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(54) **LOCK-OFF MECHANISM FOR A CHILD SEAT**

Related U.S. Application Data

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(57) **ABSTRACT**

A forward-facing child seat includes a base, a seat removably attachable to the base in a forward-facing orientation relative to a front of the vehicle, and at least one lock-off mechanism mounted to the base to secure a vehicle seat belt to the base. The lock-off mechanism may be one of a variety. For example, the lock-off mechanism may include a lower jaw mounted to the base, and an upper jaw movable relative to the lower jaw between an open position and a closed position.

(73) Assignee: **Graco Children's Products Inc.**

(21) Appl. No.: **10/999,144**

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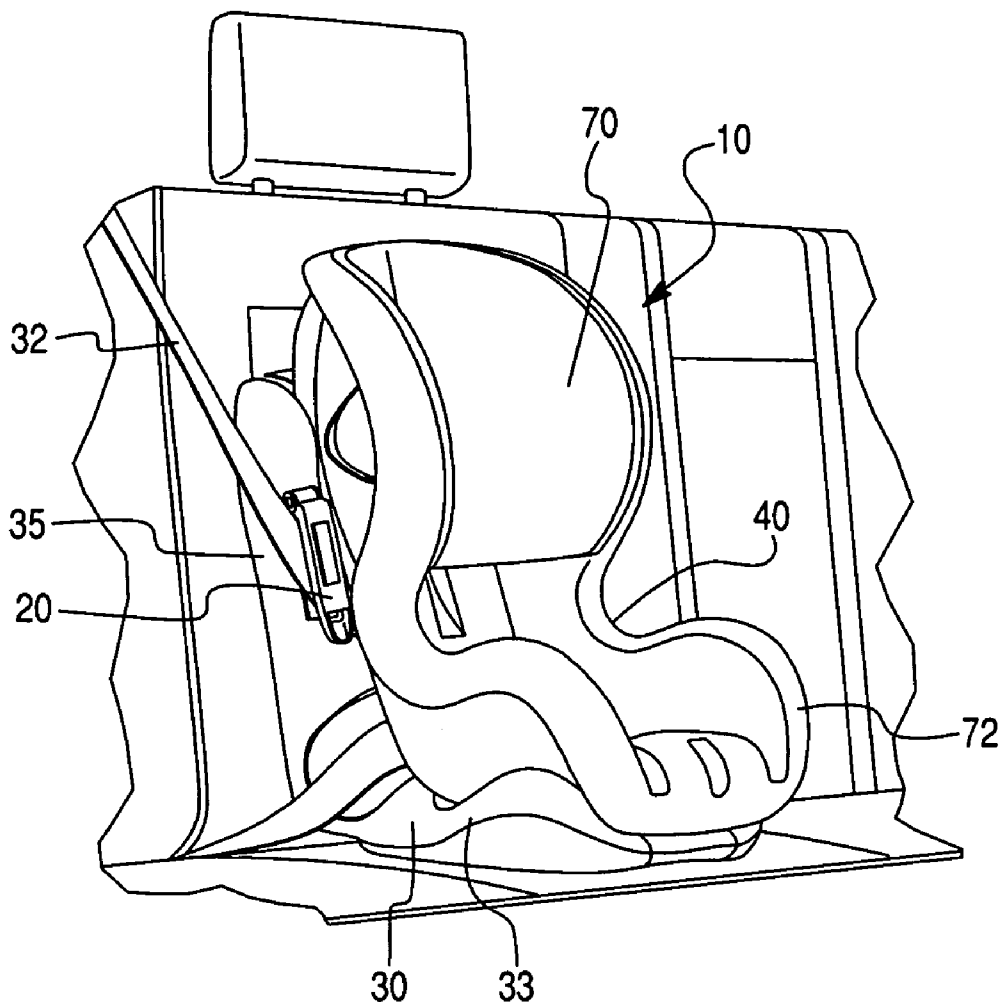


