at least one positioning element being receivable within the at least one positioning slot.

41. The child restraint system of claim 40, further comprising an actuator operably coupled to the at least one positioning slot, the actuator being operable to control separation of the at least one positioning element from the at least one positioning slot.

42. The child restraint system of claim 41, wherein the second portion of the positioning assembly includes at least one engagement pin operable to restrict the translation of the at least one positioning element within the at least one positioning slot.

43. The child restraint system of claim 42, wherein the at least one engagement pin is movable between an extended position and a retracted position, the at least one engagement pin being arranged within the at least one positioning slot when in the extended position and the at least one engagement pin being separated from the at least one positioning slot when in the retracted position.

44. The child restraint system of claim 43, wherein the actuator is operably coupled to the at least one engagement pin, the actuator being operable to transform the at least one engagement pin from the extended position to the retracted position.

45. The child restraint system of claim 43, wherein the child seat is translatable relative to the support base when the at least one engagement pin is in the retracted position.

46. The child restraint system of claim 43, wherein the at least one engagement pin is movable between the extended position and the retracted position in response to application of a force to the child seat.

47. The child restraint system of claim 35, wherein the child seat is selectively rotatable relative to the support base when the child seat is coupled to the support base.

48. The child restraint system of claim 47, wherein an axis of rotation of the child seat is offset from a centerline of at least one of the child seat and the support base.

49. The child restraint system of claim 48, wherein the centerline is arranged at the child seat, the centerline extending between lateral sides of the child seat at a position equidistantly spaced between a front and a back of the child seat.

50. The child restraint system of claim 48, wherein the centerline is arranged at the support base, the centerline extending between lateral sides of the support base at a position equidistantly spaced between a front and a back of the support base.

51. The child restraint system of claim 48, wherein the centerline is perpendicular to a longitudinal axis of the support base and intersects a center of gravity of the child seat when a longitudinal axis of the child seat is aligned with the longitudinal axis of the support base.

52. The child restraint system of claim 35, wherein the child seat is translatable out of engagement with the support base in a direction oriented at a non-parallel angle to the axis of rotation.

53. A child restraint system comprising:
a child seat;
a support base configured to support the child seat thereon, the child seat being removably connected to the support base; and
a positioning assembly operable to directly couple the child seat to the support base, wherein the child seat is rotatable about an axis of rotation relative to the support base via the positioning assembly and the child seat being translatable relative to the child seat via the positioning assembly.

54. The child restraint system of claim 53, wherein the child seat is translatable relative to the support base in a direction oriented at a non-parallel angle to the axis of rotation.

55. The child restraint system of claim 53, wherein the positioning assembly has a first portion associated with the support base and a second portion associated with the child

seat, the second portion of the positioning assembly being selectively engageable with the first portion of the positioning assembly to couple the child seat to the support base.

56. The child restraint system of claim 55, wherein the engagement between the first portion and the second portion of the positioning assembly defines a path of movement of the child seat relative to the support base.

57. The child restraint system of claim 55, wherein the first portion of the positioning assembly includes at least one positioning element and the second portion of the positioning assembly includes at least one positioning slot, the at least one positioning element being receivable within the at least one positioning slot.

58. The child restraint system of claim 57, further comprising an actuator operably coupled to the at least one positioning slot, the actuator being operable to control separation of the at least one positioning element from the at least one positioning slot.

59. The child restraint system of claim 58, wherein the second portion of the positioning assembly includes at least one engagement pin operable to restrict translation of the at least one positioning element within the at least one positioning slot.

60. The child restraint system of claim 59, wherein the at least one engagement pin is movable between an extended position and a retracted position, the at least one engagement pin being arranged within the at least one positioning slot when in the extended position and the at least one engagement pin being separated from the at least one positioning slot when in the retracted position.

61. The child restraint system of claim 60, wherein the actuator is operably coupled to the at least one engagement pin, the actuator being operable to transform the at least one engagement pin from the extended position to the retracted position.

62. The child restraint system of claim 61, wherein the child seat is translatable relative to the support base when the at least one engagement pin is in the retracted position.

63. The child restraint system of claim 61, wherein the at least one engagement pin is movable between the extended position and the retracted position in response to application of a force to the child seat.

64. The child restraint system of claim 53, wherein the axis of rotation is offset from a centerline of at least one of the child seat and the support base.

65. The child restraint system of claim 64, wherein the centerline is arranged at the child seat, the centerline extending between lateral sides of the child seat at a position equidistantly spaced between a front and a back of the child seat.

66. The child restraint system of claim 64, wherein the centerline is arranged at the support base, the centerline extending between lateral sides of the support base at a position equidistantly spaced between a front and a back of the support base.

67. The child restraint system of claim 64, wherein the centerline is perpendicular to a longitudinal axis of the support base and intersects a center of gravity of the child seat when a longitudinal axis of the child seat is aligned with the longitudinal axis of the support base.

68. The child restraint system of claim 53, wherein the child seat is movable relative to the support base along an incline path between an upright position and a reclined position.

69. The child restraint system of claim 68, wherein the child seat is movable along the incline path when the child seat is at any position about the axis of rotation.

70. The child restraint system of claim 68, wherein the child seat is movable along the incline path independently from the positioning assembly.

71. The child restraint system of claim 68, wherein the support base includes an upper base portion and a lower base portion, the upper base portion including a first base member and a second base member, the first base member being rotatably coupled to the lower base portion via the positioning assembly, and the second base member being movable relative to the first base member along the incline path.

72. A child restraint system comprising:
a child seat;
a support base configured to support the child seat thereon; and
wherein the child seat is rotatably coupled to the support base, the child seat being selectively rotatable relative to at least a portion of the support base about one of a plurality of axes.

