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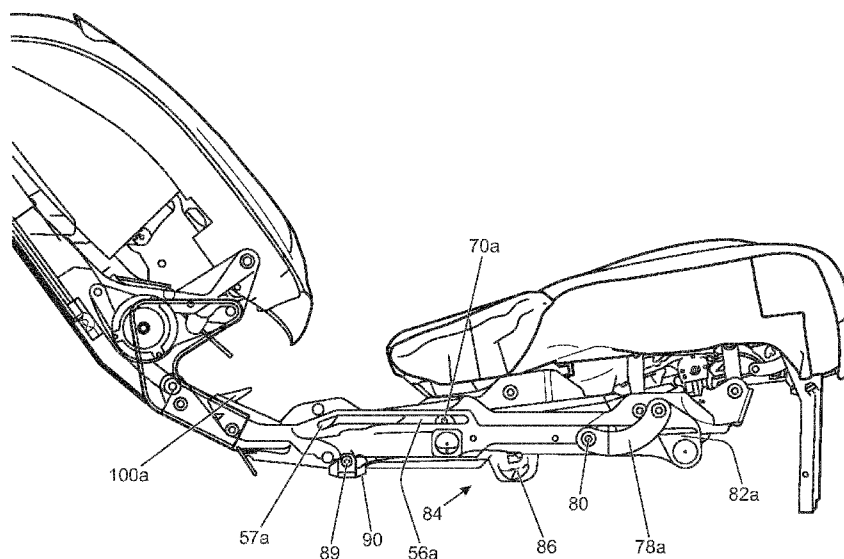


Figure 7

(57) Abstract: The invention resides in a seat support structure for a passenger seat of a vehicle, the seat support structure comprising at least one anchor point for securing child safety apparatus to the vehicle, and drive means arranged to drive the seat cushion assembly between a seating configuration in which the at least one anchor point is obscured, and a deployed configuration in which the at least one anchor point is accessible.





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IMPROVEMENTS TO VEHICLE SEATING

TECHNICAL FIELD

The present disclosure relates to improvements to vehicle seating. In particular, but not exclusively, the disclosure relates to improvements to the rear passenger seating assembly of an automobile to enable easier access to the vehicle's safety systems. Aspects of the invention relate to a seat support structure, a control module for a seat support structure, a vehicle comprising a seat support structure and a method of repositioning a seat support structure.

BACKGROUND

ISOFIX (International Standardisation Organisation Fixation) is the international standard for attachment points for child safety seats in passenger cars. ISOFIX is the name given to this standard in the European Union. The standard is known as Lower Anchors and Tethers for Children (LATCH) in the United States of America, and Lower Universal Anchorage System (LUAS) or Canfix in Canada. It is also known as the Universal Child Safety Seat System (UCSSS).

The ISOFIX system comprises a pair of anchor points attached to the frame of a passenger vehicle. The anchor points are located to the rear of where the backrest, also known in the art as a "squab", and the cushion of a rear passenger seat meet. Where the backrest and the seat cushion meet is known as the seat nip or bite. Child seats and universal bases for child seats have engagement portions that correspond to the anchor points. To install a child seat base or child seat the engagement portions are aligned and engaged with the anchor points. To prevent pivoting of a child seat in the event of a head-on collision, ISOFIX systems also include either (i) a leg which extends from the front of the child seat base or child seat to the floor of the vehicle, or (ii) a tether which extends from the child seat or child seat base to a tether point usually located behind the rear passenger seat.

United Kingdom Patent GB 2 424 177 B describes a system for installing a child seat using an ISOFIX system. However, a problem with the system described therein is that in order to locate the anchor points a user of the vehicle must prise the seat nip open and feel for the anchor points by hand. This may be uncomfortable as the materials and components used in luxury seating are typically not pliable enough to allow a person to squeeze a hand into the seat nip to locate the anchor points. Also, the installer is unable to easily visually confirm that the engagement portions have correctly engaged with the anchor points. Installation of a

child or baby seat in a luxury vehicle is made more difficult due to the bigger cushions used in the seating of luxury vehicles.

The present invention seeks to address at least some of the above problems by improving upon known vehicle seating to enable easier installation of child seats and child seat bases. In particular, the invention seeks to improve upon the known process of installing child seats and child seat bases in passenger vehicles, and to facilitate the process.

SUMMARY OF THE INVENTION

According to an aspect of the invention, there is provided a seat support structure for a passenger seat of a vehicle. The seat support structure comprises at least one child safety apparatus securing anchor point for securing child safety apparatus to the vehicle. The seat support structure comprises a backrest assembly and a seat cushion support. The seat support structure also comprises drive means arranged to drive the seat cushion support between a seating configuration in which the seat cushion support has a first position relative to the backrest assembly wherein the at least one anchor point is concealed, and a deployed configuration in which the seat cushion support has a second position relative to the backrest assembly wherein the at least one anchor point is exposed.

The invention provides a means to enable the easy installation of vehicle child safety apparatus. A user of the invention may activate the seat support structure so that it switches from the seating configuration to the deployed configuration to reveal the at least one anchor point. The backrest assembly may comprise a backrest and the seat support structure may comprise a seat cushion, which may meet so that the seat support structure may be used to carry a passenger. Since the seat cushion and backrest may meet to obscure the at least one anchor point, the first position of the seat cushion support may be referred to as the closed position

The child safety apparatus may be, for example, a child seat.