FIG. 1

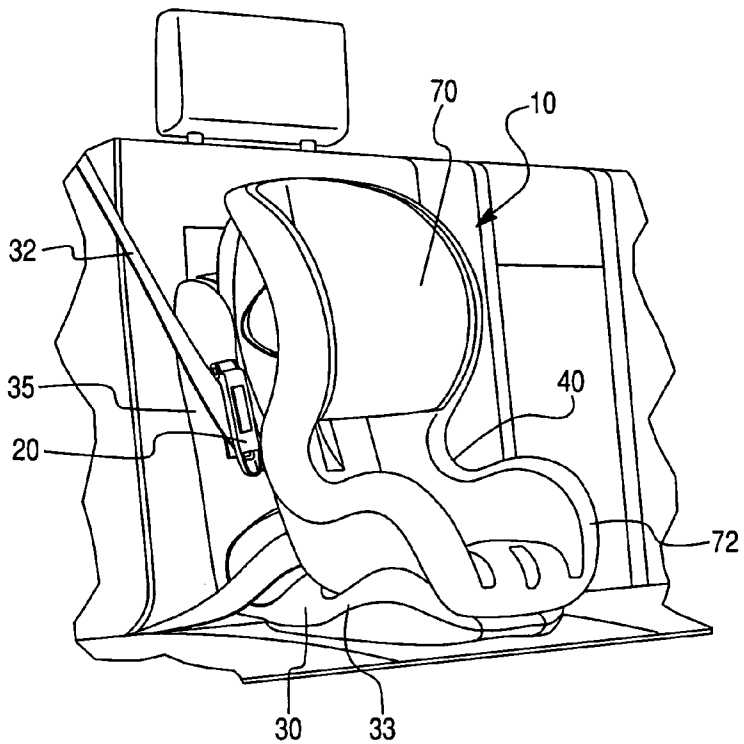


FIG. 2

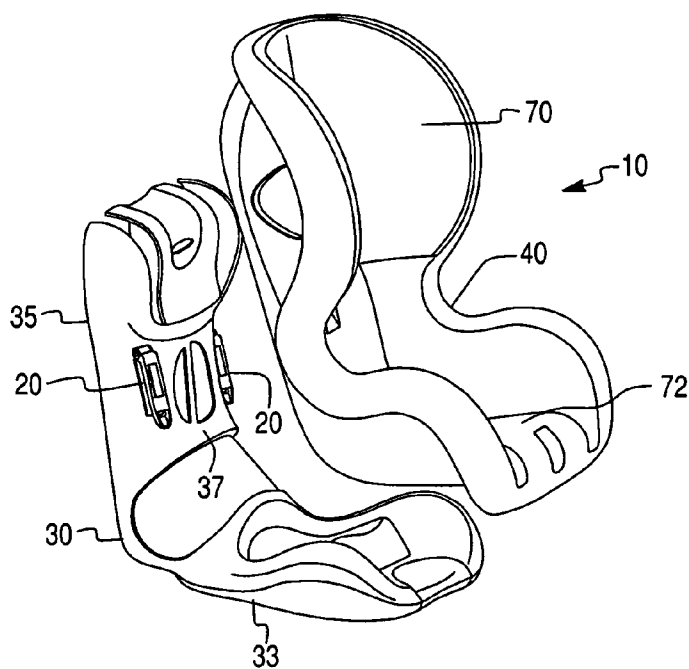


FIG. 3

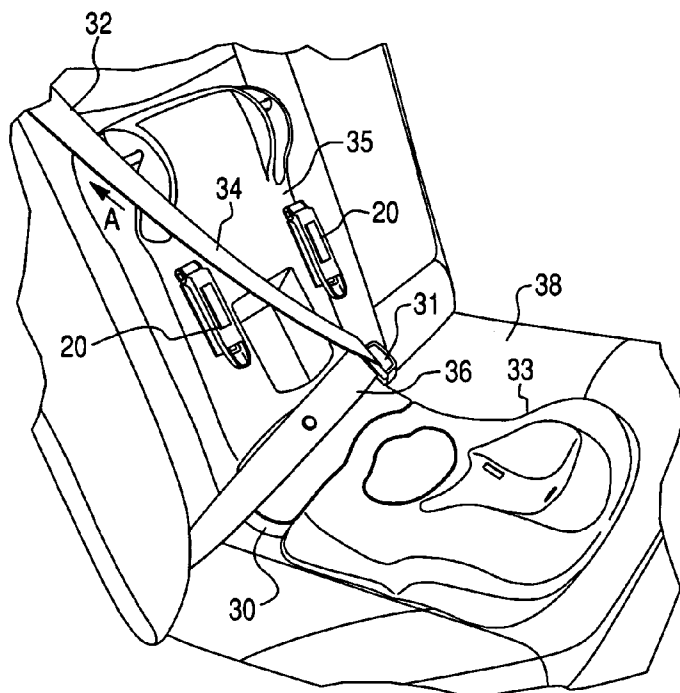


FIG. 4

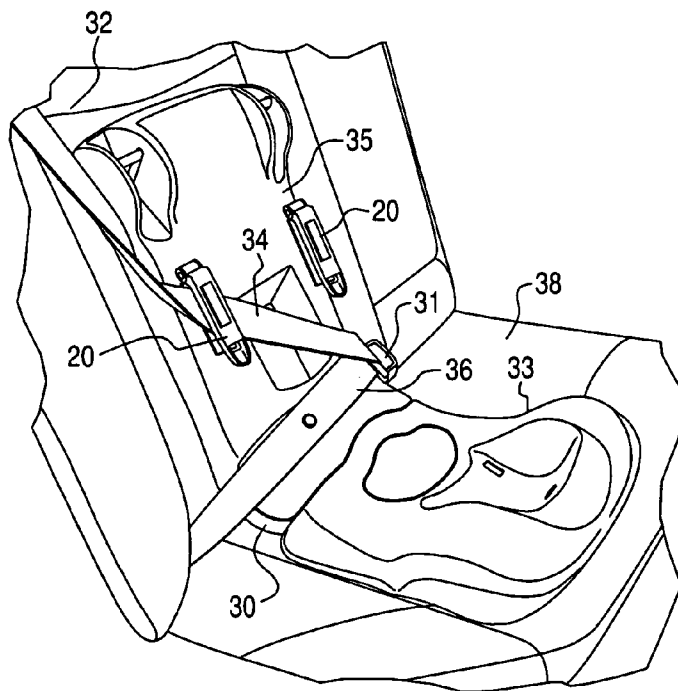


FIG. 5A

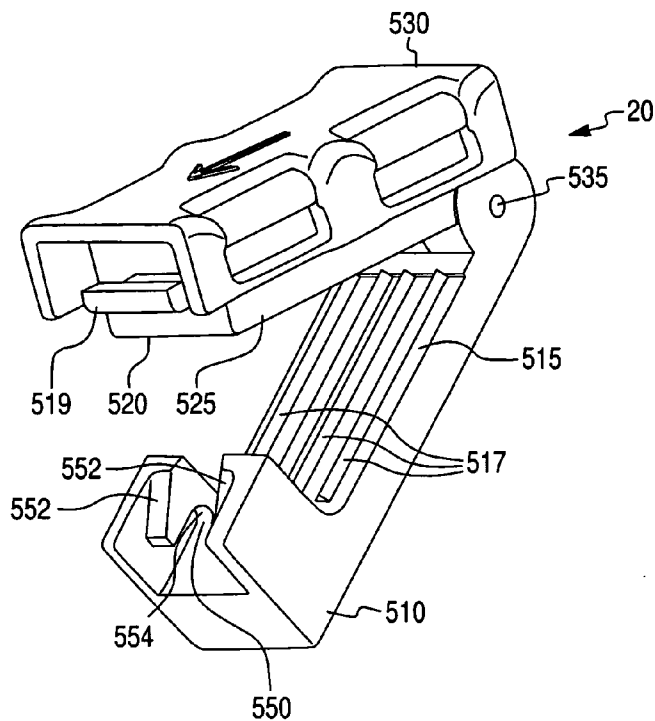


FIG. 5B

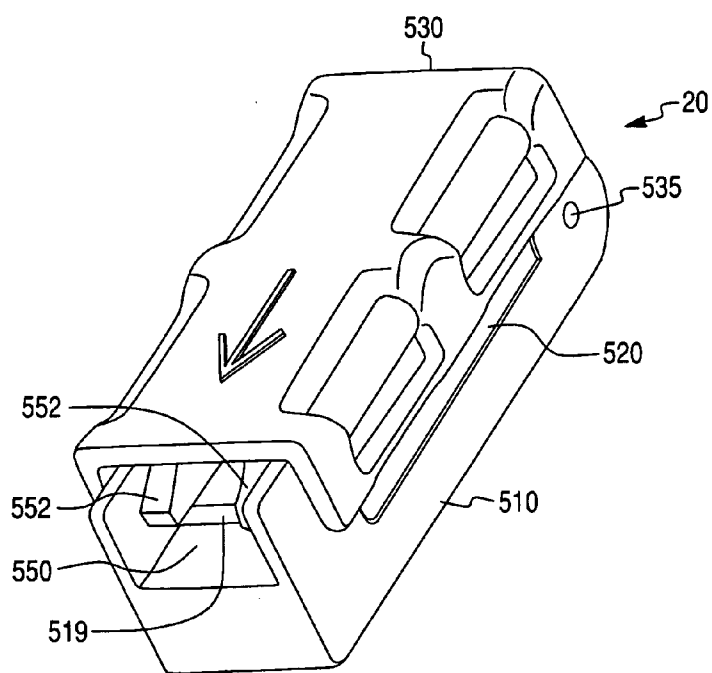


FIG. 5C

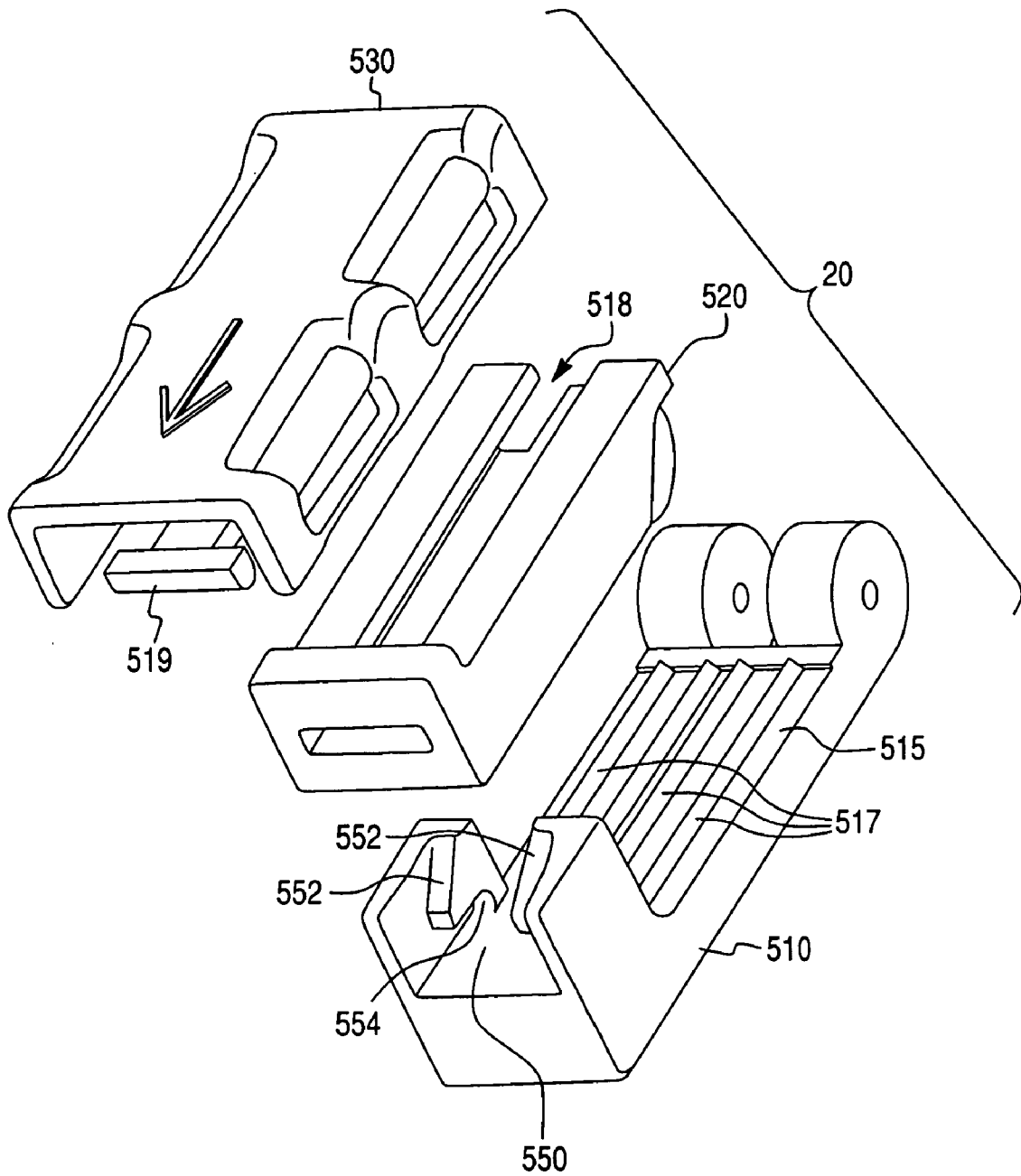


FIG. 6A

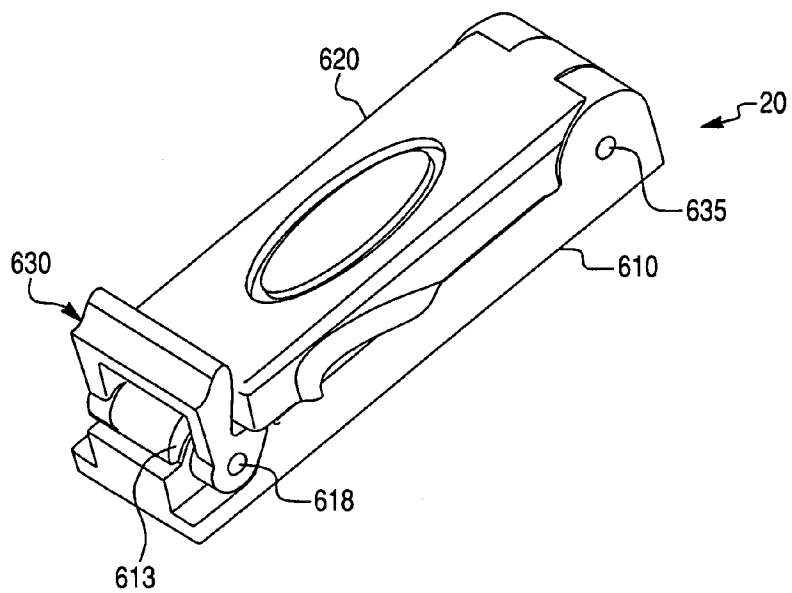


FIG. 6B

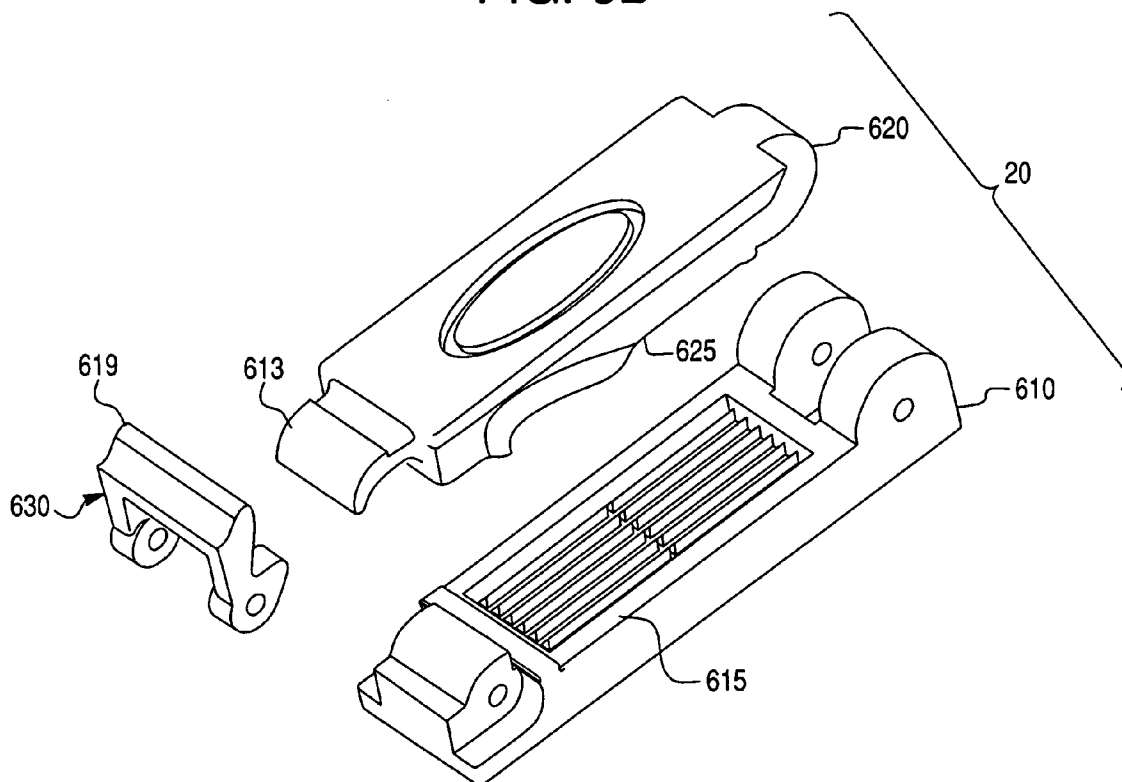


FIG. 6C