73. The child restraint system of claim 72, wherein the plurality of axes includes a first axis and a second axis, the first axis and the second axis being parallel.

74. The child restraint system of claim 73, wherein the first axis and the second axis are arranged at opposite sides of a central longitudinal axis of the support base.

75. The child restraint system of claim 73, wherein the first axis and the second axis are arranged within a plane oriented parallel to an end of the support base.

76. The child restraint system of claim 73, wherein the child seat is rotatable about the first axis of the plurality of axes when the child seat is in a rearward-facing orientation and the child seat is rotatable about the second axis of the plurality of axes when the child seat is in a forward facing orientation.

77. The child restraint system of claim 73, wherein the child seat is rotatable about the first axis to arrange a front end of the child seat at a position laterally offset from a first lateral side of the support base and the child seat is rotatable about the second axis to arrange the front end of the child seat at a position laterally offset from a second lateral side of the support base.

78. The child restraint system of claim 72, further comprising a positioning assembly operably coupled to the child seat and the at least a portion of the support base, wherein the child seat is connectable to the at least a portion of the support base via the positioning assembly.

79. The child restraint system of claim 78, wherein the child seat is translatable relative to the at least a portion of the support base via the positioning assembly.

80. The child restraint system of claim 78, wherein the positioning assembly has a first portion associated with the at least a portion of the support base and a second portion associated with the child seat, the second portion of the positioning assembly being selectively engageable with the first portion of the positioning assembly to couple the child seat to the at least a portion of the support base.

81. The child restraint system of claim 80, wherein engagement between the first portion and the second portion of the positioning assembly defines at least one path of movement of the child seat relative to the at least a portion of the support base.

82. The child restraint system of claim 80, wherein the first portion of the positioning assembly includes a first positioning element defining a first axis of rotation of the plurality of axes or rotation and a second positioning element defining a second axis of rotation of the plurality of axes or rotation.

83. The child restraint system of claim 82, wherein the second portion of the positioning assembly includes a first positioning slot and a second positioning slot, the first positioning element being receivable within the first positioning slot, and the second positioning element being receivable within the second positioning slot.

84. The child restraint system of claim 83, further comprising an actuator operably coupled to the first positioning slot and the second positioning slot, the actuator being operable to control separation of the first positioning element and the second positioning element from the first positioning slot and the second positioning slot.

85. The child restraint system of claim 84, wherein the second portion of the positioning assembly includes a first engagement pin operable to restrict translation of the first positioning element within the first positioning slot and a second engagement pin operable to restrict translation of the second positioning element within the second positioning slot.

86. The child restraint system of claim 85, wherein each of the first engagement pin and the second engagement pin is movable between an extended position and a retracted position, the first engagement pin being arranged within the first positioning slot when in the extended position and the second engagement pin being arranged within the second positioning slot when in the extended position and the first engagement pin being separated from the first positioning slot when in the retracted position and the second engagement pin being separated from the second positioning slot when in the retracted position.

87. The child restraint system of claim 86, wherein the actuator is operably coupled to both the first engagement pin and the second engagement pin, the actuator being operable to transform at least one of the first engagement pin and the second engagement pin from the extended position to the retracted position.

88. The child restraint system of claim 86, wherein the actuator is operable to independently transform the first engagement pin and the second engagement pin from the extended position to the retracted position.

89. The child restraint system of claim 88, wherein the actuator includes a first handle operable to move the first engagement pin between the extended position and the retracted position and the actuator includes a second handle operable to move the second engagement pin between the extended position and the retracted position.

90. The child restraint system of claim 89, wherein the actuator includes a third handle operable to simultaneously move the first engagement pin and the second engagement pin from the extended position to the retracted position.

91. The child restraint system of claim 72, wherein the support base includes an upper portion and a lower portion, the upper portion being rotatable relative to the lower portion.

92. The child restraint system of claim 91, wherein the child seat is selectively rotatable relative to the upper portion of the support base about one of the plurality of axes.

93. The child restraint system of claim 92, wherein the child seat is rotatable with the upper portion of the support base relative to the lower portion of the support base.

94. The child restraint system of claim 91, wherein the child seat is rotatable with the upper portion of the support base relative to the lower portion of the support base about one of the plurality of axes.

95. A child restraint system comprising:
a child seat;

a support base configured to support the child seat thereon, the support base having a rear end and an opposing front end spaced from the rear end in a front direction, the support base defining a centerline that extends substantially perpendicular to the front direction and through a center of the support base located between the front end and the rear end;

a positioning assembly operably coupled to the child seat and the support base, the child seat being movable relative to the support base between a plurality of positions via the positioning assembly, the positioning assembly having a first portion associated with the support base and a second portion associated with the child seat, the first portion of the positioning assembly being offset from the centerline of the support base; and

wherein the child seat is selectively lockable at one or more of the plurality of positions relative to the support base.

96. The child restraint system of claim 95, wherein the first portion of the positioning assembly is rotatably connectable to the second portion of the positioning assembly such that the child seat is rotatable relative to the support base between the plurality of positions.

97. The child restraint system of claim 96, wherein the centerline is a support base centerline, and wherein the front direction is a support base front direction, the child seat having a rear end and an opposing front end spaced from the rear end in a seat front direction, the front end of the child seat being adjacent to legs of a child positioned in the child seat, the child seat defining a seat centerline that extends substantially perpendicular to the seat front direction and through a center of the child seat located between the front end and the rear end of the child seat,

the second portion of the positioning assembly being located between the seat centerline and the rear end of the child seat.