In the deployed configuration the seat support structure may be configured to allow access to the at least one anchor point. In this way the seat cushion support may be moved away from the backrest assembly to reveal the at least one anchor point, thereby enabling visual confirmation of, and easy access to, the at least one anchor point. Accordingly, in this configuration the second position may be referred to as the open position. This avoids the need for a user of the vehicle to manually prise apart the seat cushion and backrest to locate the at least one anchor point and install the child safety apparatus. Instead, when the seat

support structure is in the deployed configuration, the user may visually locate the at least one anchor point to attach the child safety apparatus. The seat support structure may be powered or manually operated.

- 5 Once the child safety apparatus is engaged with the at least one anchor point, the seat support structure may be switched from the deployed configuration to the seating configuration to secure the child safety apparatus.

10 The seat cushion support may support a seat cushion. For example, the seat cushion may be mounted on the seat cushion support. The seat cushion support may be reconfigurable between the closed position and the open position. The seat cushion support may be slidably reconfigurable between the seating configuration and the deployed configuration. At least a portion of the seat cushion support may be arranged to move linearly between the seating configuration and the deployed configuration. At least a portion of the seat cushion
15 support may be arranged to move in an arc between the seating configuration and the deployed configuration.

The seat cushion support may be mounted on at least one attachment member. The at least one attachment member may be arranged to reconfigure the seat support structure between
20 the seating configuration and the deployed configuration. The at least one attachment member may comprise a track for reconfiguring the seat support structure between the seating configuration and the deployed configuration. The at least one attachment member may be arranged to impede unwanted movement of the seat cushion support. For example, when the vehicle is subject to braking.

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The seat cushion support may comprise at least one seat cushion support engagement member and the at least one attachment member may comprise at least one mounting engagement member, wherein the at least one seat cushion support engagement member may be engaged with the at least one mounting engagement member. The at least one seat
30 cushion support engagement member may be arranged to move along the at least one mounting engagement member. The at least one seat cushion support engagement member may comprise a rotational member and/or a pin. The at least one mounting engagement member may comprise a rail and/or a slot. The rail and/or slot may comprise an inclined portion to impede movement of the seat cushion support. For example, when the vehicle is
35 subject to braking.

The seat cushion support may be attached to the at least one attachment member by a hanging assembly. The hanging assembly may be articulated to enable the movement of the seat cushion support relative to the at least one attachment member.

- 5 The seat cushion support comprises at least one hanger portion and the at least one attachment member may comprise at least one pivotally mounted connection bar. The at least one connection bar and the at least one hanger portion may be pivotally coupled.

10 The drive means may comprise a seat cushion support drive means for driving the seat cushion support between the seating configuration and the deployed configuration. The seat cushion drive means may comprise a motor. The drive means may be coupled to a drive bar which may be fixed in relation to the seat cushion support.

15 The seat support structure may comprise a seat cushion frame, wherein the seat cushion assembly may be arranged to switch the seat cushion frame between an engaged configuration and a disengaged configuration. In the engaged configuration the seat cushion frame may abut the seat cushion support. The seat cushion support may comprise a seat cushion support mounting on which the seat cushion frame may be mounted. The seat cushion support mounting may comprise at least one strut extending between the seat
20 cushion support and the seat cushion frame. The seat cushion support mounting may be arranged to urge the seat cushion frame from the engaged configuration to the disengaged configuration, and may be arranged to lower the seat cushion frame from the disengaged configuration to the engaged configuration. In the engaged configuration the seat cushion frame may sit on the seat cushion support, and in the disengaged configuration the seat
25 cushion frame may be located apart from the seat cushion support.

The seat support structure may comprise a seat cushion frame drive means for driving the seat cushion frame. The seat cushion drive means may comprise a motor.

- 30 According to an aspect of the invention, there is provided a seat support structure control module for controlling a seat support structure as described herein.

According to an aspect of the invention, there is provided a vehicle comprising a seat cushion assembly as described herein.

- 35 According to an aspect of the invention, there is provided a method of reconfiguring a seat cushion support relative to a backrest assembly comprised in a seat support structure of a passenger vehicle. The method may comprise driving the seat cushion support relative to

the backrest assembly to reveal or conceal at least one child safety apparatus securing anchor point.

Within the scope of this application it is expressly intended that the various aspects, embodiments, examples and alternatives set out in the preceding paragraphs, in the claims and/or in the following description and drawings, and in particular the individual features thereof, may be taken independently or in any combination. That is, all embodiments and/or features of any embodiment can be combined in any way and/or combination, unless such features are incompatible. The applicant reserves the right to change any originally filed claim or file any new claim accordingly, including the right to amend any originally filed claim to depend from and/or incorporate any feature of any other claim although not originally claimed in that manner.