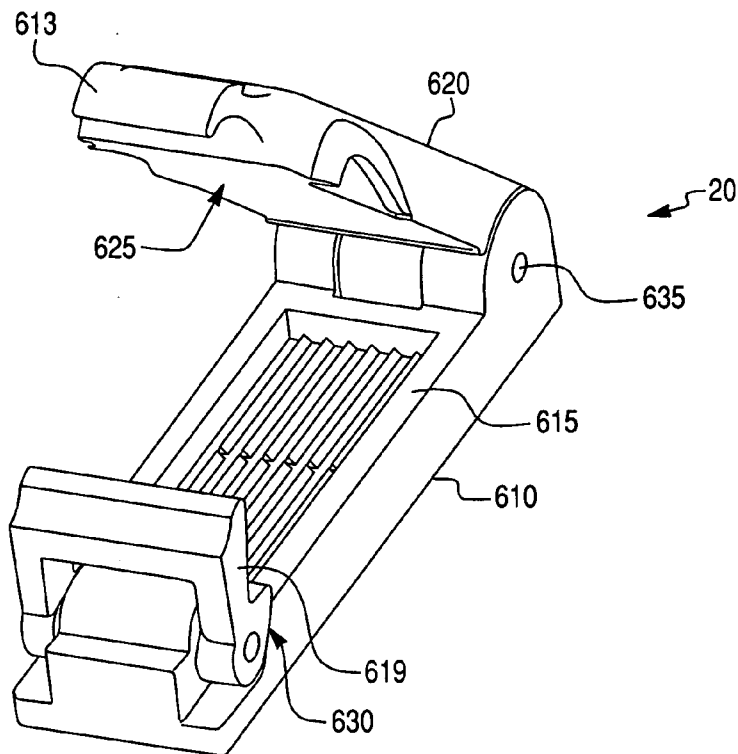


FIG. 7A

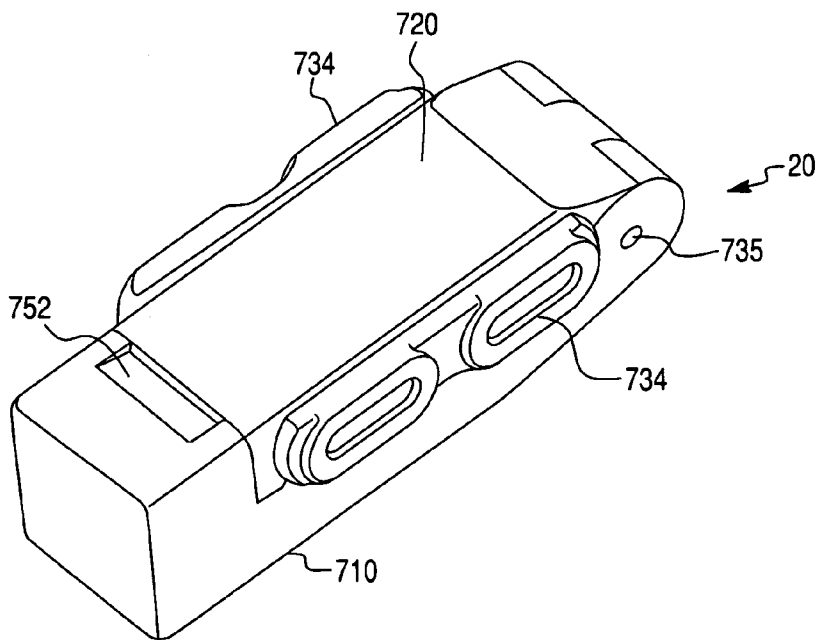


FIG. 7B

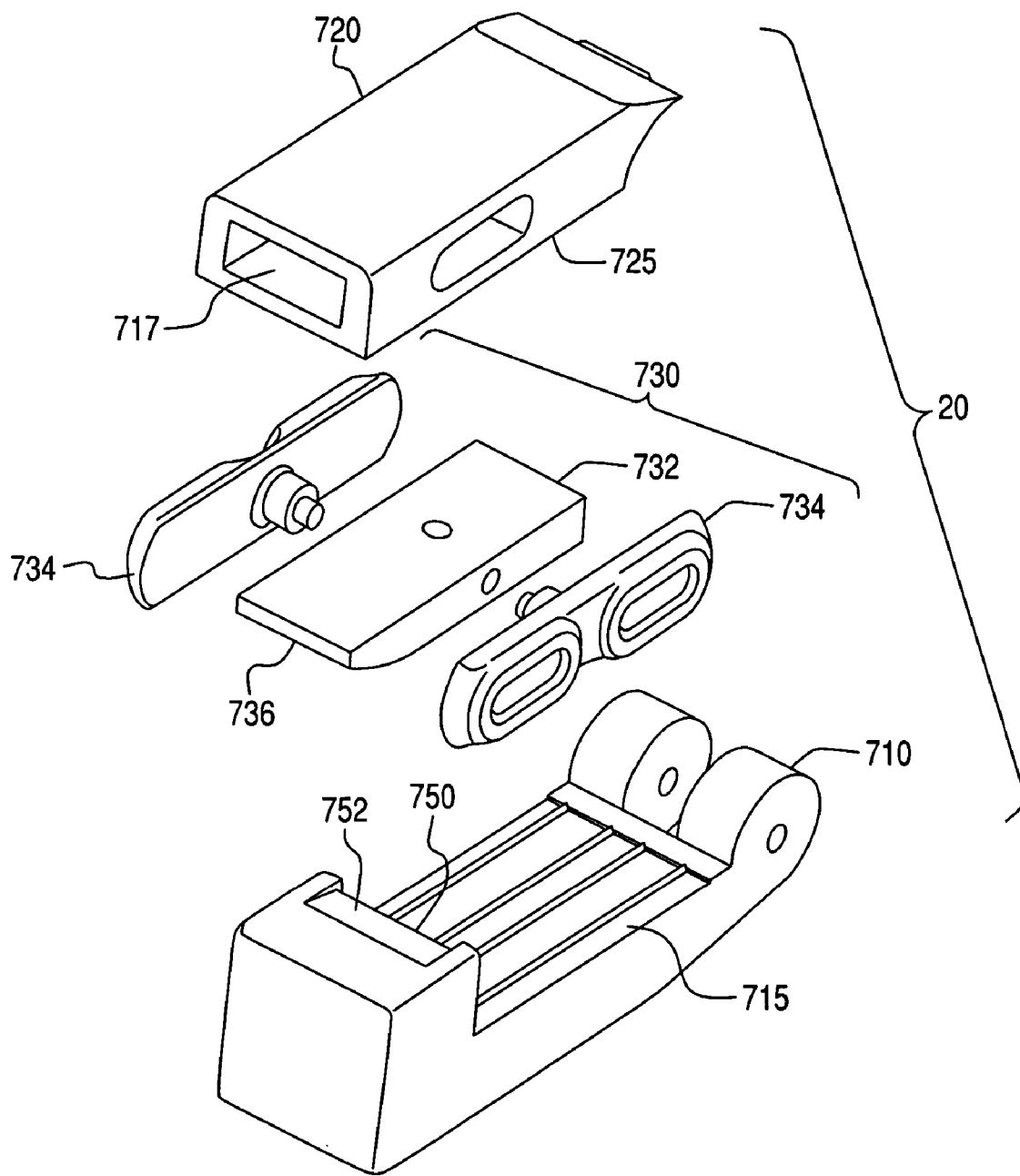


FIG. 7C

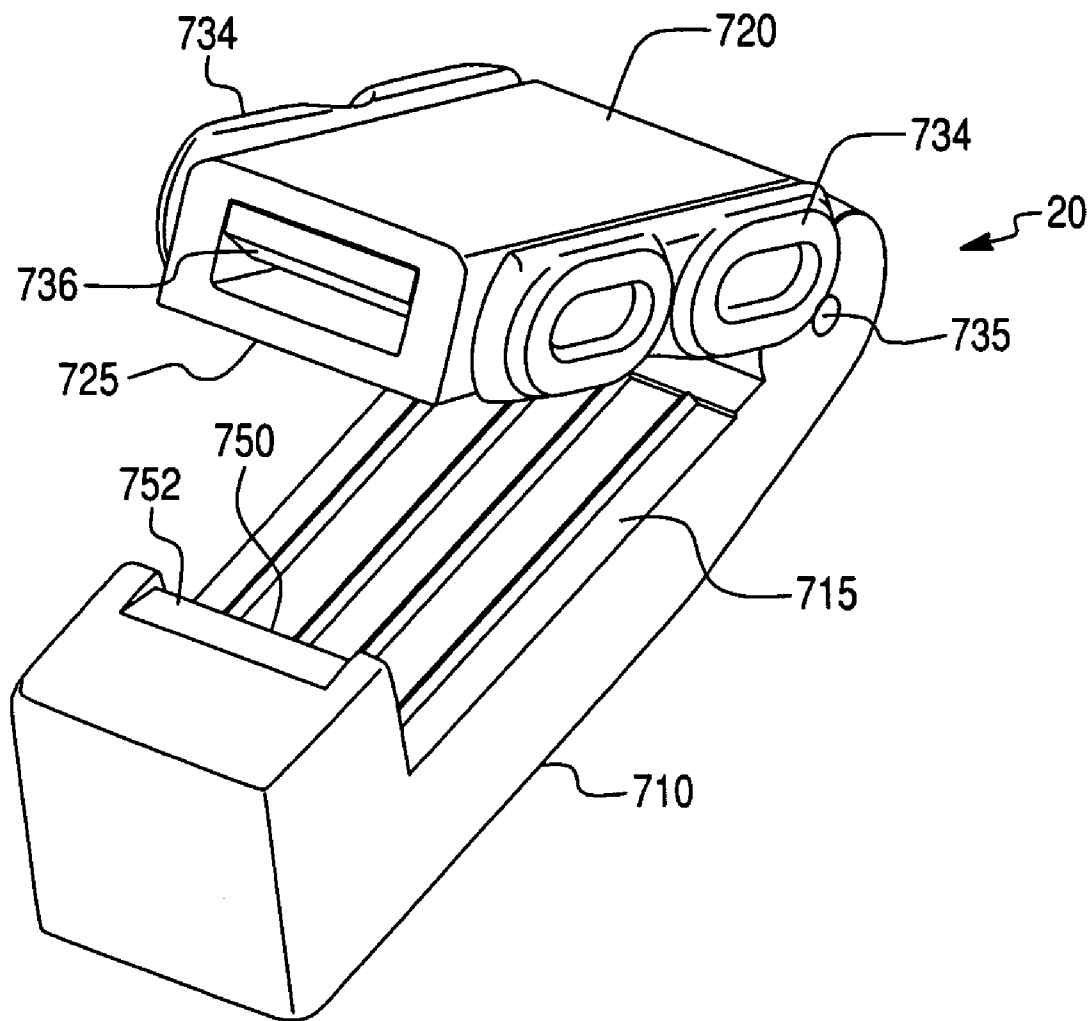


FIG. 8A

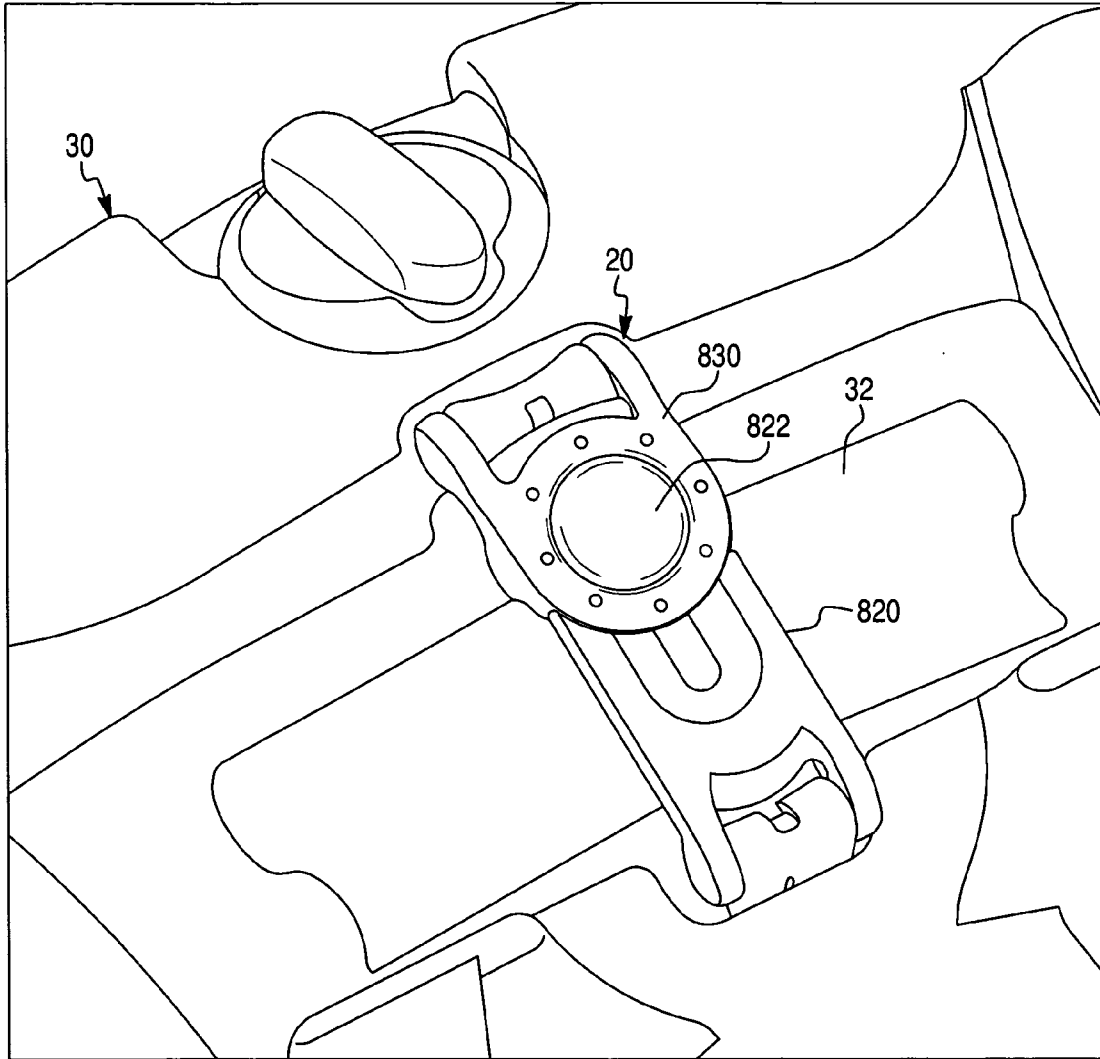


FIG. 8B

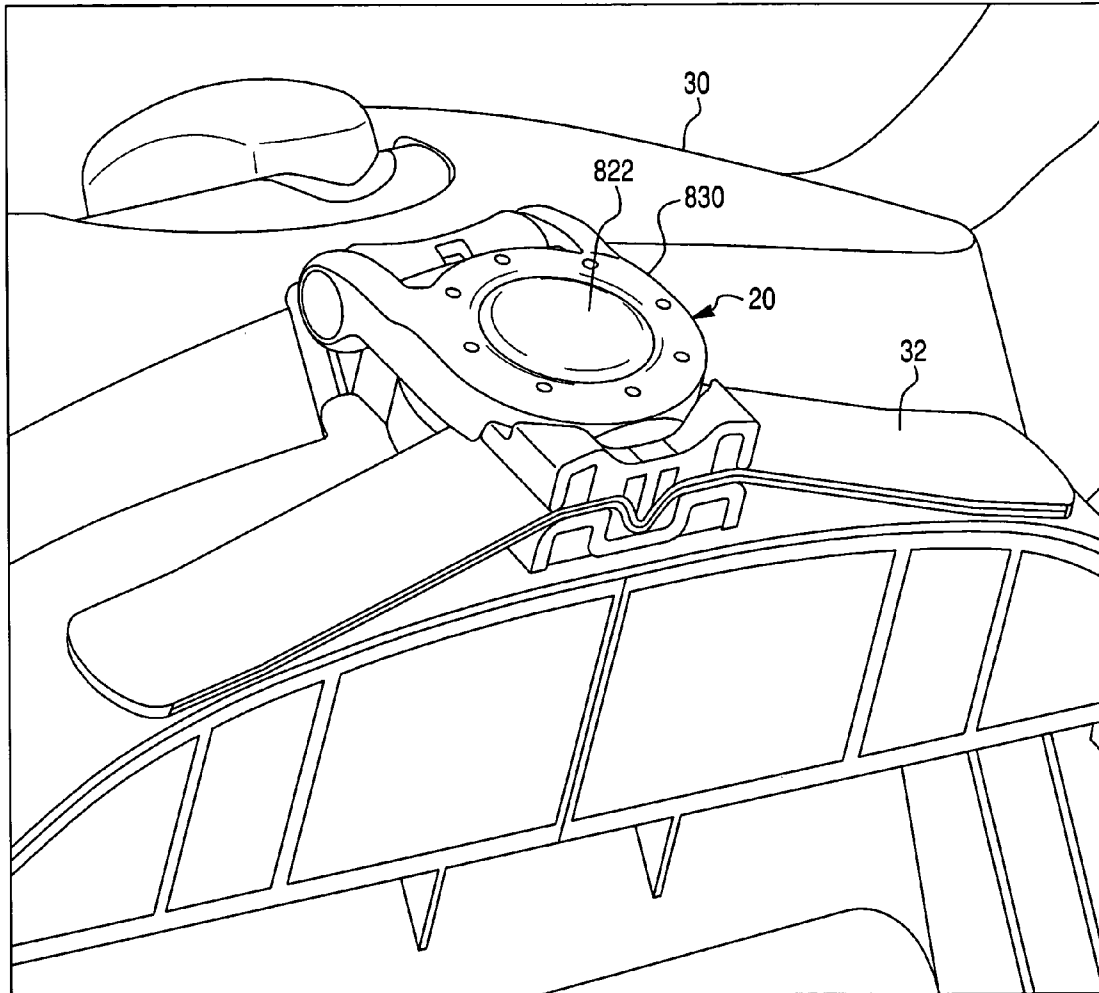


FIG. 8C

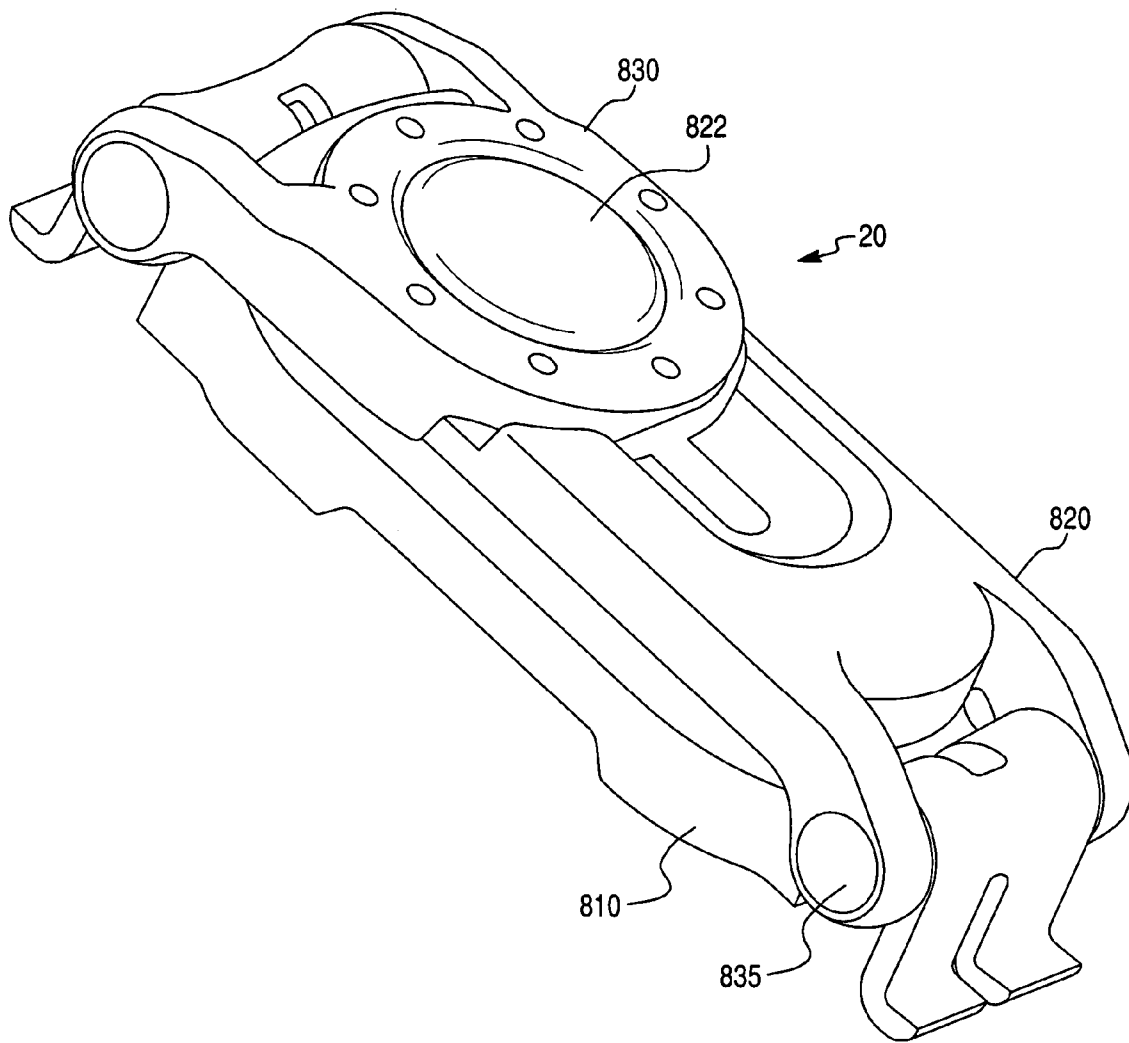


FIG. 8D

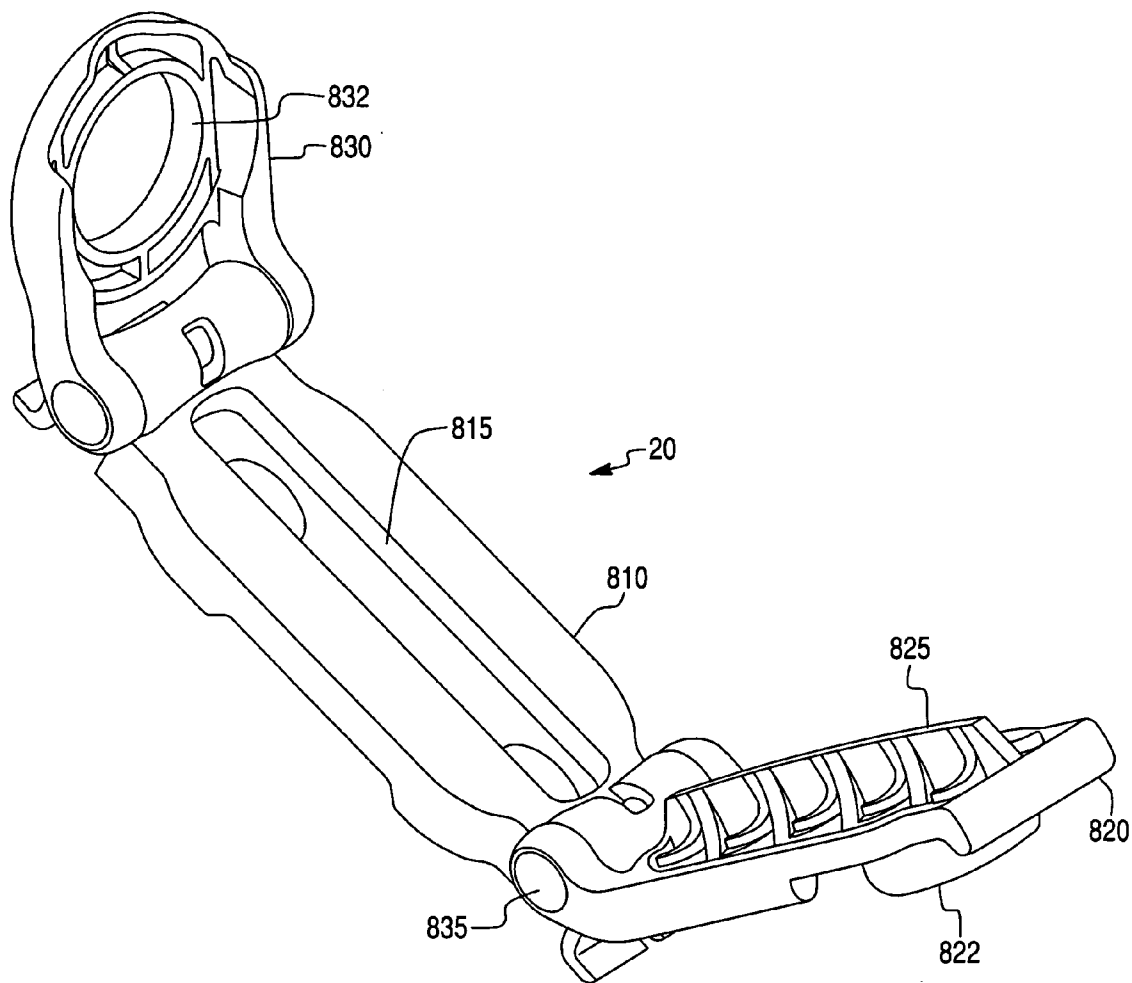


FIG. 9

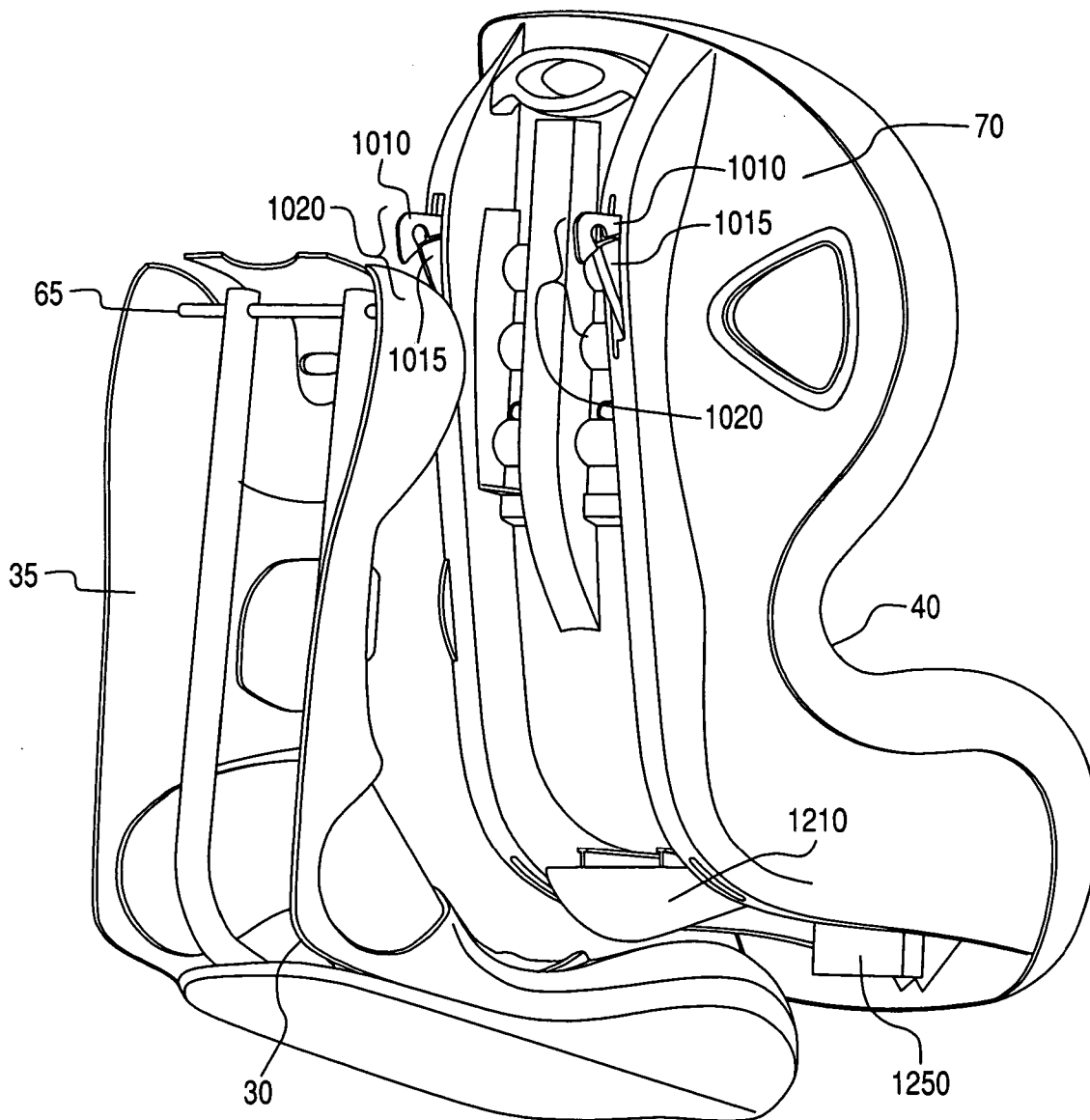


FIG. 10

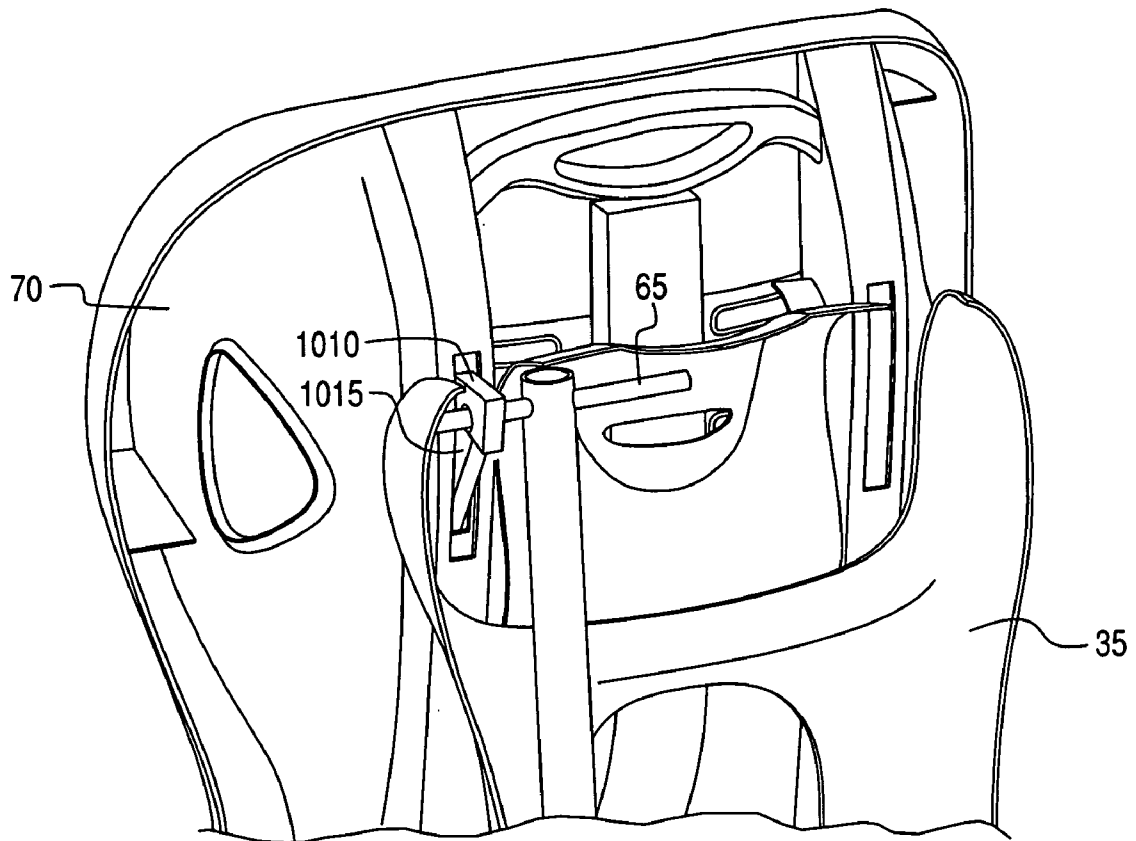