BRIEF DESCRIPTION OF THE DRAWINGS

One or more embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1a is a schematic diagram of the luggage compartment and rear portion of the passenger compartment of a vehicle, wherein the rear seating arrangement is in an unfolded configuration;

Figure 1b is a schematic diagram of the luggage compartment and rear portion of the passenger compartment of the vehicle shown in Figure 1a, wherein the minor portion of the rear seating arrangement is in a folded configuration;

Figure 1c is a schematic diagram of the luggage compartment and rear portion of the passenger compartment of the vehicle shown in Figures 1a and 1b, wherein the rear seating arrangement is in a folded configuration;

Figure 2 is a schematic diagram of a perspective view of the internal components of the major portion of a rear seating assembly according to an embodiment of the invention;

Figures 3 to 7 are schematic cutaway diagrams of side views of the components of the major portion of the rear seating assembly, which operate the rear seating assembly in accordance with an embodiment of the invention;

Figure 8 is a schematic diagram of a side view of a passenger seat, in which the seat cushion is in a first seating position according to an embodiment of the invention;

Figure 9 is a schematic diagram of the side view of the passenger seat shown in Figure 8, in which the seat cushion is in a second deployed position, according to an embodiment of the invention;

Figure 10 is a cutaway perspective view of a passenger seat after it has been operated in accordance with an embodiment of the invention; and

Figure 11 is a schematic side view of a passenger seat in which a child seat is shown engaged with the rear seating assembly in accordance with an embodiment of the invention.

DETAILED DESCRIPTION

Figure 1a shows the rear portion of a passenger compartment 2 and a luggage compartment 4 of a vehicle 6. The terms “forwards”, “backwards”, “forwardmost” and “rearmost” are used to describe positions or locations of features relative to the vehicle 6. For example, the terms “forwards” and “forwardmost” refer to locations or positions towards or nearer the front of the vehicle 6, and “backwards” and “rearmost” refer to locations or positions towards or nearer the rear of the vehicle 6.

The passenger compartment 2 is separated from the luggage compartment 4 by a bulkhead 8 which extends from one side of the vehicle 6 to the other. The luggage compartment 4 is commonly referred to as the “trunk” or “boot” of a vehicle. The bulkhead 8 has a first surface 10 and a second surface 12. Luggage and other items are typically loaded into the luggage compartment 4 by opening a hinged hatch or door at the rear of the vehicle 6 to provide access to the luggage compartment 4.

The rear portion of the passenger compartment 2 includes a seating assembly 14 which is shown in a first configuration in Figure 1a. In the first configuration the first surface 10 of the bulkhead 8 faces the passenger compartment 2 and the second surface 12 faces the luggage compartment 4.

The seating assembly 14 comprises a first seat 16 and a second seat 18. A separating portion 20 is located between the first seat 16 and the second seat 18. Each seat 16, 18 comprises a seat cushion 22, a backrest 24, also referred to in the art as a squab, and a headrest 26. The separating portion 20 comprises a separating cushion 28 and a separating

backrest 30 which may comprise an armrest. The backrests 24, 30 are located adjacent to the first surface 10 of the bulkhead 8. This is referred to in the art as a 40-20-40 split: the first seat 16 comprises 40% of the seating of the seating assembly 14, the separating portion 20 comprises 20% of the seating of the seating assembly 14 and the second seat 18 comprises 40% of the seating of the seating assembly 14. The backrests 24, 30 are located adjacent to the first surface 10 of the bulkhead 8.

The seating assembly 14 is asymmetrically divided into portions, namely a major portion 31 and a minor portion 33. The bulkhead 8 is asymmetrically divided into a major bulkhead portion 17a and a minor bulkhead portion 19a, shown in Figures 1b and 1c which correspond to the major portion 31 and the minor portion 33 respectively. The major portion 31 comprises the second seat 18, the separating portion 20 and the major bulkhead portion 17a. The minor portion 33 comprises the first seat 16 and the minor bulkhead portion 19a.

The seats 16, 18 and separating portion 20 are arranged so that the backrests 24, 30 may each fold forward about an axis 21 parallel to the plane of the bulkhead 8. The major bulkhead portion 17a is also arranged to fold in cooperation with the backrests 24, 30 of the major portion 31, and the minor bulkhead portion 19a is arranged to fold in cooperation with the backrest 24 of the minor portion 33.

As shown in Figure 1b, the seating assembly 14 may be configured so that the first seat 16 is in a folded configuration so that its backrest 24 is folded forwards. In this configuration the corresponding minor bulkhead portion 19a is folded forward to lie on top of the backrest 24. In this arrangement the first surface 10 of the minor bulkhead portion 19a generally faces the floor of the passenger compartment 2 and the second surface 12 of the minor bulkhead portion 19a generally faces the roof of the passenger compartment 2. This configuration allows a large load 32 to be carried by the vehicle 6 while allowing the second seat 18 to carry a passenger.

In a further configuration shown in Figure 1c, all the backrests 24, 30 (separating backrest 30 is obscured by the backrest 24 of the first seat 16 in Figure 1c) are folded forward about the folding axis 21. In this configuration both the major bulkhead portion 17a and the minor bulkhead portion 19a are folded forward to lie on top of the backrests 24, 30. This effectively increases the loadspace available in the vehicle 6, thereby allowing a larger load to be carried by the vehicle 6. In this configuration the first surface 10 of the bulkhead 8 generally faces the floor of the passenger compartment 2 and the second surface 12 generally faces the roof of the passenger compartment 2.

The seats 16, 18 and separating portion 20 of a seating assembly 14 are supported by a bulkhead assembly 34. The bulkhead assembly 34 is divided into a major portion and a minor portion corresponding to the major and minor portions described above. Figure 2 shows the major portion of the bulkhead assembly 34 in an unfolded configuration.

The bulkhead assembly 34 comprises a support structure 36. The support structure 36 comprises a backrest assembly 38 and a seat cushion assembly 40 which are connected by a powered linkage assembly 42. The powered linkage assembly 42 is arranged to reconfigure the bulkhead assembly 34 from a folded configuration to an unfolded configuration, and vice versa. As a consequence, the bulkhead assembly 34 reconfigures the seating assembly 14 between folded and unfolded configurations. The bulkhead assembly 34 also comprises a bulkhead 8.

As shown in Figure 2, in an unfolded configuration the backrest assembly 38 and the bulkhead 8 each generally form an obtuse angle relative to the seat cushion assembly 40.

The backrest assembly 38 includes a frame 44 and a U-shaped first bulkhead bracket 46 and a U-shaped second bulkhead bracket 48. Each bulkhead bracket 46, 48 has an expanded width portion 70 arranged to attach the brackets 46, 48 to the first surface 10 of the bulkhead 8. The planes of the bulkhead brackets 46, 48 are parallel. An armrest frame 61 is mounted on the first bulkhead bracket 46.

The seat cushion assembly 40 comprises a first attachment member 50 and a second attachment member 51, which are arranged parallel to each other on the floor of the vehicle 6. The attachment members 50, 51 have a generally U-shaped transverse cross-section. The first attachment member 50 has a large upstanding portion 50a, a base portion 50b and a small upstanding portion 50c. The second attachment member 51 has a large upstanding portion 51a, a base portion 51b and a small upstanding portion 51c. The first attachment member 50 and the second attachment member 51 are arranged so that the large upstanding portions 50a, 51a are outermost with respect to the major portion of the bulkhead assembly 34. The base portions 50b, 51b of each attachment member 50, 51 are secured to the floor of the vehicle 6. Each of the upstanding portions 50a, 50c, 51a, 51c of each attachment member 50, 51 extend upwardly from the floor of the vehicle 6 generally perpendicularly to their respective base portion 50b, 51b.

A first member bracket 52 is attached to the rearmost end of the large upstanding portion 50a of the first attachment member 50 by a first linking bracket 91a. A second member bracket 54 is attached to the rearmost end of the large upstanding portion 51a of the second attachment member 51 by a second linking bracket 91b. The first member bracket 52 is pivotally coupled to the first bulkhead bracket 46 by a pivot 55a. The second member bracket 54 is pivotally coupled to the second bulkhead bracket 48 by a pivot 55b. The powered linkage assembly 42 comprises a driveshaft 59 which extends between the first bulkhead bracket 46 and the second bulkhead bracket 48. A motor 63 powers the driveshaft 59 which drives the powered linkage assembly 42 against a connecting rod flange 87 which extends from the small upstanding portion 50c.

Each large upstanding portion 50a, 51a defines a slot 56a, 56b which extends along part of the length of the respective large upstanding portion 50a, 51a. In this way, the slots 56a, 56b define a track. The majority of each slot 56a, 56b is horizontal with the exception of the rearmost portions of the slots 56a, 56b. The rearmost portion of each slot 56a, 56b extends in a downward diagonal direction to form a dogleg 57a, 57b.

A seat cushion support 58 is located between the first attachment member 50 and the second attachment member 51. The seat cushion support 58 comprises a frame having a rear bar 60 and a front bar 62. The front bar 62 and rear bar 60 are held in a parallel configuration by a first crosspiece 64a and a second crosspiece 64b which extend between the bars 60, 62. The crosspieces 64a, 64b are parallel to each other and perpendicular to the bars 60, 62. A first end 66 of the rear bar 60 comprises a first pin 70a that fits into the first slot 56a, and a second end 68 of the rear bar 60 comprises a second pin 70b that fits into the second slot 56b. The pins 70a, 70b act to support the rear of the seat cushion support 58 between the attachment members 50, 51.

In an alternative embodiment, the pins 70a, 70b may support or be substituted with rotational members such as wheels (not shown); and the slots 56a, 56b may define or be substituted with rails (not shown).

With reference to Figures 2 and 3, a first end 72 of the front bar 62 is connected to the large upstanding portion 50a of the first attachment member 50 by a first hanging linkage 76a. The first hanging linkage 76a comprises a first flat rod 78a which is curved along its longitudinal axis to define an inner small radius 79a and an outer large radius 79b. One end of the first flat rod 78a is pivotally connected to the large upstanding portion 50a by a pivot 80 with the large radius 79a facing forwards. The first end 72 of the front bar 62 comprises a first hanger

portion 82a which is pivotally connected to the other end of the first flat rod 78a by a pivot 81. A second end 74 of the front bar 62 is connected to the large upstanding portion 51a of the second attachment member 51 by a second hanging linkage 76b. The second hanging linkage 76b comprises a second flat rod 78b which mirrors the first flat rod 78a. One end of the second flat rod 78b is pivotally connected to the large upstanding portion 51a by a pivot (not shown). The second end 74 of the front bar 62 comprises a second hanger portion 82b which is pivotally connected to the other end of the second flat rod 78b. The hanging linkages 76a, 76b support the front of the seat cushion support 58 between the attachment members 50, 51.

The combination of the pin-and-slot 70a, 56a, 70b, 56b arrangement of the rear bar 60 and the hanging linkages 76a, 76b of the front bar 62 allow the seat cushion support 58 to move forwards and backwards along the attachment members 50, 51. The doglegs 57a, 57b formed by the slots 56a, 56b lessen the risk of the seat cushion support 58 inadvertently moving forwards when the vehicle 6 is subjected to longitudinal loading conditions, for example, during a sudden braking manoeuvre of the vehicle.