FIG. 11

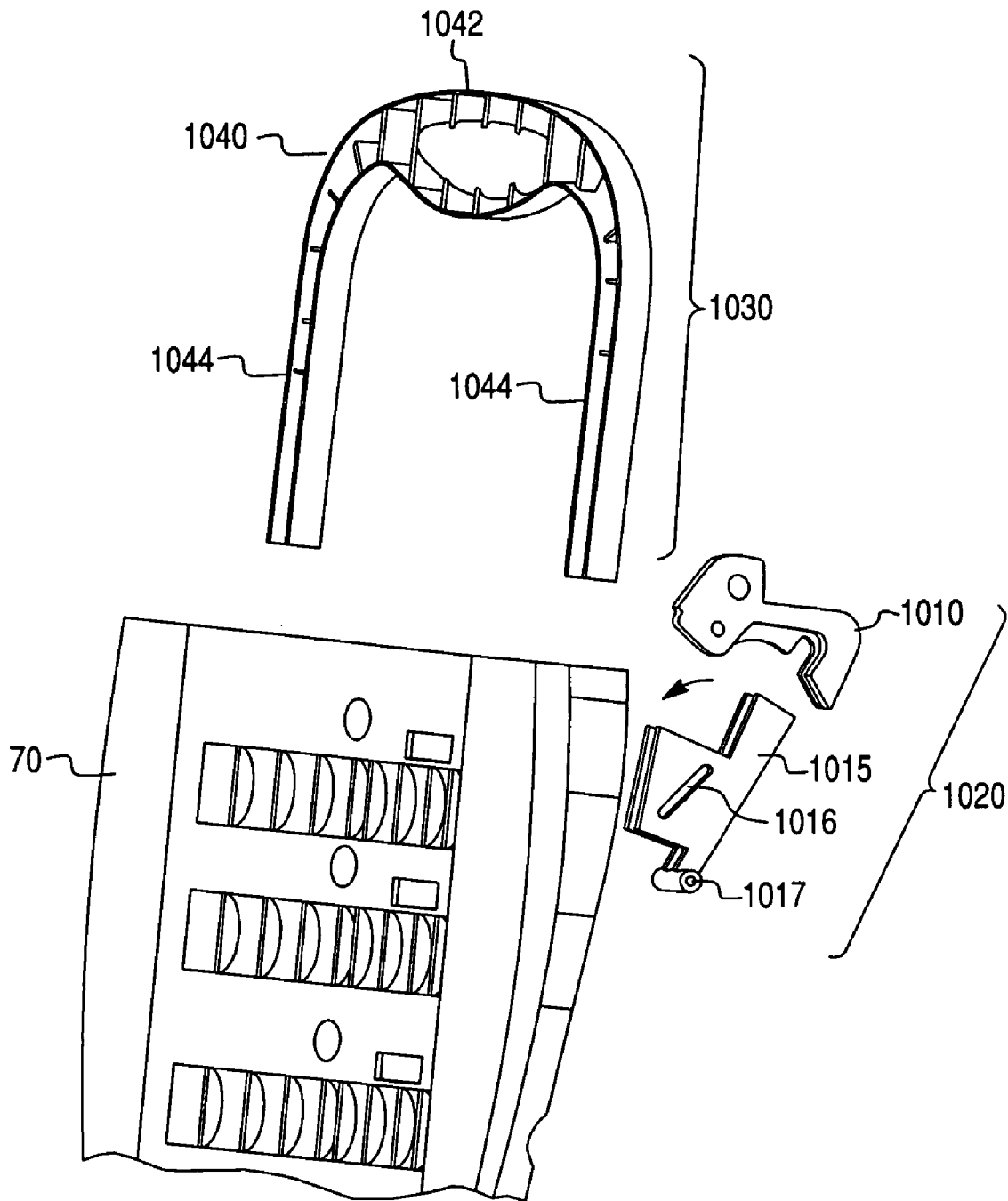


FIG. 12

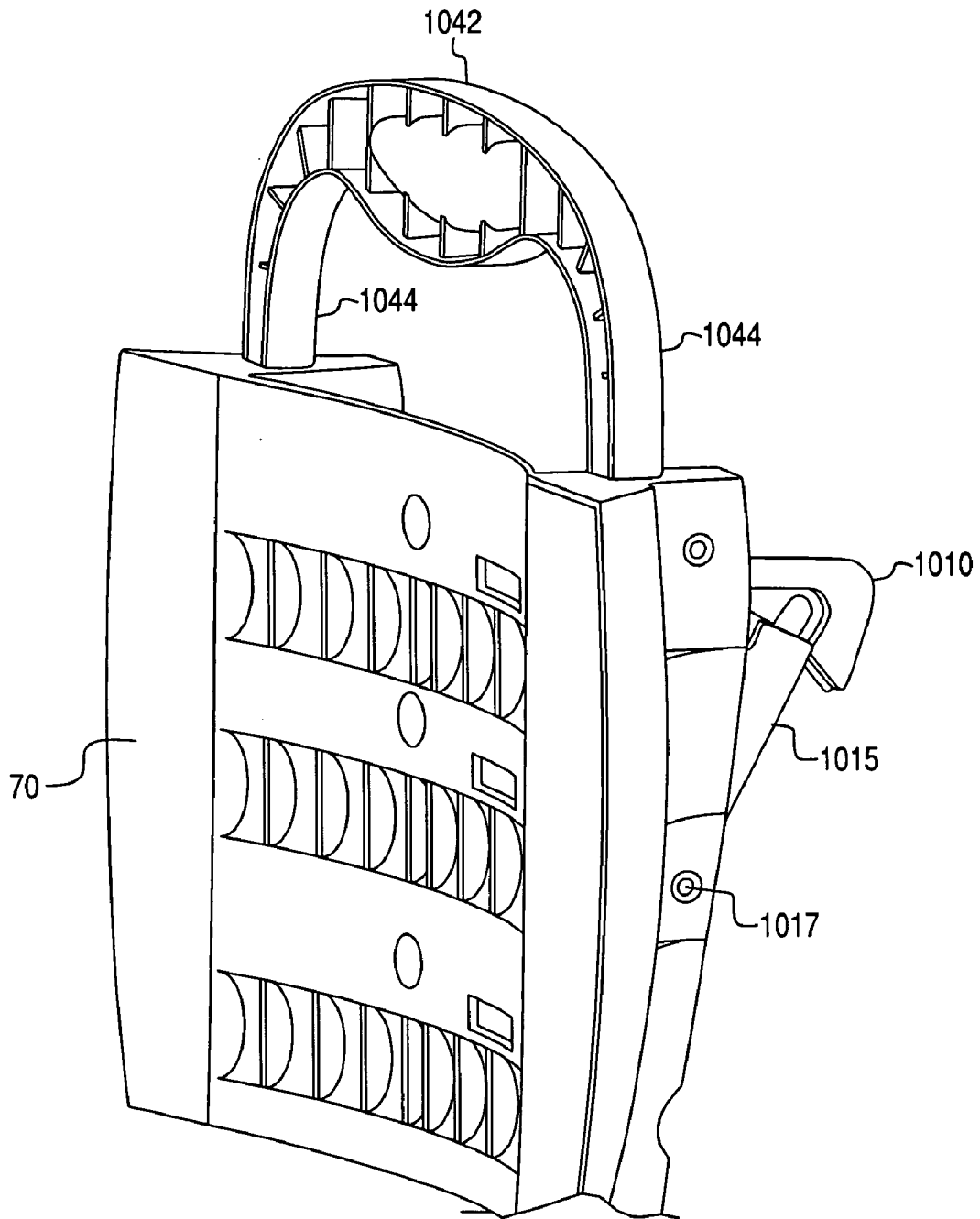


FIG. 13

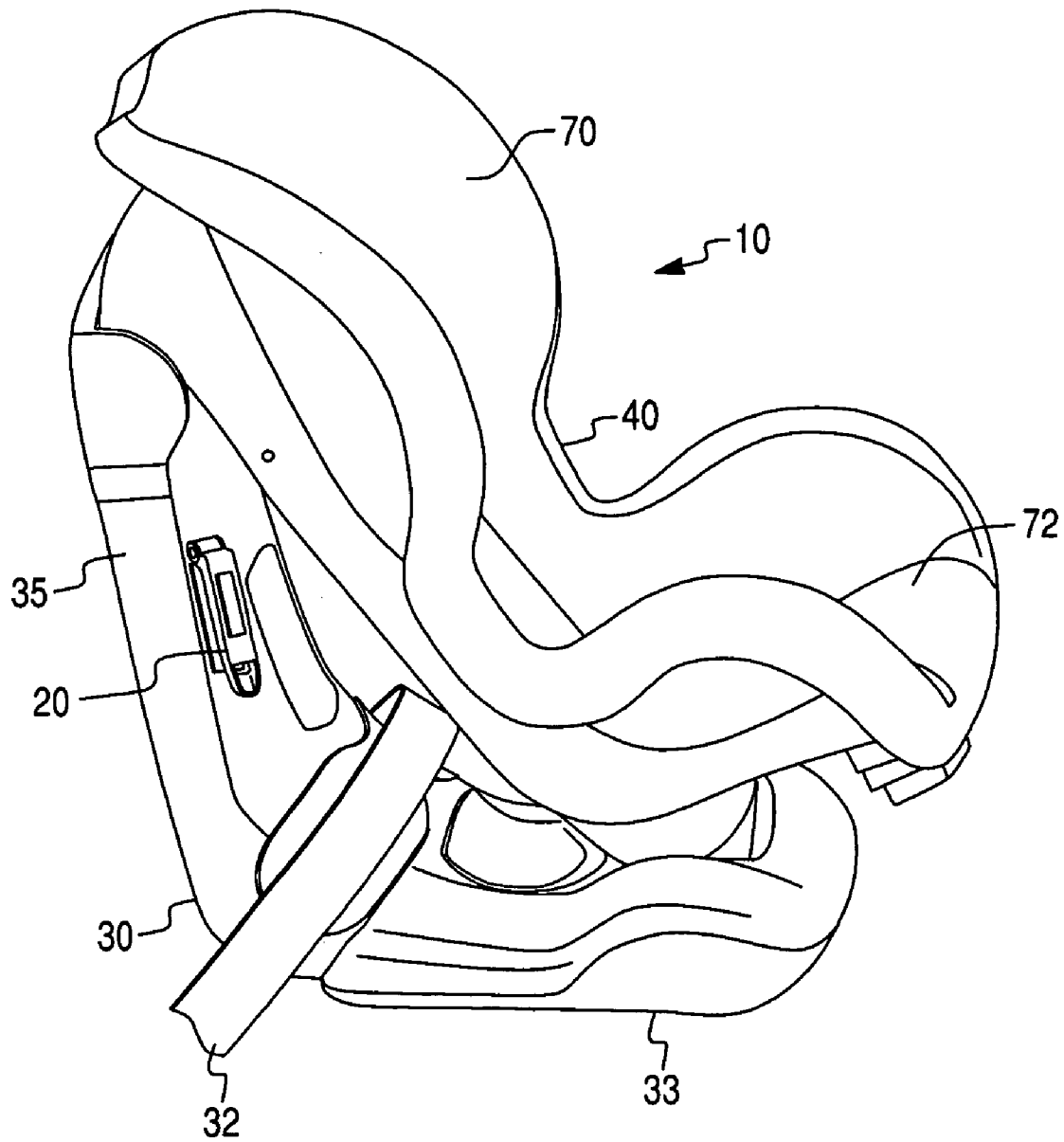


FIG. 14

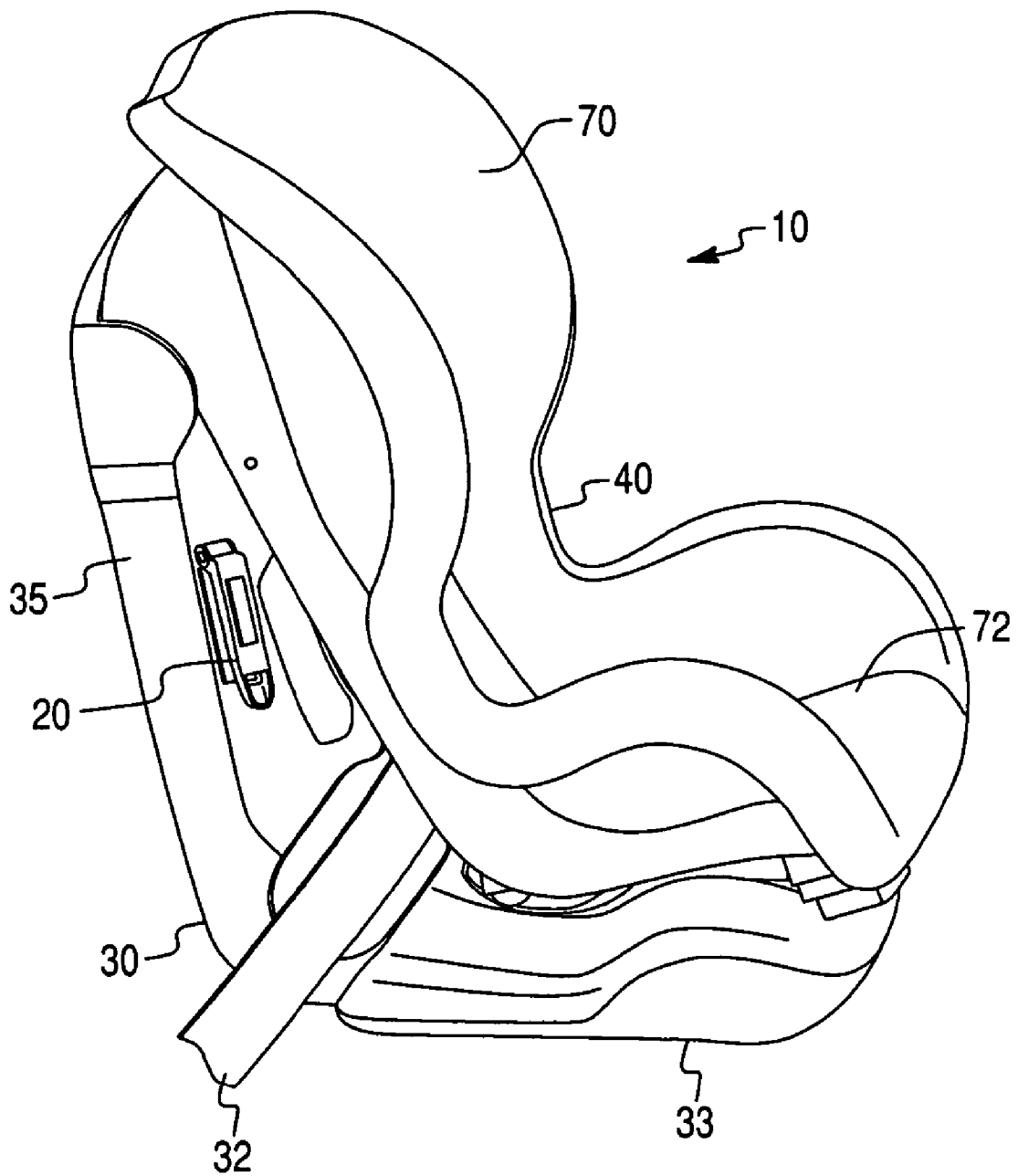


FIG. 15

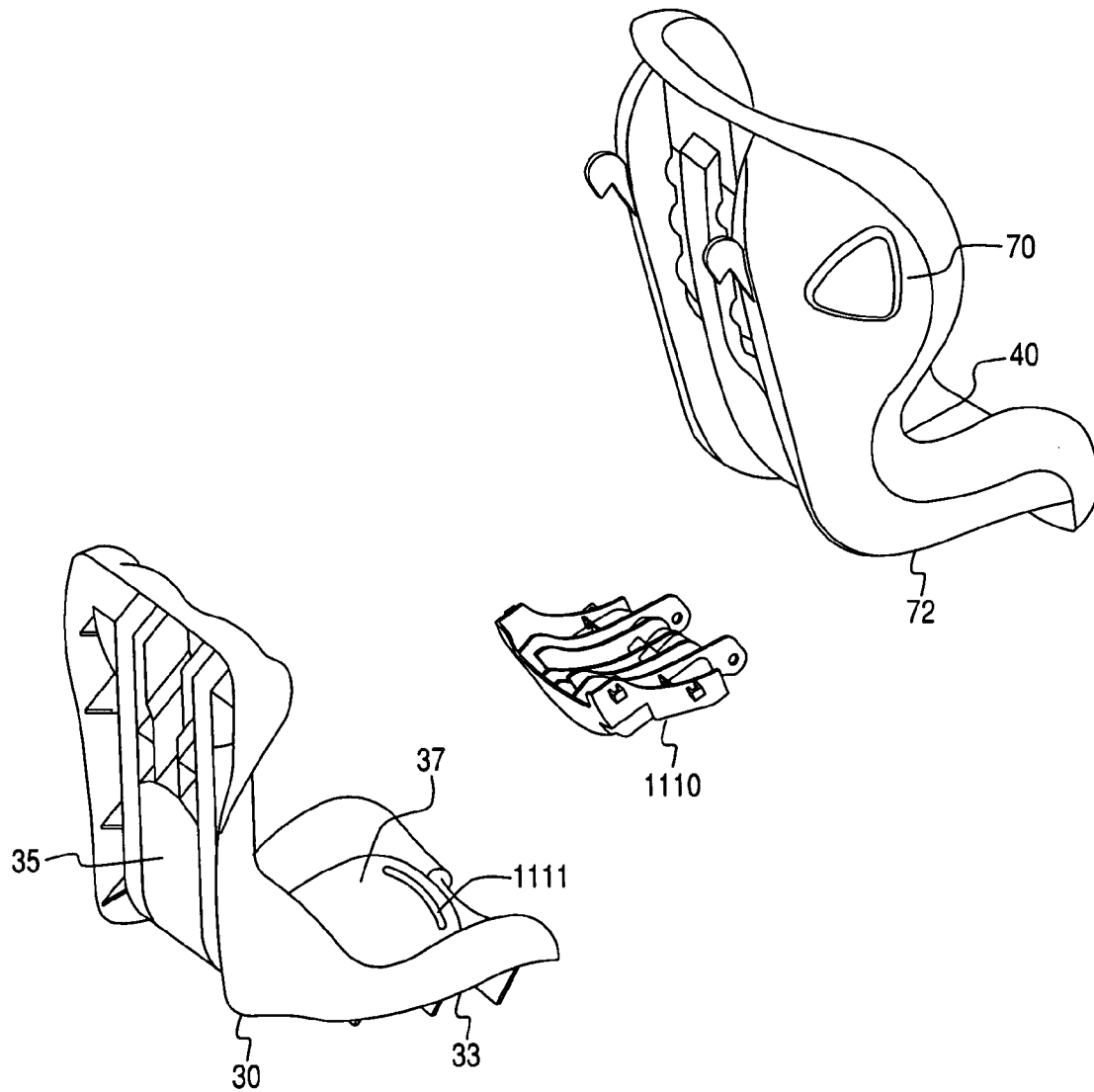


FIG. 16

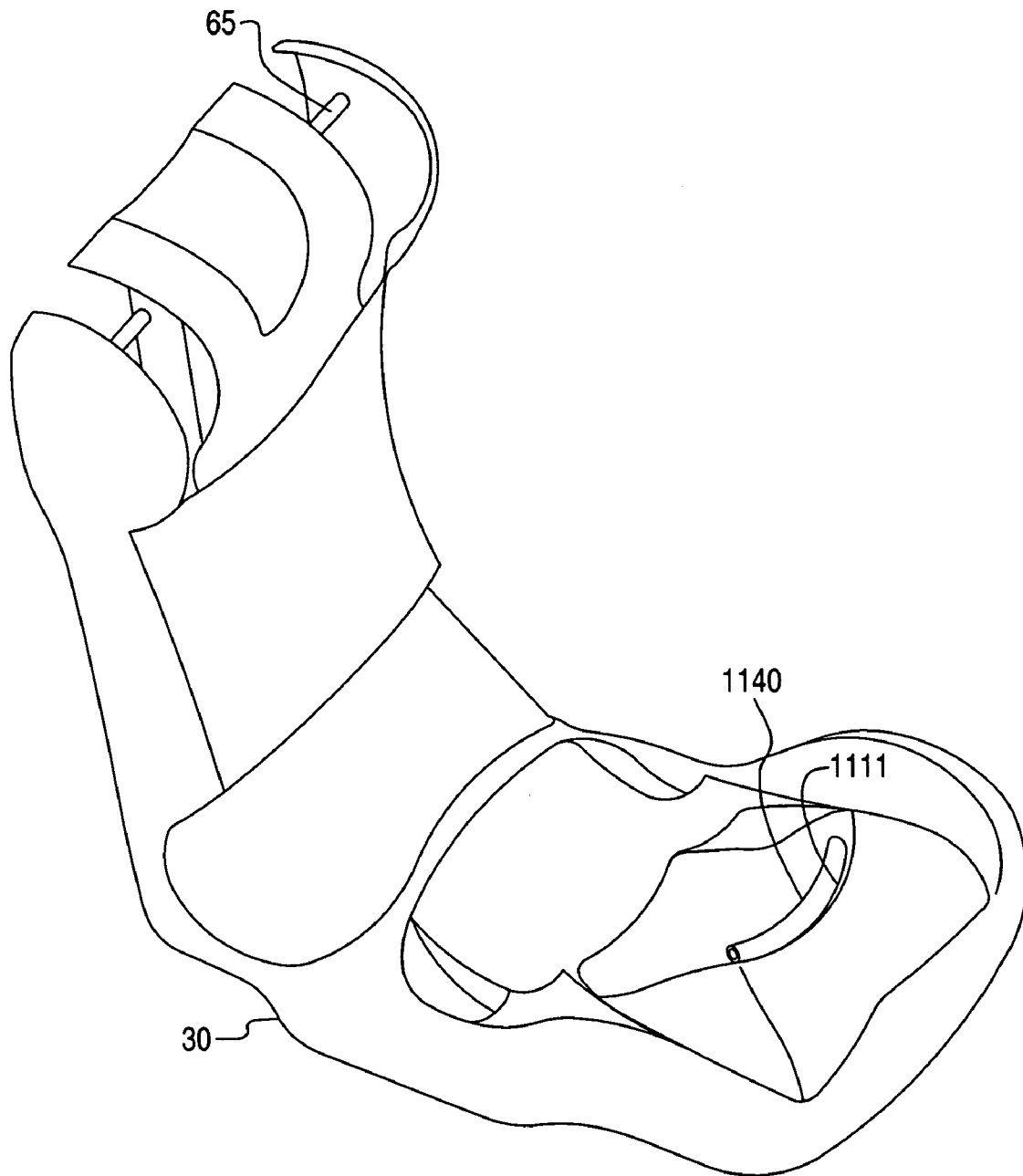


FIG. 17

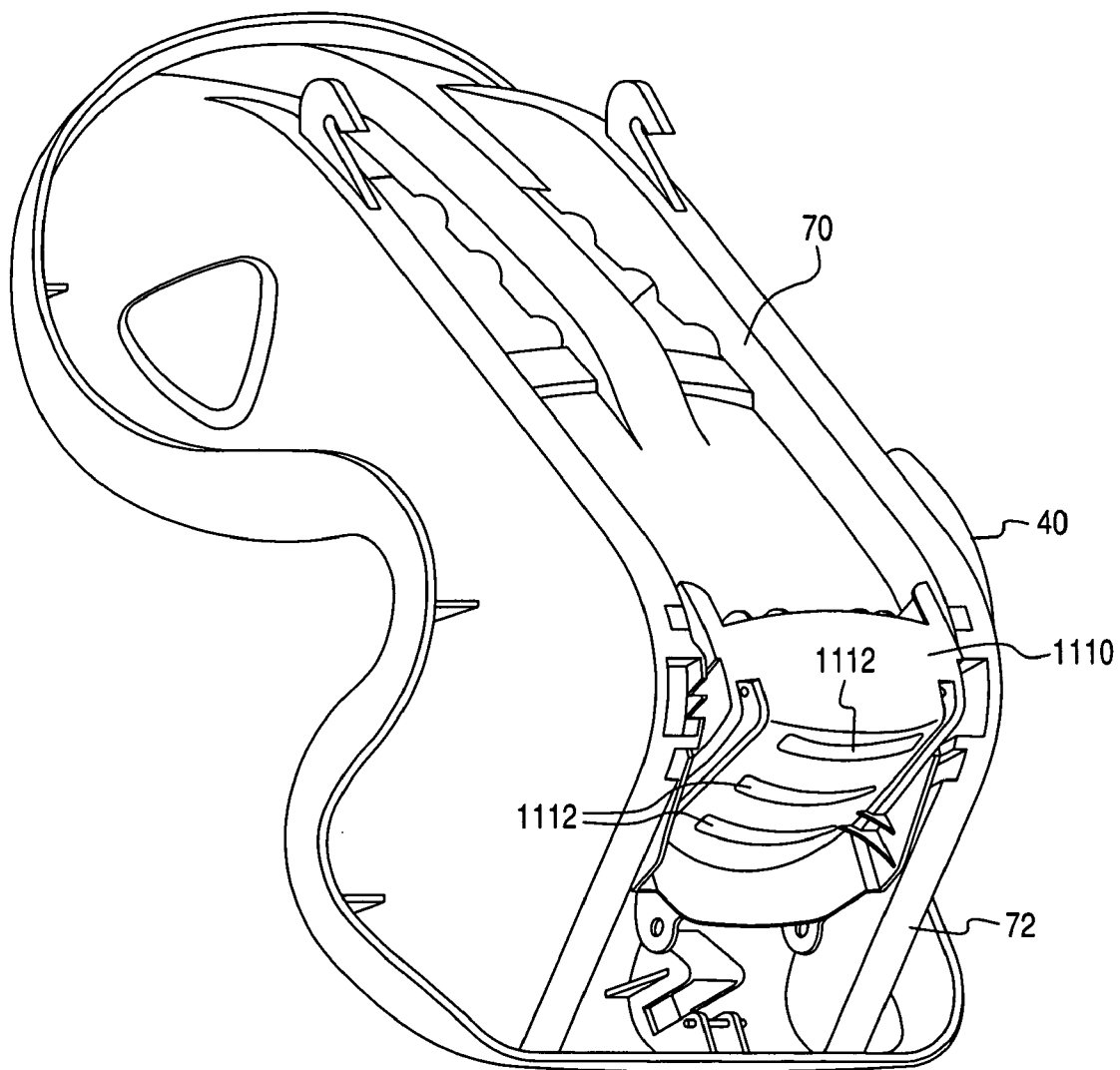


FIG. 18

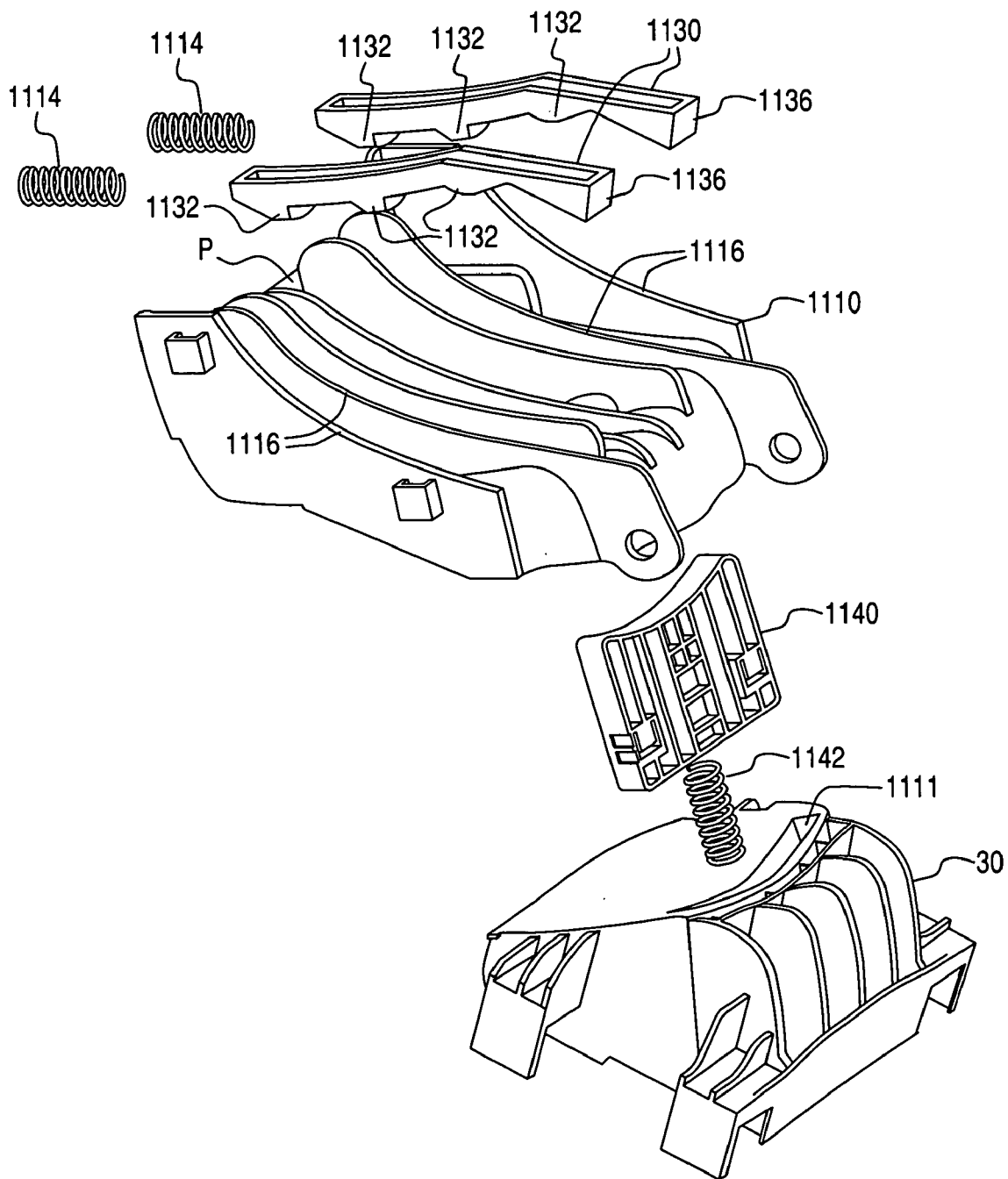


FIG. 19A

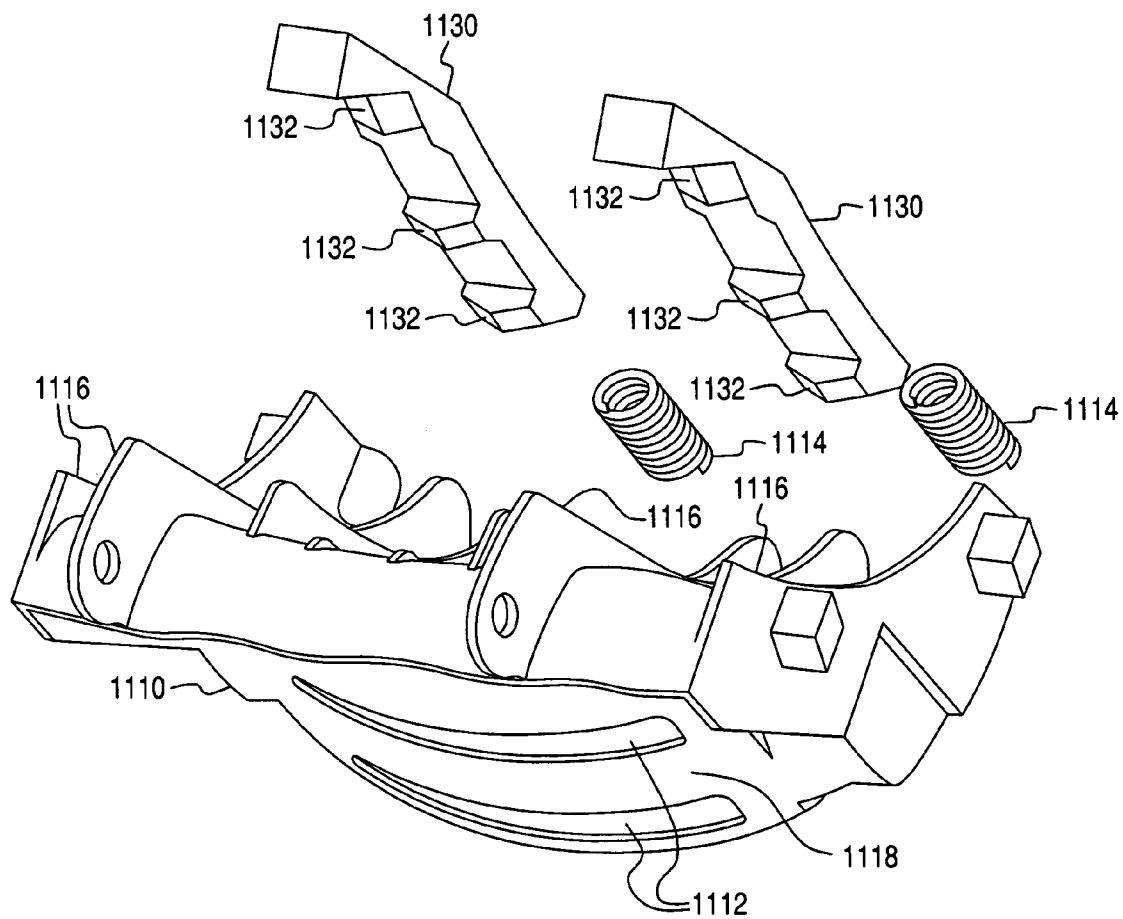


FIG. 19B