Each of Figures 3 to 7 is a cutaway side view of the components of the major portion of the seating assembly 14, which illustrate the movement of the seat cushion 22 and seat cushion assembly 40 in accordance with an embodiment of the invention. Each of Figures 3 to 7 show the same features of the major portion of the seating assembly 14 in different configurations, as the seat cushion assembly 40 moves from a first seating position in Figure 3 to a second deployed position in Figure 7.

Figures 3 to 7 illustrate a portion of the bulkhead assembly 34 shown in Figure 2 supporting a seat cushion 22 mounted on the seat cushion support 58. The seat cushion assembly 40 comprises a first ISOFIX anchor point 100a which is located to the rear of where the seat cushion 22 meets the backrest 24. The seat cushion assembly 40 comprises a second ISOFIX anchor point 100b which is located adjacent to the first anchor point 100a. Each of the anchor points 100a, 100b is formed of high tensile material and comprises a straight engagement portion 101a and attachment portions 101b, 101c (both shown in Figure 10). The attachment portions 101b, 101c extend perpendicularly from each end of the engagement portion 101a parallel to each other. The attachment portions 101b, 101c of each anchor point 100a, 100b are secured to the backrest assembly 38.

The seat cushion 22 is mounted on a seat cushion frame (not shown) by struts 69. Each strut 69 of a first pair of struts 69 is pivotally mounted to a first side of the seat cushion

frame. Each of the first struts 69 extends from the seat cushion frame to the first crosspiece 64a, and is pivotally attached to the first crosspiece 64a by pivots 73. Pivotally mounted to a second side of the seat cushion frame, opposite the first side of the cushion frame, is a second pair of struts (not shown). Each of the second struts extends from the seat cushion
5 frame to the second crosspiece 64b, and is pivotally mounted to the second crosspiece 64b. A seat cushion motor 71 (shown in Figure 4) is located beneath the seat cushion 22.

Figure 3 shows the seat cushion 22 and seat cushion support 58 in their most rearward position with respect to the attachment members 50, 51 and the backrest 24. In this position
10 the seat cushion 22 and seat cushion support 58 are proximal to the backrest 24 which restricts access to the anchor points 100a, 100b. Accordingly, in this position the seat cushion support 58 is referred to as being in a closed position.

Figure 3 also illustrates the seat cushion 22 in its engaged configuration with the cushion
15 support 58, in which the seat cushion frame sits on the seat cushion support 58. In the engaged configuration the first and second pairs of struts form acute angles with the seat cushion support 58 and the seat cushion frame. In this first position, referred to as the seating configuration, the seat 18 may be used to carry an adult passenger.

Activation of the seat cushion motor 71 disengages the seat cushion 22 from the seat
20 cushion support 58 by rotating the struts about their pivots until they are perpendicular with respect to the seat cushion support 58 and the seat cushion frame. The disengaged configuration is illustrated in Figure 4, in which the seat cushion frame has been moved to a position above the seat cushion support, so that the seat cushion frame and the seat
25 cushion support have been moved apart.

The seat cushion motor 71 and the electric motor 86 define a drive means arranged to drive the seat cushion assembly between the seating configuration in which the anchor points 100a, 100b are obscured by the backrest 24 and the seat cushion 22, and the deployed
30 configuration in which the backrest 24 and seat cushion 22 are separated, thereby exposing the anchor points 100a, 100b for access.

The seat cushion motor 71 and the electric motor 86 are operated in tandem by a control module (not shown). In order to operate the seat cushion motor 71 and the electric motor 86,
35 a user of the vehicle 6 toggles a switch (not shown) linked to the control module. In order to switch the seat cushion assembly 40 between the seating configuration and the deployed

configuration, the seat cushion 22 is lifted by the struts and seat cushion motor 71, as described above.

The seat cushion support 58 is driven by a drive means 84 which comprises the electric motor 86 which is mounted on the underside of the seat cushion support 58. The drive means 84 comprises a drive bar 88 (shown in Figure 5) pivotally mounted at one end by a pivot 89 at a pivot point to a base portion 90 which is attached to the floor of the vehicle 6. The other end of the drive bar 88 is unattached which allows the drive bar 88 to move about the pivot 89.

The electric motor 86 has an output shaft (not shown) that rotates about its longitudinal axis when the electric motor 86 operates. The output shaft is coupled to the drive bar 88 so that when the electric motor 86 operates the electric motor 86 moves along the drive bar 88. When the output shaft rotates in a first direction the electric motor 86 moves towards the unattached end of the drive bar 88. When the output shaft rotates in a second direction, i.e. the opposite direction, the electric motor 86 moves towards the end of the drive bar 88 pivotally mounted by a pivot 89 at the pivot point.

Since the electric motor 86 is mounted on the seat cushion support 58, and the seat cushion support 58 is free to move forwards and backwards relative to the attachment members 50, 51, when the output shaft rotates in the first direction the seat cushion support 58 moves forwards. Accordingly, when the output shaft rotates in the second direction the seat cushion support 58 moves backwards.

Operation of the seat cushion assembly 40 is now described in further detail with reference to Figures 3 to 7.

As mentioned above, Figure 3 shows the seat cushion assembly 40 in the seating configuration in which it may carry an adult passenger. In this configuration the seat cushion support 58 is in its most rearward position with respect to the attachment members 50, 51, proximal to the backrest 24. When the electric motor 86 is not in operation the electric motor 86 acts as a brake to prevent unwanted movement of the seat cushion support 58.

In order to switch the seat cushion assembly 40 between the seating configuration and the deployed configuration, a user of the vehicle 6 toggles the switch which activates the seat cushion motor 71. The seat cushion motor 71 drives disengagement of the seat cushion 22 from the seat cushion support 58 by rotating the struts 69 about their pivots until they are

perpendicular with respect to the seat cushion support 58 and the seat cushion frame. The disengaged position of the seat cushion 22 with respect to the seat cushion support 58 is shown in in Figure 4.

5 Electric current is then supplied to the electric motor 86 to drive the seat cushion support 58. Since the seat cushion support 58 is at its rearmost position proximal to the backrest 24, activation of the switch causes the electric motor 86 to rotate the output shaft in the first direction which moves the seat cushion support 58 and seat cushion 22 forwards to a distal position relative to the backrest 24.

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As shown in Figure 5, the pin-and-slot arrangement 70a, 56a moves along the dogleg portion 57a of the first slot 56a into the horizontal portion of the slot 56a, and the first flat rod 78a moves forward about the pivot 80. The other pin-and-slot arrangement 70b, 56b moves along the dogleg portion 57a of the second slot 56b in the same way. Similarly, the second
15 flat rod 78b moves forward about its pivot 80. As the seat cushion support 58 moves forward its front portion is raised above the plane of the attachment members 50, 51 by the rotation of the flat rods 78a, 78b.

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Continued operation of the electric motor 86 compels the pin-and-slot arrangements 70a, 56a, 70b, 56b and the flat rods 78a, 78b to continue to move forward, as illustrated by Figure 6. In Figure 6, the first and second hanger portions 82a, 82b are further forward than the first flat rod 78a. Consequently, the front portion of the seat cushion support 58 has passed its highest point with respect to the attachment members 50, 51. After reaching its highest point, due to the articulation between the flat rods 78a, 78b and the hanger portions 82a, 82b, and between the flat rods 78a, 78b and the large upstanding portions 50a, 50b,
25 continued movement of the seat cushion support 58 causes the height of the front portion of the seat cushion support 58 with respect to the attachment members 50, 51 to drop as the seat cushion support 58 moves forward, as shown in Figure 7.

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When the seat cushion support 58 arrives at its final forwardmost position, as shown in Figure 7, the electric motor 86 ceases operation. In its final position the seat cushion support 58 generally lies between the attachment members 50, 51. In the final position, the seat cushion 22 is supported by the seat cushion support 58 distal to the backrest 24 to provide access to the anchor points 100a, 100b for the user. Accordingly, in this position the seat
35 cushion support 58 is referred to as being in an open position.

Figures 8 and 9 illustrate an embodiment of the invention which does not comprise a seat cushion motor 71. Features shown in Figures 8 and 9 which correspond to features of the previous embodiments of the invention are given the same reference numerals.

5 A major portion of a seating assembly 14 is shown in Figures 8 and 9. As in the previous embodiments of the invention the seating assembly 14 comprises a seat 18 which comprises a seat cushion 22, a backrest 24, also referred to in the art as a squab, and a headrest 26. A bulkhead 8 is located to the rear of the backrest 24. The backrest 24 is pivotally mounted on a pivot member 25 to enable a passenger to adjust the angle of the backrest 24. A seat
10 cushion assembly 40 supports the seat cushion 22.

The seat cushion assembly 40 comprises a first attachment member 50 and a second attachment member (not shown in Figures 8 and 9). A first member bracket 52 is attached to the rearmost end of the first attachment member 50 by a first linking bracket 91a. A second
15 member bracket (not shown in Figures 8 and 9) is attached to the rearmost end of the second attachment member by a second linking bracket (not shown in Figures 8 and 9). The first member bracket 52 is pivotally coupled to a first bulkhead bracket 46 by a pivot 55a, and the second member bracket is pivotally coupled to a second bulkhead bracket (not shown in Figures 8 and 9).

20

A seat cushion support 58 is located between the first attachment member 50 and the second attachment member. The seat cushion support 58 comprises a first pin 70a that fits into a first slot 56a in the first attachment member 50, and a second pin (not shown in Figures 8 and 9) that fits into a second slot (not shown in Figures 8 and 9) in the second
25 attachment member. The pins act to support the rear of the seat cushion support 58 between the attachment members.

A first flat rod 78a is curved along its longitudinal axis. One end of the first flat rod 78a is pivotally connected to the first attachment portion 50 by a pivot 80. The other end of the first
30 flat rod 78a is pivotally connected to the seat cushion support 58 by a pivot 81. A second curved flat rod (not shown in Figures 8 and 9) is pivotally connected at one end to the second attachment portion by a pivot (not shown in Figures 8 and 9), and at the other end to the seat cushion support 58 by a pivot (not shown in Figures 8 and 9).

35 The seat cushion support 58 is driven by a drive means (not shown in Figures 8 and 9) which comprises an electric motor (not shown in Figures 8 and 9) which is mounted on the

underside of the seat cushion support 58. The drive means comprises a drive bar (not shown in Figures 8 and 9) along which the electric motor travels when operated.