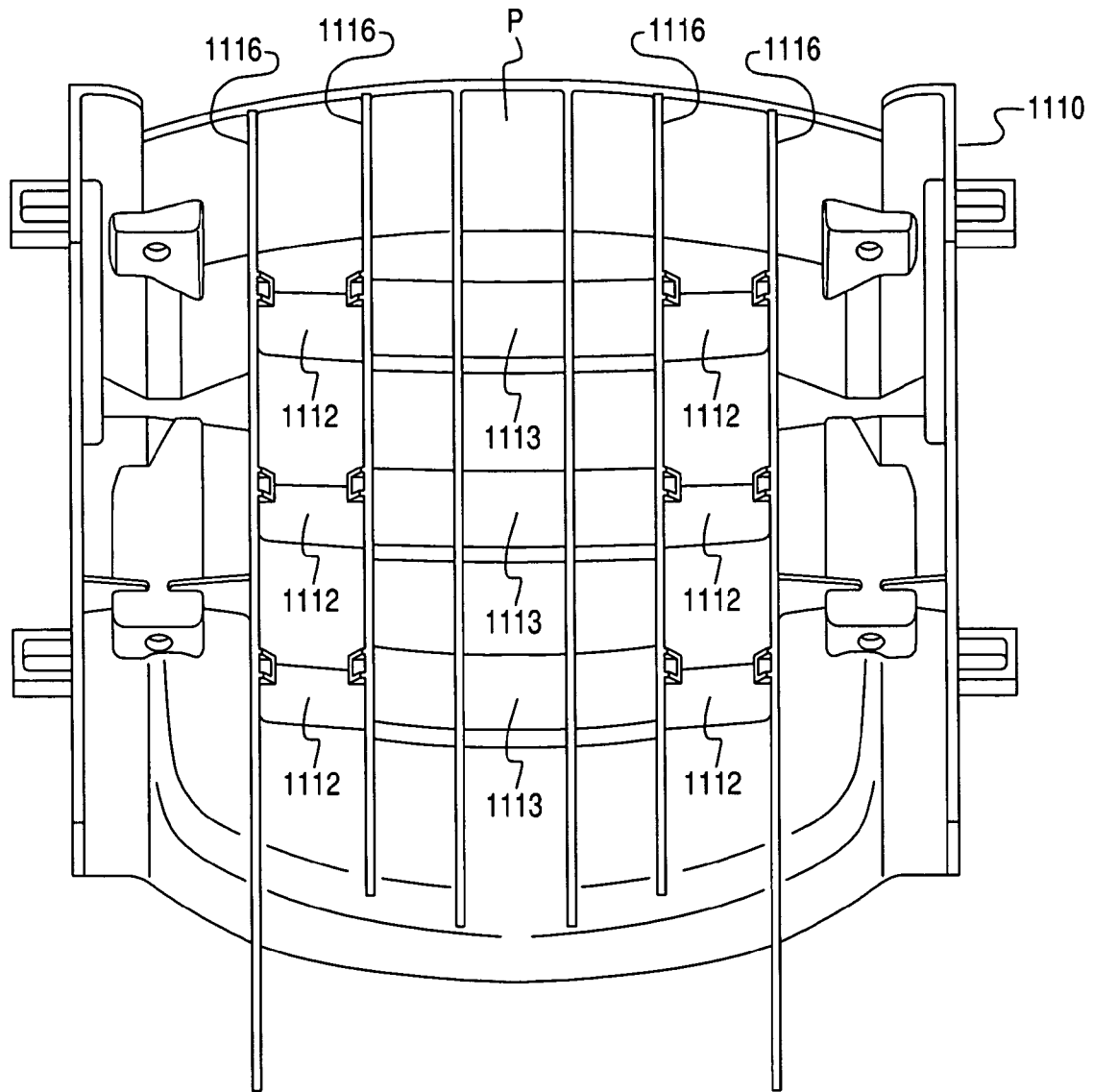


FIG. 20

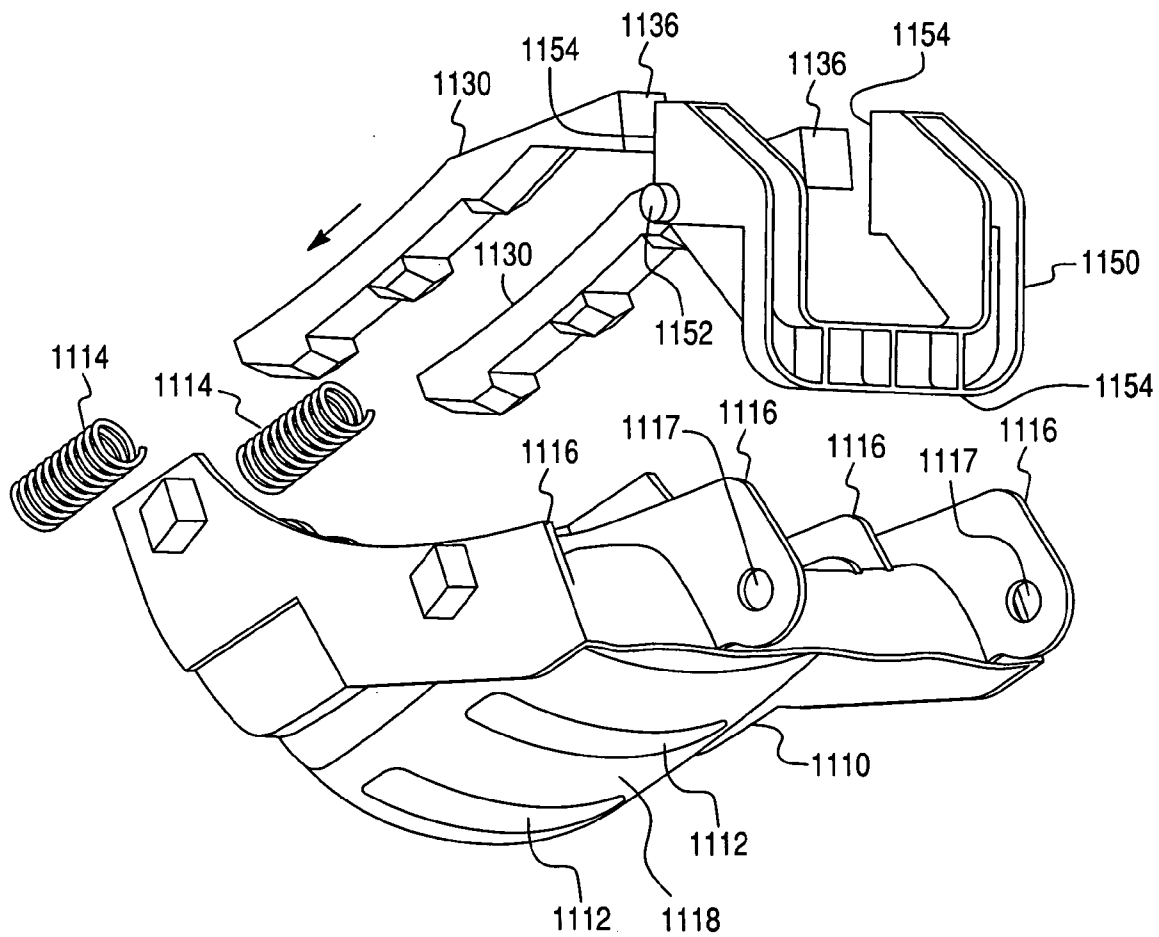


FIG. 21

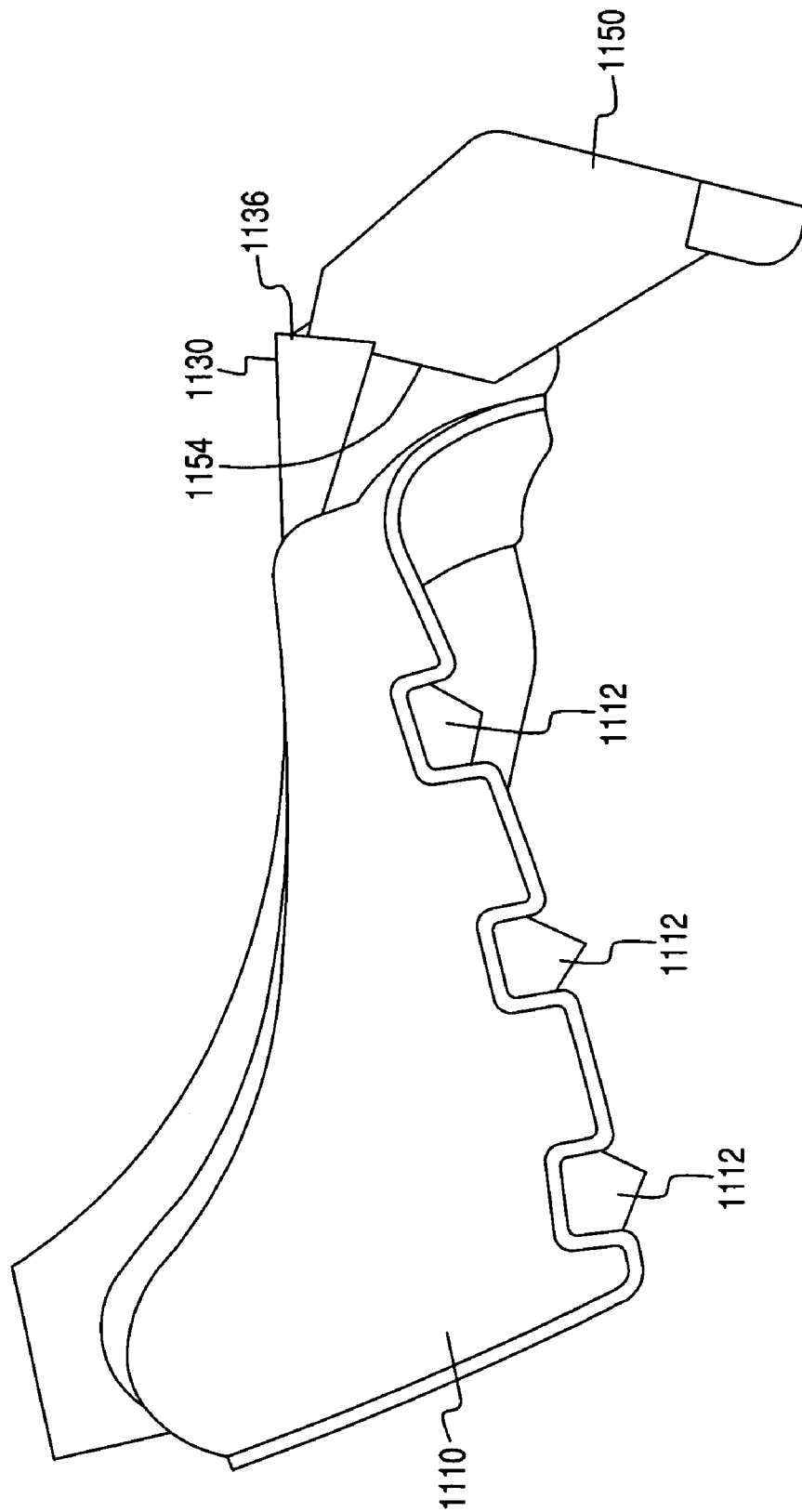


FIG. 22

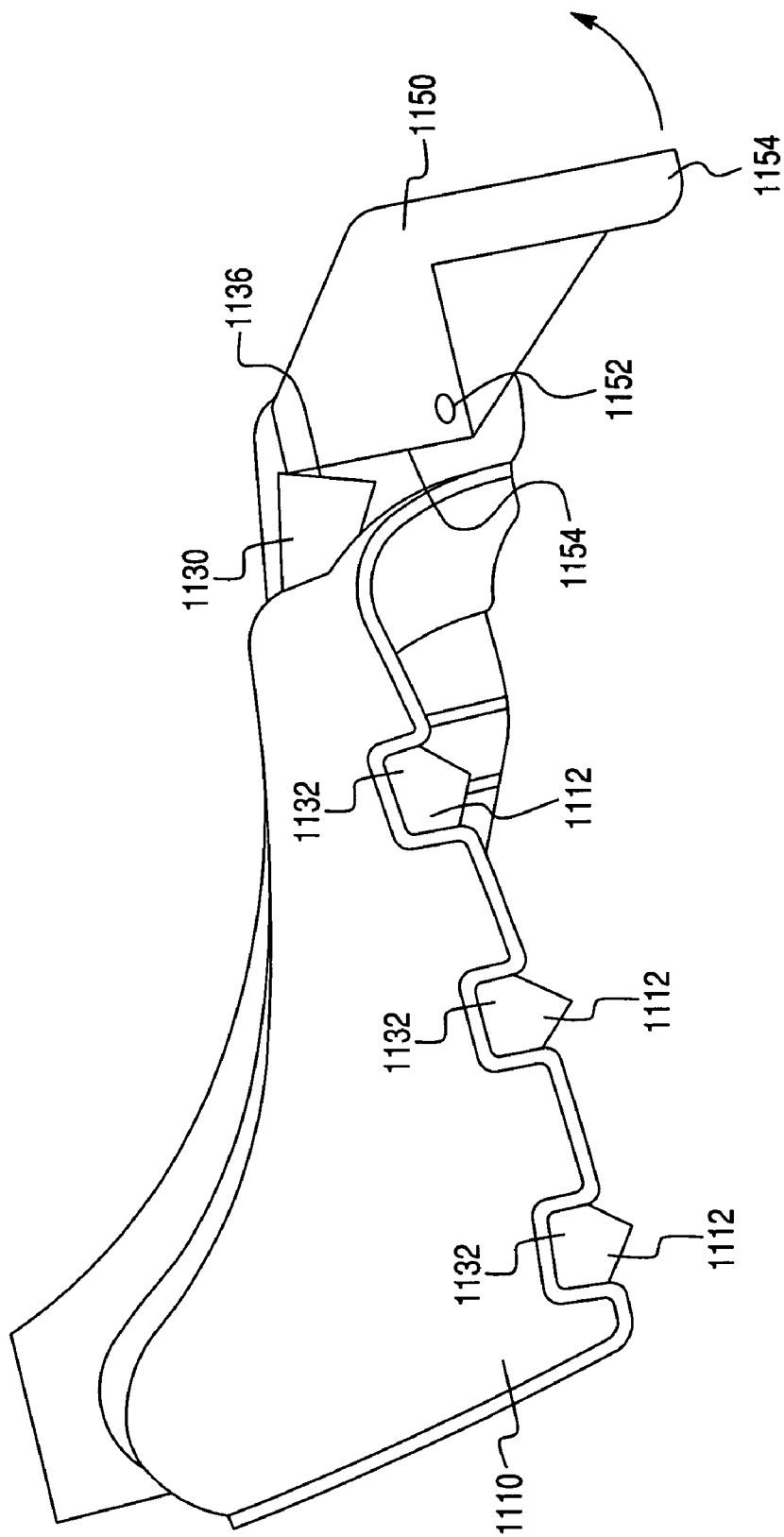


FIG. 23

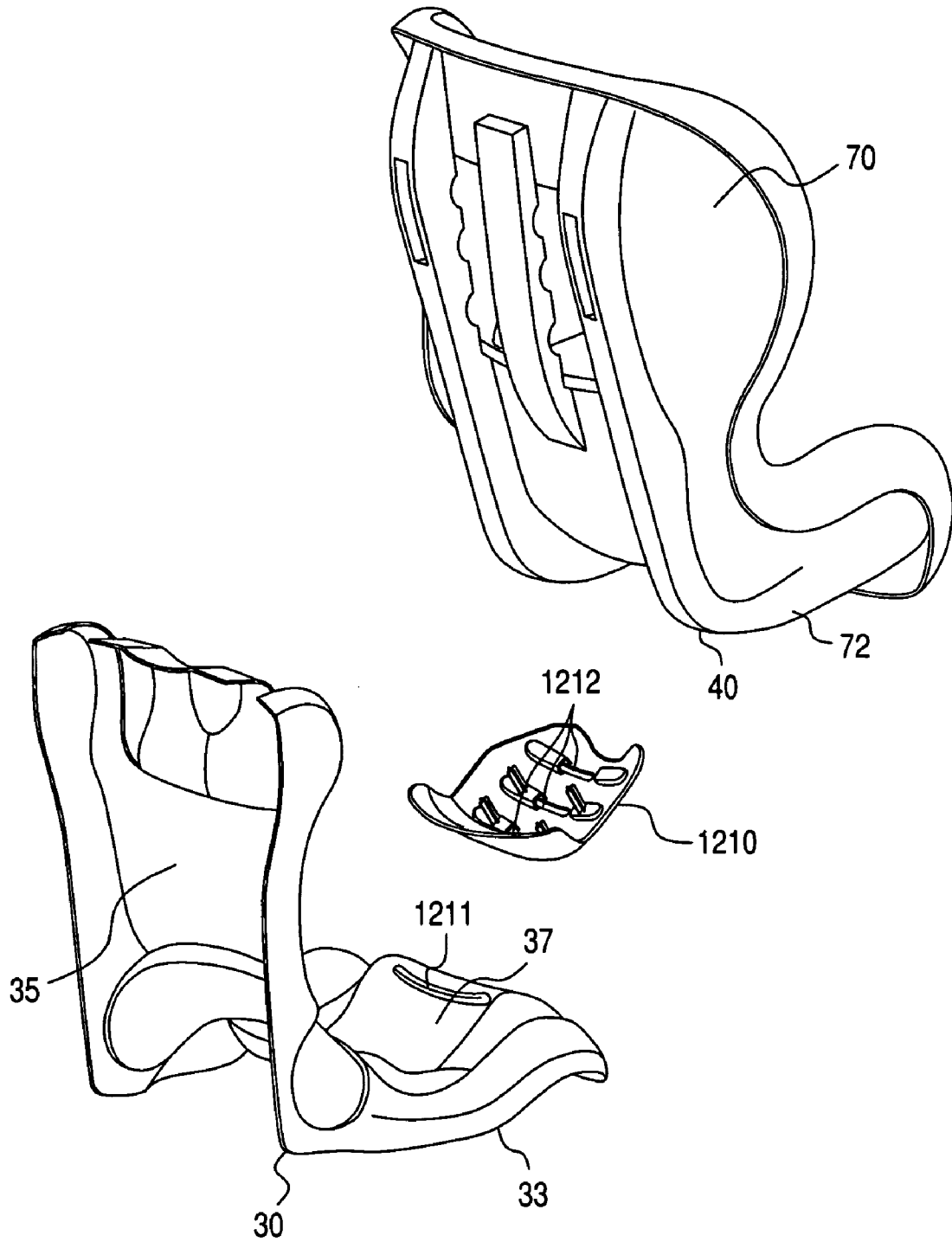


FIG. 24

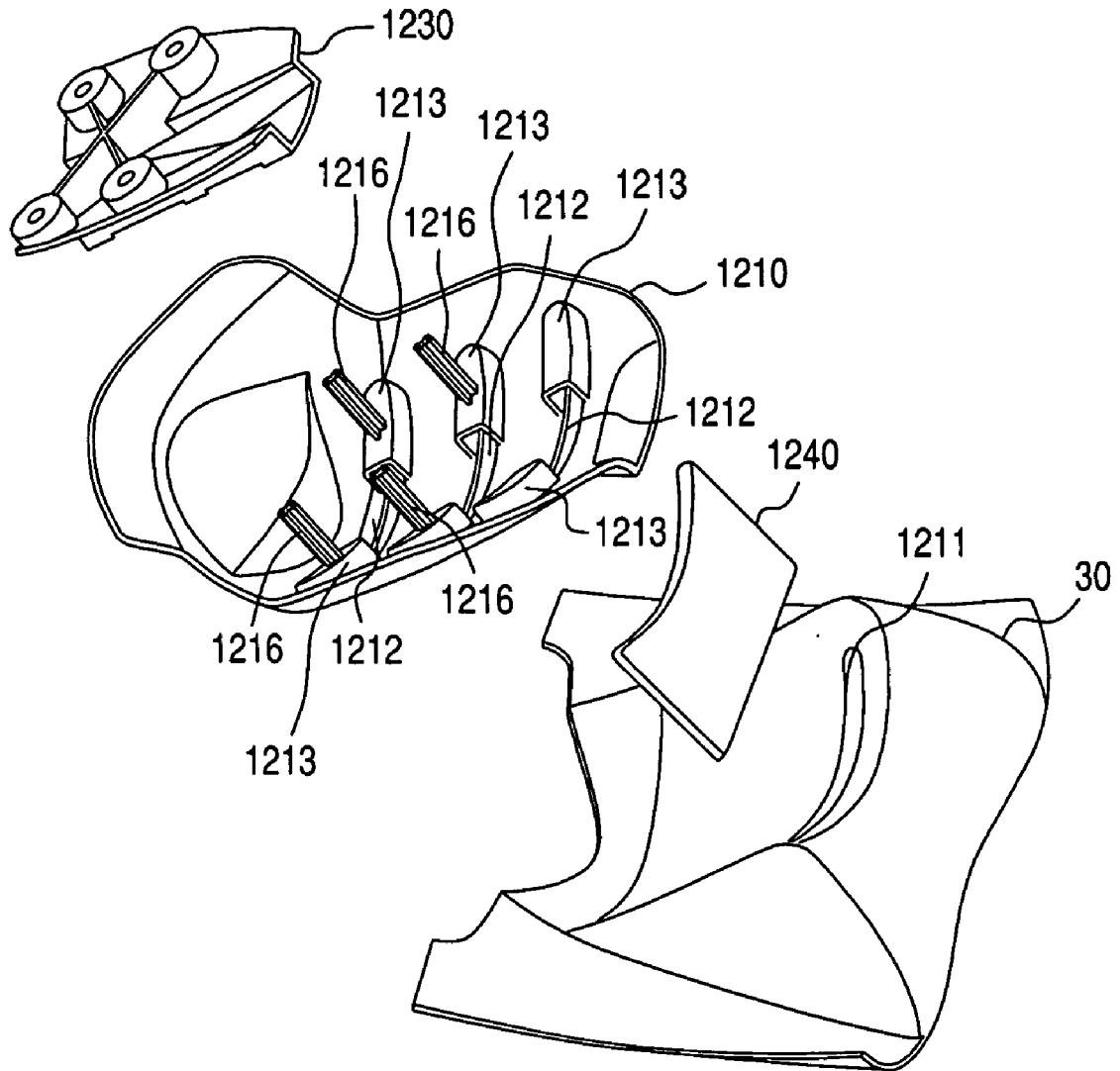


FIG. 25

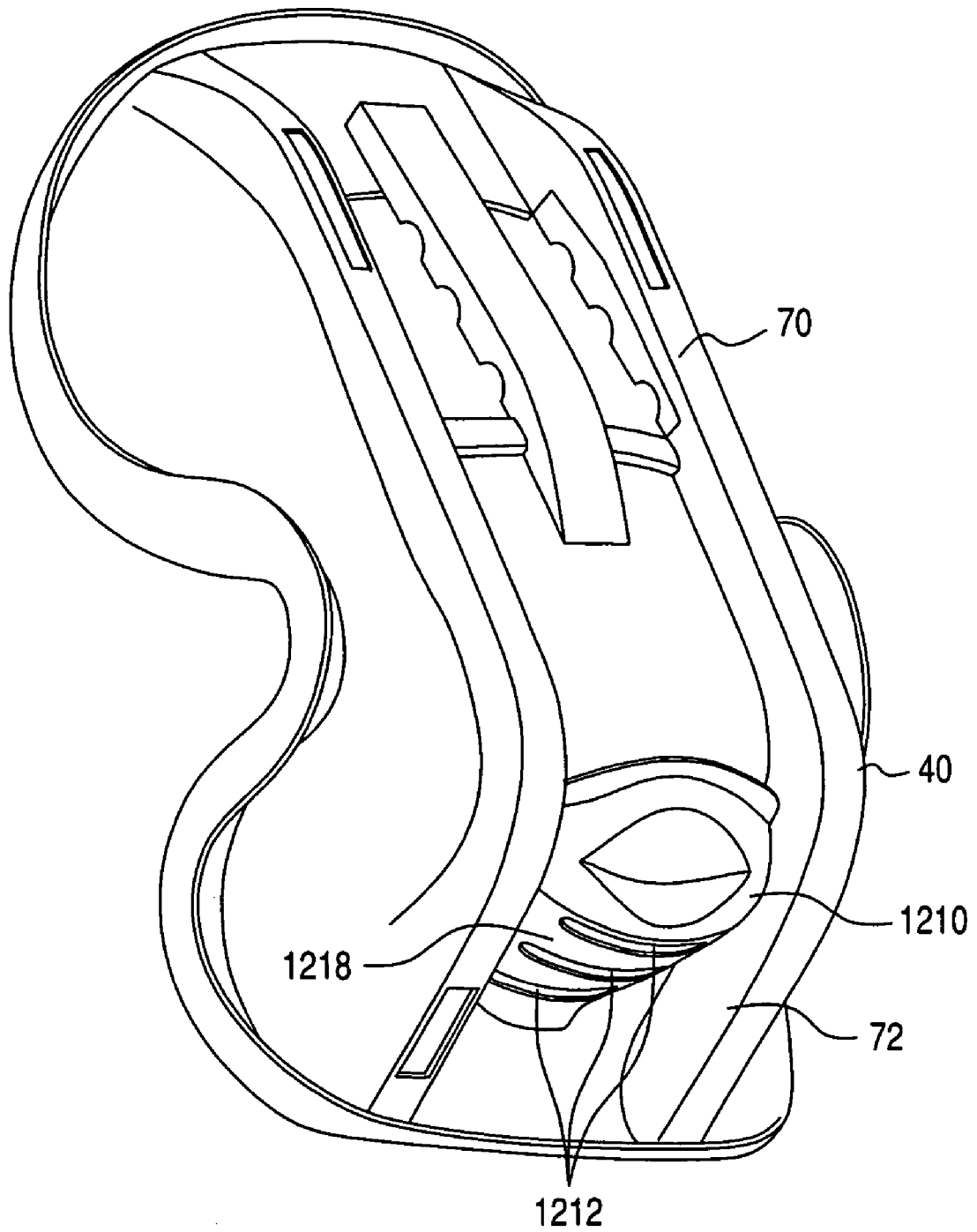


FIG. 26

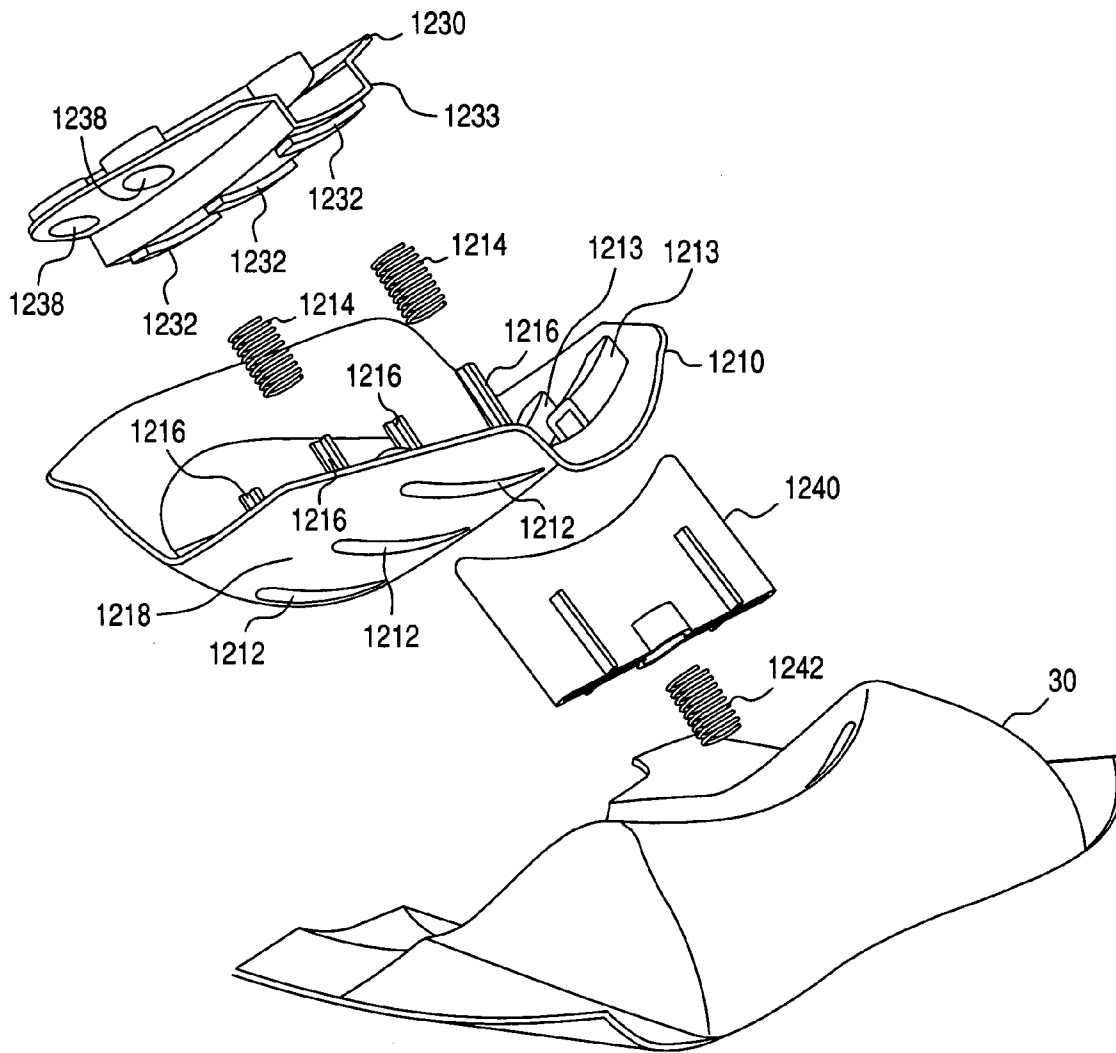


FIG. 27

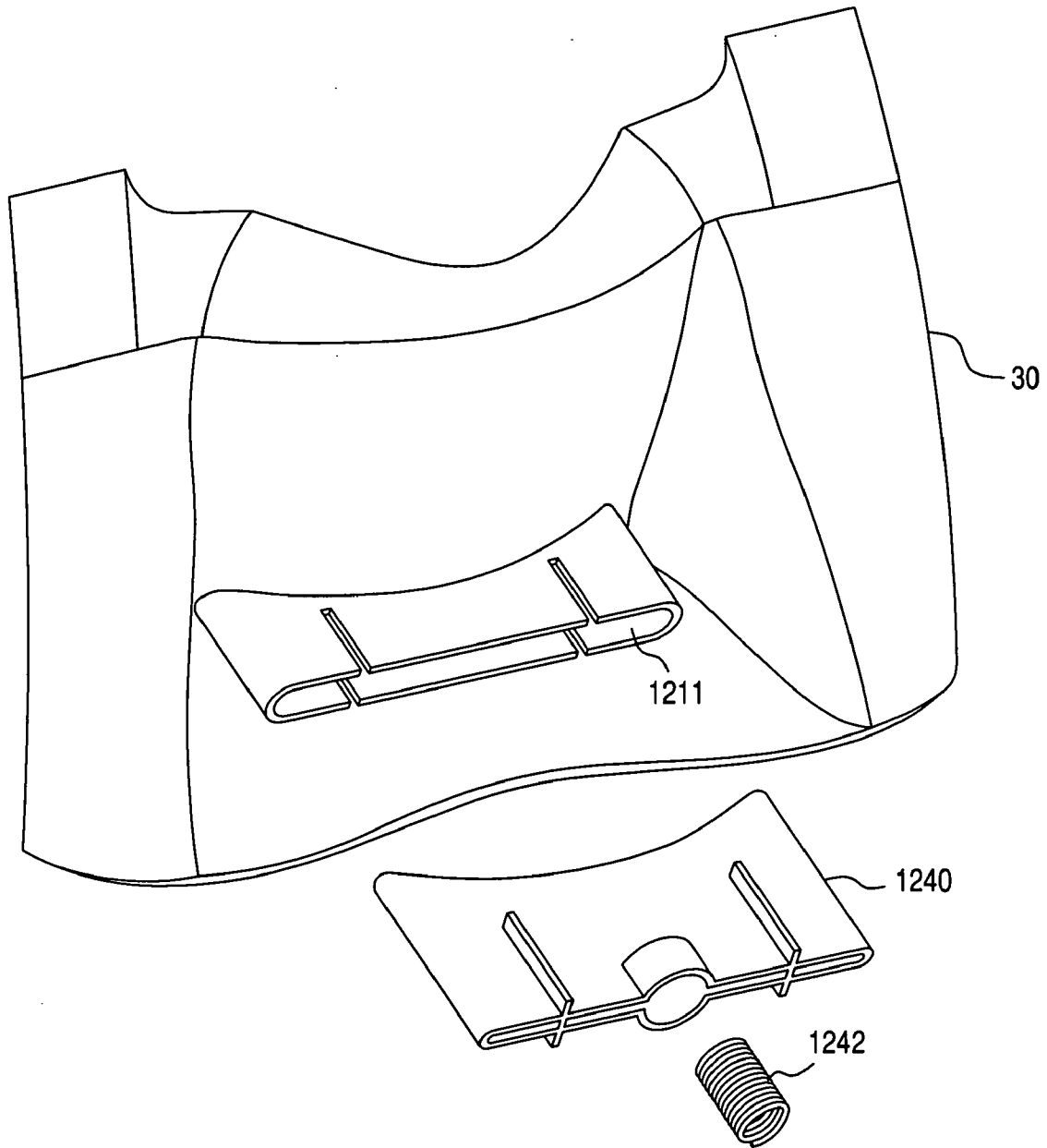


FIG. 28