The seat cushion assembly 40 also comprises a first ISOFIX anchor point 100a which is located to the rear of where the seat cushion 22 meets the backrest 24, and a second ISOFIX anchor point (not shown in Figures 8 and 9) which is located adjacent to the first anchor point 100a.

Figure 8 shows the seat cushion 22 and seat cushion support 58 in their most rearward position with respect to the attachment member 50 and the backrest 24. In this position the seat cushion 22 and seat cushion support 58 are proximal to the backrest 24 which prevents easy access to the anchor points. Accordingly, in this position the seat cushion support 58 is referred to as being in a closed position.

The drive means is arranged to drive the seat cushion assembly 40 between the seating configuration in which the anchor points are obscured by the backrest 24 and the seat cushion 22, and the deployed configuration in which the backrest 24 and seat cushion 22 are separated, thereby exposing the anchor points for access.

Since the electric motor is mounted on the seat cushion support 58, and the seat cushion support 58 is free to move forwards and backwards relative to the attachment members, activation of the electric motor in a first direction results in forward movement of the cushion support 58. Activation of the electric motor in a second direction results in rearward movement of the cushion support 58.

In order to switch the seat cushion assembly 40 between the seating configuration shown in Figure 8 and the deployed configuration shown in Figure 9, a user of the vehicle 6 toggles a switch (not shown) which activates the electric motor. Since the seat cushion support 58 is at its rearmost proximal position in Figure 8, activation of the switch causes the electric motor to move the seat cushion support 58 and seat cushion 22 forwards to a distal position relative to the backrest 24.

The electric motor causes the pin-and-slot arrangement 70a, 56a to move along the first slot 56a, and the first flat rod 78a moves forward about the pivot 80. The other pin-and-slot arrangement moves along the second slot 56b in the same way. Similarly, the second flat rod moves forward about its pivot.

When the seat cushion support 58 arrives at its final forwardmost position, as shown in Figure 9, the electric motor 86 ceases operation. In its final position the seat cushion support 58 generally lies between the attachment members. In the final position, the seat cushion 22 is supported by the seat cushion support 58 distal to the backrest 24 to enable a user of the vehicle 6 access to the anchor points. Accordingly, in this position the seat cushion support 58 is referred to as being in an open position.

Figure 10 is a perspective view of a seat 18, in which the seat cushion 22 is in its final position distal to the backrest 24, and the seat cushion support (not shown in Figure 10) is in the open position. As illustrated in Figure 10, the distal position creates space 104 between the seat cushion 22 and the backrest 24. The user of the vehicle 6 is therefore able to clearly see the anchor points 100a, 100b and access the anchor points 100a, 100b easily by hand.

A child seat 102 is shown engaged with the anchor points 100a, 100b in Figure 11. The child seat 102 comprises a first engagement mechanism 108a and a second engagement mechanism (not shown) which extend from the base of the child seat 102. The distance between the first engagement mechanism 108a and the second engagement mechanism corresponds to the distance between the first anchor point 100a and the second anchor point 100b. Each engagement mechanism comprises a lobster clasp which engages with the corresponding anchor point 100a, 100b. The user of the vehicle 6 may confirm secure engagement of the first engagement mechanism 108a with the first anchor point 100a, and the second engagement member with the second anchor point 100b, visually and/or by touch.

To move the seat cushion support 58 from its forwardmost distal position (e.g. the open position) to its rearmost proximal position (e.g. the closed position), the child seat 102 is removed from the seat 18. The electric motor 86 is engaged by the switch so that the output shaft rotates in the second direction. This compels the seat cushion support 58 to move backwards to its rearmost proximal position. Operation of the seat cushion assembly 40 from the distal position to the proximal position is the reverse of the operation of the seat cushion assembly 40 described above for the operation from the distal position to the proximal position. The seat cushion motor 71, if the seat cushion assembly 40 comprises a seat cushion motor 71, drives engagement of the seat cushion 22 with the seat cushion support 58 by rotating the struts 69 about their pivots until they form the acute angles illustrated in Figure 3. Engagement of the seat cushion 22 with the seat cushion support 58 is the reverse of the disengagement process described above.

Embodiments of the invention may comprise anti-trap and/or anti-clash sensors (not shown) linked to the control module and arranged to halt movement of the seat cushion 22 or the seat cushion support 58, if an object is or is about to become trapped between the seat cushion 22 or the seat cushion support 58, and either of their surroundings. Examples of suitable sensors include pinch strips and Hall effect sensors, which may be located in one or more of the motors. The motors may include clutches or a motor stall load (also known as stall torque) value to prevent continued operation of the apparatus in the event that a foreign body is trapped by movement of the seat cushion 22 or seat cushion support 58.

The above specific description refers to the seat of the major portion of the seating assembly. However, it will be apparent that aspects of the invention may be applied to the seat of the minor portion of the seating assembly.

Although particular embodiments of the invention have been disclosed herein in detail, this has been done by way of example and for the purposes of illustration only. The aforementioned embodiments are not intended to be limiting with respect to the scope of the appended claims, which follow. It is contemplated by the inventors that various substitutions, alterations, and modifications may be made to the invention without departing from the scope of the invention as defined by the claims.