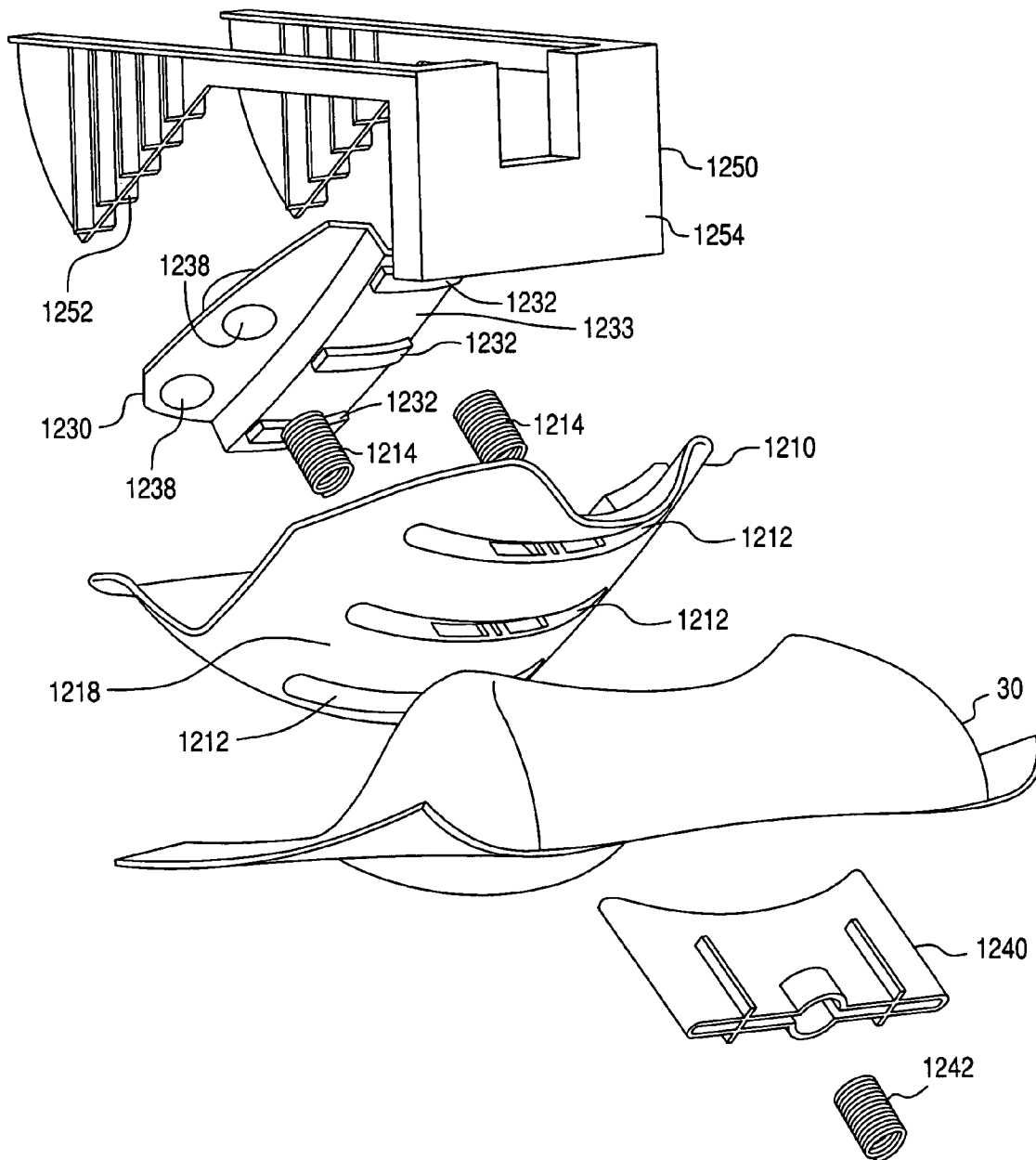


FIG. 29

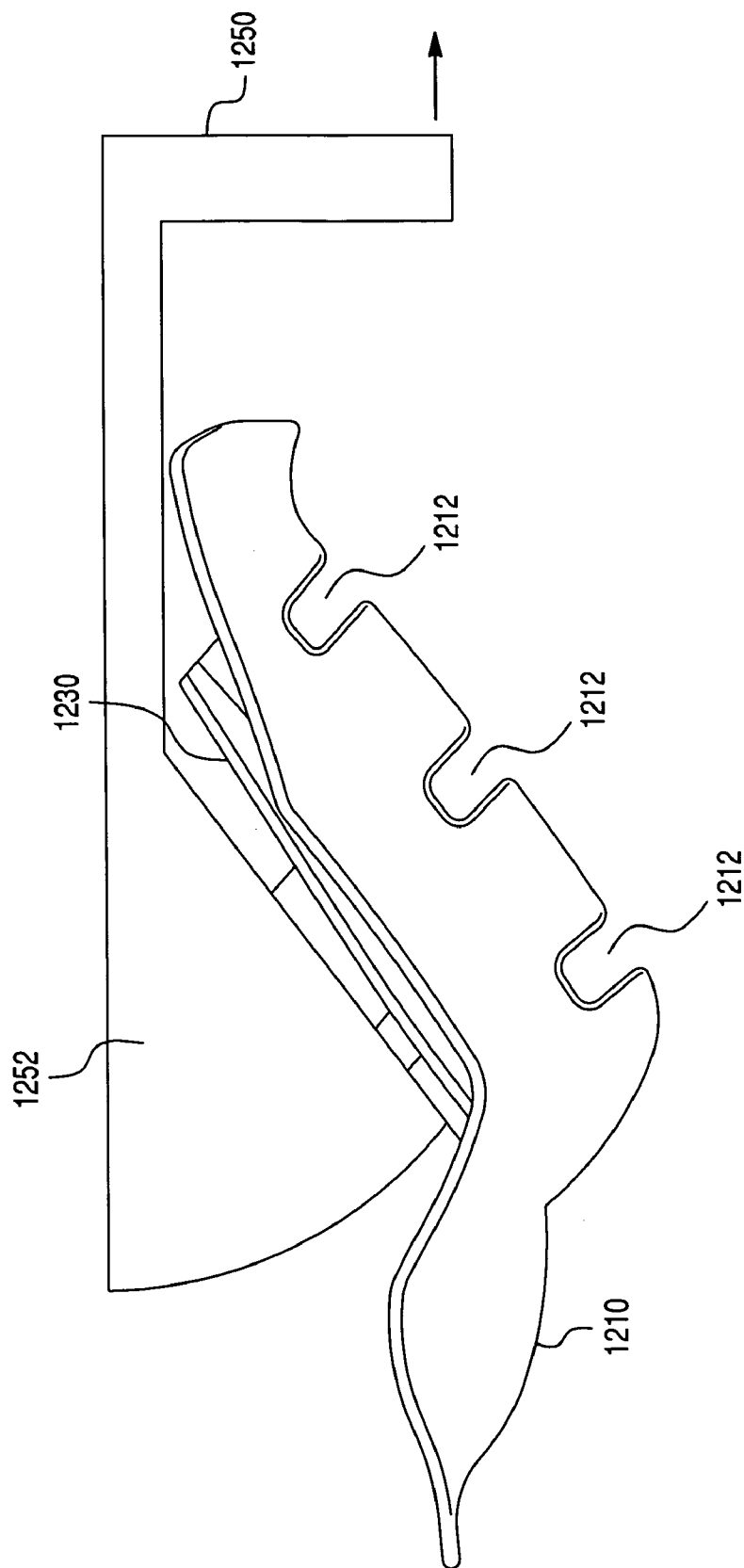
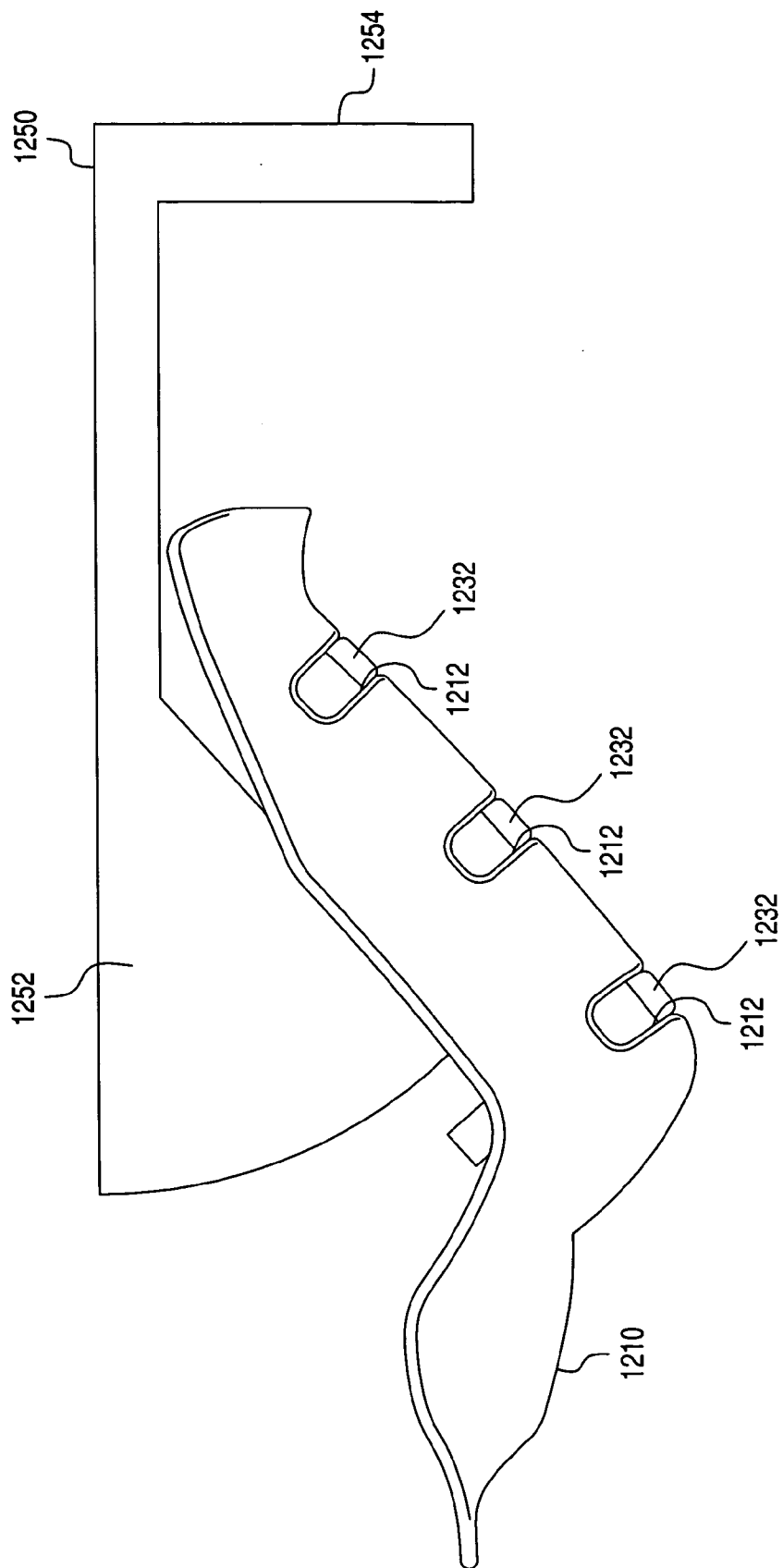


FIG. 30



LOCK-OFF MECHANISM FOR A CHILD SEAT

RELATED APPLICATIONS

[0001] This application claims priority to U.S. provisional application No. 60/525,846, filed on Dec. 1, 2003, U.S. provisional application No. 60/525,849, filed on Dec. 1, 2003, and U.S. provisional application No. 60/560,964, filed on Apr. 12, 2004, all of which are incorporated by reference.

FIELD OF THE INVENTION

[0002] This invention relates to a lock-off mechanism for a child seat. More specifically, this invention relates to a lock-off mechanism for a forward-facing child seat to secure a vehicle seat belt to the child seat.

BACKGROUND OF THE INVENTION

[0003] Child caregivers currently have a variety of methods to install child seats in vehicles. For example, toddler child seats often require the vehicle seat belt to be routed through a narrow opening behind the child seat. Also, in order to install the child seat properly, the installer (child caregiver) must put weight into the child seat while tightening the vehicle seat belt. In addition, more and more commonly, automobile manufacturers provide combination shoulder and lap belts in rear seats, which may be equipped with emergency locking retractors and sliding latch plates. These combination shoulder and lap belts require the application of additionally supplied pre-crash positioners (often referred to as locking clips) for installation of child seats. Finally, LATCH (Lower Anchors and Tethers for Children) restraints are mandatory on cars manufactured after September 2002. These anchors and tethers provide a standardized, common method of installing child seats and eliminate the above-described problems with conventional mechanisms to install child seats in vehicles. However, they will not be present in the majority of the existing vehicle fleet for many years. Therefore, there is a need for a simplified mechanism to install a forward-facing child seat in a vehicle.

[0004] Reclinable toddler child seats present an additional challenge. Most reclinable toddler child seats sold on the US market cannot be reclined without loosening or removing the vehicle seat belts or LATCH restraint. Thus, there is a need for a forward-facing child seat that can be reclined while the child seat remains secured to the vehicle seat.

SUMMARY OF THE INVENTION

[0005] An aspect of the present invention relates to a forward-facing child seat. The child seat comprises: a base; a seat removably attachable to the base in a forward-facing orientation relative to a front of the vehicle; and at least one lock-off mechanism mounted to the base to secure a vehicle seat belt to the base.

[0006] Another aspect of the present invention relates to a method of installing a child seat in a vehicle having a combination shoulder and lap belt. The method comprises: providing the child seat with a base and a seat removably attachable to the base in a forward-facing orientation relative to a front of the vehicle; positioning the base on a vehicle seat; placing the combination shoulder lap and belt across the base and securing the combination shoulder and lap belt to a vehicle belt socket; locking a shoulder belt portion of the combination shoulder and lap belt to the base in a lock-off

mechanism mounted to the base; and attaching the seat to the base in the forward-facing orientation.

[0007] Another aspect of the present invention relates to a lock-off mechanism for a child seat. The lock-off mechanism comprises: a lower jaw to couple to the child seat; an upper jaw movably connected to the lower jaw and movable between an open position and a closed position; an actuator connected to one of the lower jaw and the upper jaw; and an actuator receptacle located on the other of the lower jaw and the upper jaw, wherein, movement of the upper jaw from the open position to the closed position causes engagement of the actuator and the actuator receptacle to lock the upper jaw relative to the lower jaw.

[0008] Another aspect of the present invention relates to a lock-off mechanism for a child seat. The lock-off mechanism comprises: a lower jaw to couple to the child seat; and an upper jaw movably connected to the lower jaw and movable between an open position and a closed position; wherein, movement of the upper jaw from the open position to the closed position automatically causes the upper jaw to lock relative to the lower jaw.

[0009] Another aspect of the present invention relates to a child seat to secure to a vehicle seat. The child seat comprises: a lock-off mechanism coupled to the child seat, the lock-off mechanism including, a lower jaw to couple to the child seat; and an upper jaw movably connected to the lower jaw and movable between an open position and a closed position; wherein, movement of the upper jaw from the open position to the closed position automatically causes the upper jaw to lock relative to the lower jaw.

[0010] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the invention, as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate several embodiments of the invention and, together with the description, serve to explain the principles of the invention.

[0012] FIG. 1 is a perspective view of a seat assembly according to an exemplary embodiment.

[0013] FIG. 2 is an exploded perspective view of the seat assembly of FIG. 1.

[0014] FIG. 3 is a perspective view of a base of the seat assembly on a vehicle seat according to an exemplary embodiment.

[0015] FIG. 4 is a perspective view of a base on a vehicle seat with a seat belt attached to a lock-off mechanism on the base according to an exemplary embodiment

[0016] FIG. 5A is a perspective view of a lock-off mechanism in an open position according to an exemplary embodiment.

[0017] FIG. 5B is a perspective view of the lock-off mechanism of FIG. 5A in a closed position.

[0018] FIG. 5C is a perspective exploded view of the lock-off mechanism of FIG. 5A.

[0019] FIG. 6A is a perspective view of a lock-off mechanism in a closed position according to another exemplary embodiment.

[0020] FIG. 6B is a perspective exploded view of the lock-off mechanism of FIG. 6A.

[0021] FIG. 6C is a perspective view of the lock-off mechanism of FIG. 6A in an open position.

[0022] FIG. 7A is a perspective view of a lock-off mechanism in a closed position according to another exemplary embodiment.

[0023] FIG. 7B is a perspective exploded view of the lock-off mechanism of FIG. 7A.

[0024] FIG. 7C is a perspective view of the lock-off mechanism of FIG. 7A in an open position.

[0025] FIG. 8A is a perspective view of a lock-off mechanism in a closed position on a base of an infant car seat according to another exemplary embodiment.

[0026] FIG. 8B is a cutaway view of the lock-off mechanism on the seat base of FIG. 8A.

[0027] FIG. 8C is a perspective view of the lock-off mechanism only of FIG. 8A in a closed position.

[0028] FIG. 8D is a perspective view of the lock-off mechanism of FIG. 8C in an open position.

[0029] FIG. 9 is a perspective exploded view of a seat and a base with a latch mechanism according to another exemplary embodiment.

[0030] FIG. 10 is a perspective view of a seat with the latch mechanism of FIG. 9 illustrating the left side only of the latch mechanism.

[0031] FIG. 11 is a perspective exploded view of a latch and release mechanism relative to the back of the seat according to an exemplary embodiment.

[0032] FIG. 12 is a perspective view of the latch and release mechanism on a seat back of a seat of the seat assembly of FIG. 11.

[0033] FIG. 13 is a perspective view of a seat assembly with a seat in a first recline position according to an exemplary embodiment.

[0034] FIG. 14 is a perspective view of the seat assembly of FIG. 13 with the seat in another recline position.

[0035] FIG. 15 is a perspective exploded view of a seat assembly with a recline mechanism according to an exemplary embodiment.

[0036] FIG. 16 is a perspective view of a base of the seat assembly of FIG. 15.

[0037] FIG. 17 is a perspective view of a seat with a recline positioner of the seat assembly of FIG. 15.

[0038] FIG. 18 is a perspective exploded view of a recline positioner, recline actuator, and recline lock of the seat assembly of FIG. 15.

[0039] FIG. 19A is a perspective exploded view of the recline positioner and recline actuator of the seat assembly of FIG. 15.

[0040] FIG. 19B is a top view of the recline positioner of the seat assembly of FIG. 15.

[0041] FIG. 20 is a perspective exploded view of the recline positioner, recline actuator, and recline adjustment handle of the seat assembly of FIG. 15.

[0042] FIG. 21 is a side view of the recline positioner, recline actuator, and recline adjustment handle of the seat assembly of FIG. 15, with the recline adjustment handle in the unactuated position.

[0043] FIG. 22 is a side view of the recline positioner, recline actuator, and recline adjustment handle of the seat assembly of FIG. 15, with the recline adjustment handle in the actuated position.

[0044] FIG. 23 is a perspective exploded view of a seat assembly with a recline mechanism according to another exemplary embodiment.

[0045] FIG. 24 is a perspective exploded view of a recline positioner, recline actuator, and recline lock of the seat assembly of FIG. 23.

[0046] FIG. 25 is a perspective view of a seat with a recline positioner of the seat assembly of FIG. 23.

[0047] FIG. 26 is a perspective exploded view of a recline positioner, recline actuator, and recline lock of the seat assembly of FIG. 23.

[0048] FIG. 27 is a perspective exploded view of the recline lock and base of the seat assembly of FIG. 23.

[0049] FIG. 28 is a perspective exploded view of the recline positioner, recline actuator, recline lock, and recline adjustment handle of the seat assembly of FIG. 23.

[0050] FIG. 29 is a side view of the recline positioner, recline actuator, and recline adjustment handle of the seat assembly of FIG. 23, with the recline adjustment handle in the unactuated position.

[0051] FIG. 30 is a side view of the recline positioner, recline actuator, and recline adjustment handle of the seat assembly of FIG. 23, with the recline adjustment handle in the actuated position.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0052] Reference will now be made in detail to presently preferred embodiments of the invention, examples of which are illustrated in the accompanying drawings. An effort has been made to use the same reference numbers throughout the drawings to refer to the same or like parts.

[0053] A child seat for a toddler and/or young child in accordance with one aspect of the invention includes a separable seat and base to be installed in the forward facing position only. The separable base simplifies installation because it may be placed in the desired vehicle seat location and the vehicle seat belt wrapped around the base and buckled in a manner similar to a seated passenger. Providing for only forward facing installation simplifies installation because many toddler seats provide forward and rear facing belt paths, which can be confusing to the installer (child caregiver). The top surface of the separable base may be contoured in such a way that the installer (child caregiver)

may apply their weight comfortably using their hand, elbow or knee so that a more secure installation may be obtained.

[0054] The separable base may be provided with one or more vehicle belt lockoff mechanisms positioned substantially in the path of the vehicle belt shoulder portion. These vehicle belt lockoff mechanisms will allow the vehicle belt shoulder portion to be locked to the base once it has been pulled tight and eliminates the need for additionally supplied pre-crash positioners (locking clips).

[0055] The separable seat and base may be provided with a latch mechanism for securely latching the seat to the securely installed base. The seat or base may also be provided with a seat release mechanism to easily release the seat from the base for re-installation. The seat or base may be provided with a recline mechanism for reclining the child seat without requiring vehicle belt, tether or LATCH belt loosening or reinstallation.

[0056] FIGS. 1 and 2 illustrate a child seat assembly 10 that includes one or more lock-off mechanisms 20 according to an exemplary embodiment of the invention. The seat assembly 10 includes a base 30 and a seat 40 that may be movably and detachably coupled to the base 30 in a forward-facing orientation relative to a front of a vehicle. The seat 40 includes a seat back 70 and a seat bottom 72. The base 30 includes a bottom portion 33 and a back portion 35. The lockoff mechanisms 20 may be mounted to the base 30 and act to secure a vehicle seat belt 32 of the vehicle to the base 30. The lockoff mechanisms 20 may be mounted to a front surface 37 of the back portion 35, for example, and the lock-off mechanisms 20 may be a pair of lock-off mechanisms 20 mounted to opposite sides of the front surface 37 of the back portion 35. Mounting the lock-off mechanisms 20 on opposite sides allows for the base 30 to be secured either the left or right vehicle seat.

[0057] FIGS. 3-4 illustrate the base 30 of the seat assembly 10 during steps in a method of installing the seat assembly 10 in a vehicle with a vehicle seat 38 having a seat belt 32. The method of installing is described for the situation where the seat belt 32 is a combination shoulder and lap belt and comprises a shoulder belt portion 34, lap belt portion 36, and a vehicle belt buckle 31. Initially, the base 30 is positioned on the vehicle seat 38. The shoulder belt portion 34 and the lap belt portion 36 are then placed across the base 30 and the buckle 31 is secured to a vehicle belt socket. The seat belt 32 may be tightened as desired by pressing the base 30 down into the vehicle seat 38, and pulling the shoulder belt portion 34 tight in the direction of the arrow A. The shoulder belt portion 34 is locked to the base 30 in one of the lock-off mechanisms 20 mounted to the base 30. The seat 40 is attached to the base 30 in a forward-facing orientation (towards the front of the vehicle), as discussed further below.

[0058] Because the seat belt is not secured to the seat 40 itself, the seat can be reclinably adjusted, or removed to clean a wash cover of the seat, for example, without altering the seat belt.

[0059] FIGS. 1-4 illustrate the lock-off mechanism 20 as part of a base 30 of a seat assembly 10 having a separate base 30 and seat 40. Alternatively, the lock-off mechanism 20 may be part of a seat assembly without a separate base.

[0060] FIGS. 5A-5C illustrate one embodiment of the lock-off mechanism 20. The lock-off mechanism in this

embodiment includes a lower jaw 510, upper jaw 520, and an actuator 530. The lower jaw 510 may be coupled to a child seat (such as being attached to the base 30 shown in FIG. 1, for example). The lower jaw 510 may be molded as part of the base 30, for example, or may be attached with fasteners. The upper jaw 520 is movably connected to the lower jaw 510 and movable between an open position (see FIG. 5A) and a closed position (see FIG. 5B), by means of, for example, a hinge 535 that allows the upper jaw 520 to move relative to the lower jaw 510 via rotation about an axis of the hinge 535. When the upper jaw 520 and the lower jaw 510 are in the closed position, the upper jaw 520 and the lower jaw 510 create a belt path therebetween to receive a vehicle seat belt.

[0061] Both the upper jaw 520 and the lower jaw 510 may include a gripping geometry to enhance the grip of the lock-off mechanism 20 on a seat belt (not shown in FIGS. 5A-5C) when the lock-off mechanism 20 is in a closed position with the seat belt between the upper jaw 520 and the lower jaw 510. For example, the lower jaw 510 may have a contact surface 515 which is roughened or ridged, and the upper jaw 520 may also have a contact surface 525 which is roughened or ridged. When the lock-off mechanism 20 is closed with a seat belt between the upper jaw 520 and the lower jaw 510, the contact surfaces 515 and 525 contact the seat belt to enhance the grip on the seat belt.

[0062] The contact surface 515 of the lower jaw 510 may include at least two ridges 517 formed on the contact surface 515 and at least partially traversing the belt path to deflect the vehicle seat belt in the belt path. The ridges 517 may be perpendicular to the belt path, or angled relative to the belt path.

[0063] The actuator 530 of the lock-off mechanism 20 acts to lock or unlock the lock-off mechanism 20 in the closed position. The actuator 530 is slidably connected to the upper jaw 510. In this regard, the upper jaw 520 may include a slot 518 to engage the actuator 530 so that the actuator 530 may slide relative to the upper jaw 520.

[0064] When the upper jaw 520 is moved relative to the lower jaw 510 so that the lock-off mechanism 20 is in a closed position, the actuator 530 acts to lock the lock-off mechanism 20. In this regard, the actuator 530 includes a tongue 519 that engages and interlocks with an actuator receptacle 550 on the lower jaw 510. When the upper jaw 520 is moved relative to the lower jaw 510 towards the closed position, the tongue 519, which has a cam shape, slides over ramps 552 of the actuator receptacle 550 and engages within a recess 554 of actuator receptacle 550.

[0065] Thus, the lock-off mechanism 20 in this embodiment allows for a one-step automatic closure of the lock-off mechanism 20 simply by closing the upper jaw 520 relative to the lower jaw 510.

[0066] When the lock-off mechanism 20 is in the closed and locked position, the actuator 530 may be slid relative to the upper jaw 520 in the direction of the arrow so that the tongue 519 slides out of the recess 554 and over the ramps 552, and thus becomes disengaged from the actuator receptacle 550, thus unlocking the lock-off mechanism 20. When the lock-off mechanism 20 is unlocked, the upper jaw 520 may be moved relative to the lower jaw 510 to an open position.

[0067] FIGS. 5A-5C illustrate the actuator 530 connected to the upper jaw 520, and the actuator receptacle 550 on the lower jaw 510. Alternatively, the actuator 530 may be connected to the lower jaw 510, and the actuator receptacle 550 may be on the upper jaw 520.

[0068] FIGS. 6A-6C illustrate another embodiment of the lock-off mechanism 20. The lock-off mechanism in this embodiment includes a lower jaw 610, an upper jaw 620, and an actuator 630. The lower jaw 610 may be coupled to a child seat (such as being attached to the base 30 shown in FIG. 1, for example). The upper jaw 620 is movably connected to the lower jaw 610 and movable between an open position (see FIG. 6C) and a closed position (see FIG. 6B), by means of, for example, a hinge 635 that allows the upper jaw 620 to move relative to the lower jaw 610 via rotation about an axis of the hinge 635.

[0069] Both the upper jaw 620 and the lower jaw 610 may include a gripping geometry to enhance the grip of the lock-off mechanism 20 on a seat belt (not shown in FIGS. 6A-6C) when the lock-off mechanism 20 is in a closed position with the seat belt between the upper jaw 620 and the lower jaw 610. For example, the lower jaw 610 may have a contact surface 615 which is roughened or ridged, and the upper jaw 620 may also have a contact surface 625 which is roughened or ridged. When the lock-off mechanism 20 is closed with a seat belt between the upper jaw 620 and the lower jaw 610, the contact surfaces 615 and 625 contact the seat belt to enhance the grip on the seat belt.

[0070] The actuator 630 of the lock-off mechanism 20 acts to lock or unlock the lock-off mechanism 20 in the closed position. The actuator 630 is pivotably connected to an end of the lower jaw 610 opposite to the end of the lower jaw 610 that connects to the upper jaw 620.

[0071] When upper jaw 620 is moved relative to the lower jaw 610 so that the lock-off mechanism 20 is in a closed position, the actuator 630 may be actuated to lock the lock-off mechanism 20. In this regard, the actuator 630 includes a bail 619 that may be rotated (clockwise in FIG. 6A) about a hinge 618 so that the bail 619 engages an extension portion 613 on the upper jaw 620. The extension portion 613 has a self tightening cam shape so that as the bail 619 is rotated to engage the extension portion 613, the lock-off mechanism may be locked tight.

[0072] When the lock-off mechanism 20 is in the closed and locked position, the bail 619 may be rotated (counterclockwise in FIG. 6A) to disengage the extension portion 613, thus unlocking the lock-off mechanism 20. When the lock-off mechanism 20 is unlocked, the upper jaw 620 may be moved relative to the lower jaw 610 to an open position.

[0073] FIGS. 6A-6C illustrate the actuator 630 connected to the lower jaw 610, and the extension portion 613 on the upper jaw 620. Alternatively, the actuator 630 may be connected to the upper jaw 620, and the extension portion 613 may be on the lower jaw 610.

[0074] FIGS. 7A-7C illustrate yet another embodiment of the lock-off mechanism 20. The lock-off mechanism in this embodiment includes a lower jaw 710, an upper jaw 720, and an actuator 730. The lower jaw 710 may be coupled to a child seat (such as being attached to the base 30 shown in FIG. 1, for example). The upper jaw 720 is movably connected to the lower jaw 710 and movable between an

open position (see FIG. 7C) and a closed position (see FIG. 7A), by means of, for example, a hinge 735 that allows the upper jaw 720 to move relative to the lower jaw 710 via rotation about an axis of the hinge 735.

[0075] Both the upper jaw 720 and the lower jaw 710 may include a gripping geometry to enhance the grip of the lock-off mechanism 20 on a seat belt (not shown in FIGS. 7A-7C) when the lock-off mechanism 20 is in a closed position with the seat belt between the upper jaw 720 and the lower jaw 710. For example, the lower jaw 710 may have a contact surface 715 which is roughened or ridged, and the upper jaw 720 may also have a contact surface 725 which is roughened or ridged. When the lock-off mechanism 20 is closed with a seat belt between the upper jaw 720 and the lower jaw 710, the contact surfaces 715 and 725 contact the seat belt to enhance the grip on the seat belt.

[0076] The actuator 730 of the lock-off mechanism 20 acts to lock or unlock the lock-off mechanism 20 in the closed position. The actuator 730 is slidably connected to the upper jaw 710. The upper jaw 720 includes an inner cavity 717 to receive the actuator 730 so that the actuator 730 may be slid relative to the upper jaw 720 within the inner cavity 717.

[0077] When the upper jaw 720 is moved relative to the lower jaw 710 to the closed position, the actuator 730 acts to lock the lock-off mechanism 20. In this embodiment, when the upper jaw 720 is moved relative to the lower jaw 710 to move to the closed position, the lock-off mechanism 20 is automatically locked. The movement of the upper jaw 720 from the open position to the closed position automatically causes the upper jaw 720 to lock relative to the lower jaw 710.

[0078] The actuator 730 includes an actuator body 732 and grips 734. The actuator body 732 has an extended portion 736 that engages and interlocks with an actuator receptacle 750 on the lower jaw 710 automatically when the upper jaw 720 and lower jaw 710 are pressed closed together into the closed position. The actuator receptacle 750 comprises a ramp 752. When the upper jaw 720 and lower jaw 710 are pressed closed together to be in the closed position, a cam surface of the extended portion 736 slides over the ramp 752, and then the extended portion 736, slides into a socket under the ramp to prevent the lock-off mechanism 20 from opening. In this regard the actuator body 732 is biased outwards towards the socket.

[0079] When the lock-off mechanism 20 is in the closed and locked position, the actuator 730 may be slid relative to the upper jaw 720 by engaging the grips 734 and sliding the actuator 730 away from the actuator receptacle 750, thus moving the extended portion 736 out of the socket under the ramp 752. When the lock-off mechanism 20 is unlocked, the upper jaw 720 may be moved relative to the lower jaw 710 to an open position.

[0080] FIGS. 7A-7C illustrate the actuator 730 connected to the upper jaw 720, and the actuator receptacle 750 on the lower jaw 710. Alternatively, the actuator 730 may be connected to the lower jaw 710, and the actuator receptacle 750 may be on the upper jaw 720.

[0081] FIGS. 8A-8D illustrate another embodiment of the lock-off mechanism 20. The lock-off mechanism in this embodiment includes a lower jaw 810, an upper jaw 820, and a latch 830. The lower jaw 810 may be coupled to a child

seat (such as being attached to the base **30** shown in **FIG. 1**, for example). Alternatively, the lock-off mechanism **20** (of this embodiment or the embodiments discussed above) may be attached to a base of an infant child seat along the belt path of the base, as shown in **FIGS. 8A and 8B**. The upper jaw **820** is movably connected to the lower jaw **810** and movable between an open position (see **FIG. 8D**) and a closed position (see **FIG. 8C**), by means of, for example, a hinge **835** that allows the upper jaw **820** to move relative to the lower jaw **810** via rotation about an axis of the hinge **835**.

[**0082**] Both the upper jaw **820** and the lower jaw **810** may include a gripping geometry to enhance the grip of the lock-off mechanism **20** on a seat belt **32** when the lock-off mechanism **20** is in a closed position with the seat belt **32** between the upper jaw **820** and the lower jaw **810**. For example, the lower jaw **810** may have a slot **815**, and the upper jaw **820** may have a ridge **825** configured to fit within the slot **815**. When the lock-off mechanism **20** is closed with a seat belt between the upper jaw **820** and the lower jaw **810**, the ridge **825** presses the seat belt into the slot **815** to enhance the grip on the seat belt, such as shown in **FIG. 8B**.

[**0083**] The latch **830** of the lock-off mechanism **20** acts to lock or unlock the lock-off mechanism **20** in the closed position. The latch **830** is pivotably connected to an end of the lower jaw **810** opposite to the end of the lower jaw **810** that connects to the upper jaw **820**.

[**0084**] When upper jaw **820** is moved relative to the lower jaw **810** so that the lock-off mechanism **20** is in a closed position, the latch **830** may be moved relative to the lower jaw **810** to lock the lock-off mechanism **20**. In this regard, the latch **830** includes a recess **832** that engages a protrusion **822** on the upper jaw **820**. In locking the lock-off mechanism **20**, the seat belt **32** is pulled tight, and moving the latch **830** so that the recess **832** engages the protrusion **822** provides leverage in holding the belt **32**.

[**0085**] When the lock-off mechanism **20** is in the closed and locked position, the latch **830** may be lifted to disengage the recess **832** from the protrusion **822**, thus unlocking the lock-off mechanism **20**. When the lock-off mechanism **20** is unlocked, the upper jaw **820** may be moved relative to the lower jaw **810** to an open position.

[**0086**] **FIGS. 8A-8D** illustrate the latch **830** connected to the lower jaw **810**, and the protrusion **822** on the upper jaw **820**. Alternatively, the latch **830** may be connected to the upper jaw **820**, and the protrusion **822** on the lower jaw **810**.

[**0087**] The above described lock-off mechanism **20**, while described above for use with a forward facing child seat, may alternatively be used with a rearward facing infant seat, where the lock-off mechanism acts to secure a base of an infant seat assembly including the base to an infant seat removably attachable to the base.

[**0088**] **FIGS. 9-12** illustrate a latch mechanism and release mechanism for respectively latching and releasing the seat **40** to and from the base **30**. The latch mechanism **1020** detachably couples to a cross bar **65** on the back portion **35** of the base **30** (**FIG. 10** shows only one latch mechanism **1020** and part of the cross bar **65** for ease of illustration). The latch mechanism **1020** includes a first latch member **1010** fixed to a seat back **70** of the seat **40** and a second latch member **1015** movably coupled to the seat back **70**. The second latch member **1015** moves upon contact with

the cross bar **65** as the seat **40** is being attached to the base **30**. The first and second latch members **1010** and **1015** are configured to latch around the cross bar **65** to secure the seat **40** to the base **30**. When the seat **40** is secured to the base **30**, the seat back **70** is pivotally and detachably coupled to the back portion **35**.

[**0089**] The first latch member **1010** may comprise a hook, and the second latch member **1015** may comprise a pivotable jaw pivotably attached to the seat back **70** at a pivot point **1017**, for example. When the seat **40** is attached to the base **30**, the first latch member **1010** is guided in towards the cross bar **65** by the shape of the base **30**. As the seat **40** is guided into the base **30**, the second latch member **1015** strikes the cross bar **65**, and pivots about its pivot point **1017** to an unbiased position allowing the cross bar **65** to fit between the first latch member **1010** and the second latch member **1015**. The second latch member **1015** then springs back into a biased position, thereby securing the cross bar **65** between the first latch member **1010** and the second latch member **1015**.

[**0090**] The seat back **70** includes a release mechanism **1030** that releases the latch mechanism **1020** so that the seat **40** may be separated from the base **30**. The release mechanism **1030** includes a latch actuator **1040** movably coupled to the seat back **70**. The second latch member **1015** is coupled to the latch actuator **1040** such that movement of the latch actuator **1040** causes movement of the second latch member **1015** from a closed position to an open position relative to the first latch member **1010**. In the closed position the cross bar **65** may be secured. In the open position the cross bar **65** may be removed from the first and second latch members **1010** and **1015**. The release mechanism **1030** allows the seat **40** to be easily released from the base **30** for re-installation.

[**0091**] The latch actuator **1040** may include a handle portion **1042** and arm portions **1044**, where the arm portions **1044** are coupled to the second latch member **1015**. When the first and second latch member **1010** and **1015** are in the closed position, the handle portion **1042** may be raised so that pin on the arm portions **1044** rides in a slot **1016** of the second latch member **1015** to cause the second latch member **1015** to rotate into the open position. The cross bar **65** may then be removed from the first and second latch members **1010** and **1015**.

[**0092**] As mentioned above, the seat **40** can be adjusted to different recline positions relative to the base **30**. **FIGS. 13-14** respectively illustrate two of the recline positions of the seat **40** relative to the base **30**. In general the number of recline positions may be two or more. The different recline positions allow the seat assembly to be used for different situations as desired. For example, an upright recline position may be desired for an older child, while a more reclined position may be desired for a younger child.

[**0093**] To facilitate adjustment between recline positions, the seat **40** can pivot relative to the base **30** about the cross bar **65** mounted to the back portion **35** of the base **30**. In addition, the seat **40** and the base **30** each include components of a recline mechanism, as described and illustrated fully in **FIGS. 15-22** and **23-30**. The recline mechanism allows for reclining the seat **40** without requiring a vehicle belt, tether or LATCH belt loosening/reinstallation.

[**0094**] Briefly, as best shown in **FIG. 18** and **FIG. 20**, the recline mechanism includes a recline positioner **1110**, **1210**,

a recline actuator 1130, 1230, a recline lock 1140, 1240, and a recline adjustment handle 1150, 1250. The recline positioner 1110, 1210 is permanently mounted to an underside of a seat bottom 72 of the seat 40. The recline positioner 1110, 1210 includes a number of slots 1112, 1212, such as three slots, for example, corresponding to respectively different recline positions. The recline actuator 1130, 1230 is located between the recline positioner 1110, 1210 and the seat bottom 72. The recline actuator 1130, 1230, may be moved relative to the recline positioner 1110, 1210 to be engaged within slots 1112, 1212 in the recline positioner 1110, 1210.

[0095] The recline lock 1140, 1240 is movably mounted to the base 30 of the child seat assembly 10. The recline lock 1140, 1240 can travel into and out of a slot 1111, 1211 in the base 30 for engagement with a selected slot 1112, 1212 in the recline positioner 1110, 1210 to lock the seat 40 in place at a selected recline position. The recline lock 1140, 1240 is disengaged from the recline positioner 1110, 1210 upon actuation of the recline adjustment handle 1150, 1250, which is mounted to the seat 40. When the handle 1150, 1250 is moved so to actuate the recline actuator 1130, 1230, the handle 1150, 1250 forces the recline actuator 1130, 1230 toward the recline positioner 1110, 1210 pushing the recline lock 1140, 1240 clear of the slots 1112, 1212 in the recline positioner 1110, 1210 so that the seat 40 can be adjusted to a different recline position. The details of the recline mechanism now will be described with reference to FIGS. 15-30.

[0096] FIGS. 15-22 illustrate one embodiment of the recline mechanism. The recline positioner 1110 is mounted to the seat 40 at an underside of the seat bottom 72. The recline positioner 1110 is configured to slide along a contoured upper surface 37 of the bottom portion 33 of the base 30 so that the seat 40 may be adjusted in its recline position. As can be seen in FIG. 20, the front face 1118 of the recline positioner 1110 is contoured the same as the upper surface 37 of the bottom portion 33. The upper surface has a slot 1111 through which the recline lock 1140 can protrude. The recline lock 1140 is biased by one or more springs 1142 towards an engaging position at which the recline lock 1140 engages one of the slots 1112 of the recline positioner 1110. Thus when the recline lock 1140 is aligned with the desired slot 1112 of the recline positioner 1110, the spring(s) 1142 biases the recline lock 1140 into the desired slot 1112 so as to engage and lock the seat 40 relative to the base 30.

[0097] In this embodiment each of the slots 1112 has a stop portion 1113 in the center of the slot 1112 so that the recline lock 1140 is stopped from further penetration into the slot 1112 upon engaging with the stop portion 1113.

[0098] A pair of recline actuators 1130 are positioned between the underside of the seat bottom 72 and the recline positioner 1110. The recline actuators 1130 are biased to a disengaged position by springs 1114 arranged between a back wall P of the recline positioner 1110 and the recline actuator 1130 (see FIGS. 18-19B). The recline actuators slide in and are guided in channels defined by ribs 1116 on the recline positioner 1110 between an engaged and disengaged position. The springs 1114 act to bias the recline actuators 1130 away from the back wall P so that, until the actuators are actuated, the actuators 1130 do not prevent the recline lock 1140 from extending in its engaged position (biased position) within one of the slots 1112.

[0099] The recline actuators 1130 may be moved between an engaged position with ridges 1132 extending into slots

1112 (see FIGS. 19B and 22), and a disengaged position (see FIG. 21). The recline actuators 1130 have a number of ridges 1132 sized to fit within the slots 1112 of the recline positioner 1110. When the recline actuators 1130 are actuated and move in the direction shown by the arrow in FIG. 21, the actuators 1130 move counter to the biasing from the springs 1114, and the ridges 1132 move into respective of the slots 1112 as shown in FIG. 22. When the ridges 1132 move into the slots, one of the ridges necessarily moves into the slot where the recline lock 1140 is positioned and engages the recline lock 1140, forcing the recline lock 1140 from the slot to a disengaged position. The seat 30 may then be moved to a different recline position and the lock 1140 slid along the contoured surface 1118 until the lock 1140 engages another slot 1112.

[0100] The recline actuators 1130 are movable relative to the seat bottom 72 into engagement with slots 1112 of the recline positioner 1110 upon actuation by the recline adjustment handle 1150 to cause the recline lock 1140 to move from the engaged position to the disengaged position. The actuators 1130 are actuated by means of the recline adjustment handle 1150. The recline adjustment handle 1150 is pivotably mounted to the recline positioner 1110, such as by pivot bosses 1152 engaging pivot holes 1117 on the recline positioner 1110. The handle 1150 extends through the seat 40 to the front surface of the seat bottom 72 and includes a grip 1154 for a user to grasp to pivot the handle 1150. When the handle 1150 is pivoted in the direction of the arrow shown in FIG. 22, a handle engagement surface 1154 of the handle 1150 engages with the actuator engagement surfaces 1136 of the recline actuator 1130 and forces the recline actuators 1130 towards the back wall P of the recline positioner 1110 in a direction opposite to the biasing by the springs 1114. The ridges 1132 then move into respective slots 1112 and disengage the recline lock 1140 as discussed above.

[0101] FIGS. 23-30 illustrate another embodiment of the recline mechanism. The recline mechanism in this embodiment has a number of features similar to those of the embodiment illustrated in FIGS. 15-22. For example, in this embodiment the recline positioner 1210 is mounted to the seat 40 at an underside of the seat bottom 72 as shown in FIG. 25, and is configured to slide along a contoured upper surface 37 of the bottom portion 33 of the base 30 so that the seat 40 may be adjusted in its recline position. The upper surface 35 has a slot 1211 through which the recline lock 1240 protrudes. As shown in FIG. 27, the recline lock 1240 is assembled from a back side of the base 30 and slides within slot 1211. The recline lock 1240 is biased by one or more springs 1242 towards the engaging position of the recline lock 1240 where the recline lock 1240 engages with a slot 1212. Thus, when the recline lock 1240 is aligned with the desired slot 1212 of the recline positioner 1210, the springs 1242 bias the recline lock 1240 into the desired slot 1212 so as to engage the desired slot and lock the seat 40 relative to the base 30.

[0102] In this embodiment the recline actuator 1230 is positioned between the underside of the seat bottom 72 and the recline positioner 1210. In this embodiment, however, the recline actuator 1230 is biased away from the recline positioner 1210 toward the underside of the seat back 33 by springs 1214 arranged around posts 1216 on the recline positioner 1210. The springs 1214 engage respective

recesses **1238** of the recline actuator **1230** to bias the recline actuator **1230** in a direction away from the recline positioner **1210**. The recline actuator **1230** is movable relative to the recline positioner **1210** in a direction normal to the slots **1212** of the recline positioner **1210**. The springs **1214** act to bias the recline actuators **1230** away from the slots **1212** in a direction normal to the slots **1212**, so that until the actuator **1230** is actuated, the actuator **1230** does not prevent the recline lock **1240** from extending in its engaged (biased) position with one of the slots **1212**. In contrast to the slots **1112** in the embodiment of FIGS. 15-22, in this embodiment the slots **1212** each have two stop portions **1213** on opposite ends of the slot **1212** so that the recline lock **1140** is stopped from further penetration into the slot **1212** upon engaging with the stop portions **1213**. By contrast, the slots **1112** in the embodiment of FIGS. 15-22 have a stop portion **1113** in the center of the slot **1112** (see FIG. 19B).

[0103] As seen in FIGS. 26 and 28, the recline actuator **1230** has a number of ridges **1232** on a raised portion **1233**. The raised portion **1233** fits between walls of the stop portions **1213** of the slots **1212**. The ridges **1232** are sized to fit within the slots **1212** of the recline positioner **1210**. When the recline actuators **1230** are actuated, the actuators **1230** move in a direction opposite to the biasing from the springs **1214**, and the ridges **1232** move into respective slots **1212** as shown in FIG. 30. When the ridges **1232** move into the slots, the recline lock **1240** present in one of the slots **1212** is engaged with one of the ridges **1232** forcing the recline lock **1140** from the slot. The seat **30** may then be reclined to a different recline position.

[0104] FIG. 29 illustrates a recline adjustment handle **1250** in an unactuated position, while FIG. 31 illustrates the recline adjustment handle **1250** in an actuated position. The recline actuator **1230** is movable relative to the seat bottom **72** into engagement with the recline positioner **1210** upon actuation by the recline adjustment handle **1250** to cause the recline lock **1240** to move from the engaged position to the disengaged position. The actuators **1230** are actuated by means of the recline adjustment handle **1250**. The recline adjustment handle **1250** is mounted to the seat bottom **72**, and the grip **1254** of the handle **1250** is visible on the front of the seat **40**. When the handle **1250** is pulled forward by a user, a handle engagement portion **1252** of the handle **1250** engages with the actuator **1230** and forces the recline actuator **1230** towards the recline positioner **1210** in a direction opposite to the biasing by the springs **1242**. The ridges **1232** then move into respective slots **1212** and disengage the recline lock **1240** as discussed above.

[0105] The preferred embodiments have been set forth herein for the purpose of illustration. This description, however, should not be deemed to be a limitation on the scope of the invention. Various modifications, adaptations, and alternatives may occur to one skilled in the art without departing from the claimed inventive concept. The true scope and spirit of the invention are indicated by the following claims.

What is claimed is:

1. A forward-facing child seat, comprising:
 - a base;
 - a seat removably attachable to the base in a forward-facing orientation relative to a front of the vehicle; and

at least one lock-off mechanism mounted to the base to secure a vehicle seat belt to the base.

2. The child seat according to claim 1, wherein the lock-off mechanism comprises a lower jaw mounted to the base, and an upper jaw movable relative to the lower jaw between an open position and a closed position.

3. The child seat according to claim 2, wherein the upper jaw slides relative to the lower jaw.

4. The child seat according to claim 2, wherein the upper jaw is pivotably attached to the lower jaw.

5. The child seat according to claim 2, wherein the upper jaw and the lower jaw create a belt path therebetween when the upper jaw is in the closed position.

6. The child seat according to claim 5, wherein the lower jaw includes a contact surface and at least two ridges formed on the contact surface and at least partially traversing the belt path to deflect the vehicle seat belt in the belt path.

7. The child seat according to claim 6, wherein the ridges are formed perpendicular to the belt path.

8. The child seat according to claim 1, wherein the base includes a back, and the lock-off mechanism is mounted to the back.

9. The child seat according to claim 8, wherein the back includes a front surface, and the lock-off mechanism is mounted to the front surface of the back.

10. The child seat according to claim 9, wherein the at least one lock-off mechanism comprises a pair of lock-off mechanisms mounted to opposite sides of the front surface of the back.

11. The child seat according to claim 1, wherein the seat includes a seat back and the base includes a back portion, and the seat back is pivotally and detachably coupled to the back portion.

12. The child seat according to claim 11, wherein the back portion includes a cross bar, and the seat back includes a latch mechanism to detachably couple to the cross bar.

13. The child seat according to claim 12, wherein the latch mechanism includes a first latch member fixed to the seat back and a second latch member movably coupled to the seat back to move upon contact with the cross bar of the back portion, and wherein the first and second latch members are configured to latch around the cross member.

14. The child seat according to claim 13, wherein the first latch member comprises a hook, and the second latch member comprises a pivotal jaw to pivot between an open position and a closed position relative to the hook.

15. The child seat according to claim 12, wherein the seat back includes a release mechanism to release the latch mechanism from the cross bar.

16. The child seat according to claim 15, wherein the latch mechanism includes a first latch member fixed to the seat back and a second latch member movably coupled to the seat back to move upon contact with the cross bar of the back portion, and wherein the first and second latch members are configured to latch around the cross bar.

17. The child seat according to claim 16, wherein the release mechanism includes a latch actuator movably coupled to the seat back, and wherein the second latch member is coupled to the latch actuator such that movement of the latch actuator causes movement of the second latch member from a closed position to an open position relative to the first latch member.

18. A method of installing a child seat in a vehicle having a combination shoulder and lap belt, comprising:

providing the child seat with a base and a seat removably attachable to the base in a forward-facing orientation relative to a front of the vehicle;

positioning the base on a vehicle seat;

placing the combination shoulder lap and belt across the base and securing the combination shoulder and lap belt to a vehicle belt socket;

locking a shoulder belt portion of the combination shoulder and lap belt to the base in a lock-off mechanism mounted to the base; and

attaching the seat to the base in the forward-facing orientation.

19. A lock-off mechanism for a child seat, comprising:

a lower jaw to couple to the child seat;

an upper jaw movably connected to the lower jaw and movable between an open position and a closed position;

an actuator connected to one of the lower jaw and the upper jaw; and

an actuator receptacle located on the other of the lower jaw and the upper jaw,

wherein, movement of the upper jaw from the open position to the closed position causes engagement of the actuator and the actuator receptacle to lock the upper jaw relative to the lower jaw.

20. The lock-off mechanism according to claim 19, wherein the actuator is slidably connected to the upper jaw.

21. The lock-off mechanism according to claim 20, wherein the actuator includes an actuator body and at least one actuator handle to move the actuator body relative to the upper jaw.

22. The lock-off mechanism according to claim 21, wherein the actuator body includes an extended portion, and the actuator receptacle includes a lip, and wherein the extended portion is configured to slide under and engage the lip.

23. A lock-off mechanism for a child seat, comprising:

a lower jaw to couple to the child seat; and

an upper jaw movably connected to the lower jaw and movable between an open position and a closed position;

wherein, movement of the upper jaw from the open position to the closed position automatically causes the upper jaw to lock relative to the lower jaw.

24. A child seat to secure to a vehicle seat, comprising:

a lock-off mechanism coupled to the child seat, the lock-off mechanism including,

a lower jaw to couple to the child seat; and

an upper jaw movably connected to the lower jaw and movable between an open position and a closed position;

wherein, movement of the upper jaw from the open position to the closed position automatically causes the upper jaw to lock relative to the lower jaw.

* * * * *