CLAIMS

1. A seat support structure for a passenger seat of a vehicle, the seat support structure comprising:
 - at least one child safety apparatus securing anchor point for securing child safety apparatus to the vehicle;
 - a backrest assembly and a seat cushion support; and
 - drive means arranged to drive the seat cushion support between a seating configuration in which the seat cushion support has a first position relative to the backrest assembly wherein the at least one anchor point is concealed, and a deployed configuration in which the seat cushion support has a second position relative to the backrest assembly wherein the at least one anchor point is exposed.
2. The seat support structure of Claim 1, wherein a seat cushion is mounted on the seat cushion support.
3. The seat support structure of any one of Claims 1 or 2, wherein the seat cushion support is slidably reconfigurable between the seating configuration and the deployed configuration.
4. The seat support structure of any preceding claim, wherein at least a portion of the seat cushion support is arranged to move substantially linearly between the seating configuration and the deployed configuration.
5. The seat support structure of any preceding claim, wherein at least a portion of the seat cushion support is arranged to move in an arc between the seating configuration and the deployed configuration.
6. The seat support structure of any preceding claim, wherein the seat cushion support is mounted on at least one attachment member.
7. The seat support structure of Claim 6, wherein the at least one attachment member is arranged to reconfigure the seat cushion support between the seating configuration and the deployed configuration.
8. The seat support structure of Claim 6 or 7, wherein the at least one attachment member comprises a track for reconfiguring the seat cushion support between the seating configuration and the deployed configuration.

9. The seat support structure of any one of Claims 6 to 8, wherein the at least one attachment member is arranged to impede unwanted movement of the seat cushion support.
- 5 10. The seat support structure of any one of Claims 6 to 9, wherein the seat cushion support comprises at least one seat cushion support engagement member and the at least one attachment member comprises at least one mounting engagement member, wherein the at least one seat cushion support engagement member is engaged with the at least one mounting engagement member.
- 10 11. The seat support structure of Claim 10, wherein the at least one seat cushion support engagement member is arranged to move along the at least one mounting engagement member.
- 15 12. The seat support structure of Claim 10 or Claim 11, wherein the at least one seat cushion support engagement member comprises a rotational member and/or a pin.
13. The seat support structure of any one of Claims 10 to 12, wherein the at least one mounting engagement member comprises a rail and/or a slot.
- 20 14. The seat support structure of Claim 13, wherein the rail and/or slot comprises an inclined portion to impede movement of the seat cushion support.
15. The seat support structure of any one of Claims 6 to 14, wherein the seat cushion support is attached to the at least one attachment member by a hanging assembly.
- 25 16. The seat support structure of Claim 15, wherein the hanging assembly is articulated to enable the movement of the seat cushion support relative to the at least one attachment member.
- 30 17. The seat support structure of any one of Claims 6 to 16, wherein the seat cushion support comprises at least one hanger portion and the at least one attachment member comprises at least one pivotally mounted connection bar, wherein the at least one connection bar and the at least one hanger portion are pivotally coupled.
- 35 18. The seat support structure of any preceding claim, wherein the drive means comprises a seat cushion support drive means for driving the seat cushion support between the seating configuration and the deployed configuration.

19. The seat support structure of Claim 18, wherein the seat cushion support drive means comprises a motor.

20. The seat support structure of Claim 18 or 19, wherein the seat cushion support drive means is coupled to a drive bar which is fixed in relation to the seat cushion support.

21. The seat support structure of any preceding claim, wherein the seat cushion assembly comprises a seat cushion frame, wherein the seat cushion assembly is arranged to switch the seat cushion frame between an engaged configuration in which the seat cushion frame abuts the seat cushion support and a disengaged configuration in which the seat cushion frame is spaced apart from the seat cushion support.

22. The seat support structure of Claim 21, wherein the seat cushion support comprises a seat cushion support mounting on which the seat cushion frame is mounted.

23. The seat support structure of Claim 22, wherein the seat cushion support mounting comprises at least one strut extending between the seat cushion support and the seat cushion frame.

24. The seat support structure of Claim 22 or 23, wherein the seat cushion support mounting is arranged to lift the seat cushion frame from the engaged configuration to the disengaged configuration, and to lower the seat cushion frame from the disengaged configuration to the engaged configuration.

25. The seat support structure of any one of Claims 21 to 24, wherein the drive means comprises a seat cushion frame drive means for driving the seat cushion frame.

26. The seat support structure of Claim 25, wherein the seat cushion drive means comprises a motor.

27. A seat support structure control module for controlling a seat support structure of any one of Claims 1 to 26.

28. A seat support structure control module for controlling a seat support structure of any one of Claims 1 to 26, the control module being arranged to control the drive means to drive the seat cushion support between a seating configuration in which the seat cushion support has a first position relative to the backrest assembly wherein the at

least one anchor point is concealed, and a deployed configuration in which the seat cushion support has a second position relative to the backrest assembly wherein the at least one anchor point is exposed.

5 29. A vehicle comprising a seat support structure according to any one of Claims 1 to 26.

30. A method of driving a seat cushion support relative to a backrest assembly comprised in a seat support structure of a passenger vehicle, to reveal or conceal at least one child safety apparatus securing anchor point.

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31. A seat support structure as substantially described herein, and/or as illustrated in any one of the accompanying drawings.

15

32. A method of reconfiguring a seat support structure as substantially described herein, and/or as illustrated in any one of the accompanying drawings.

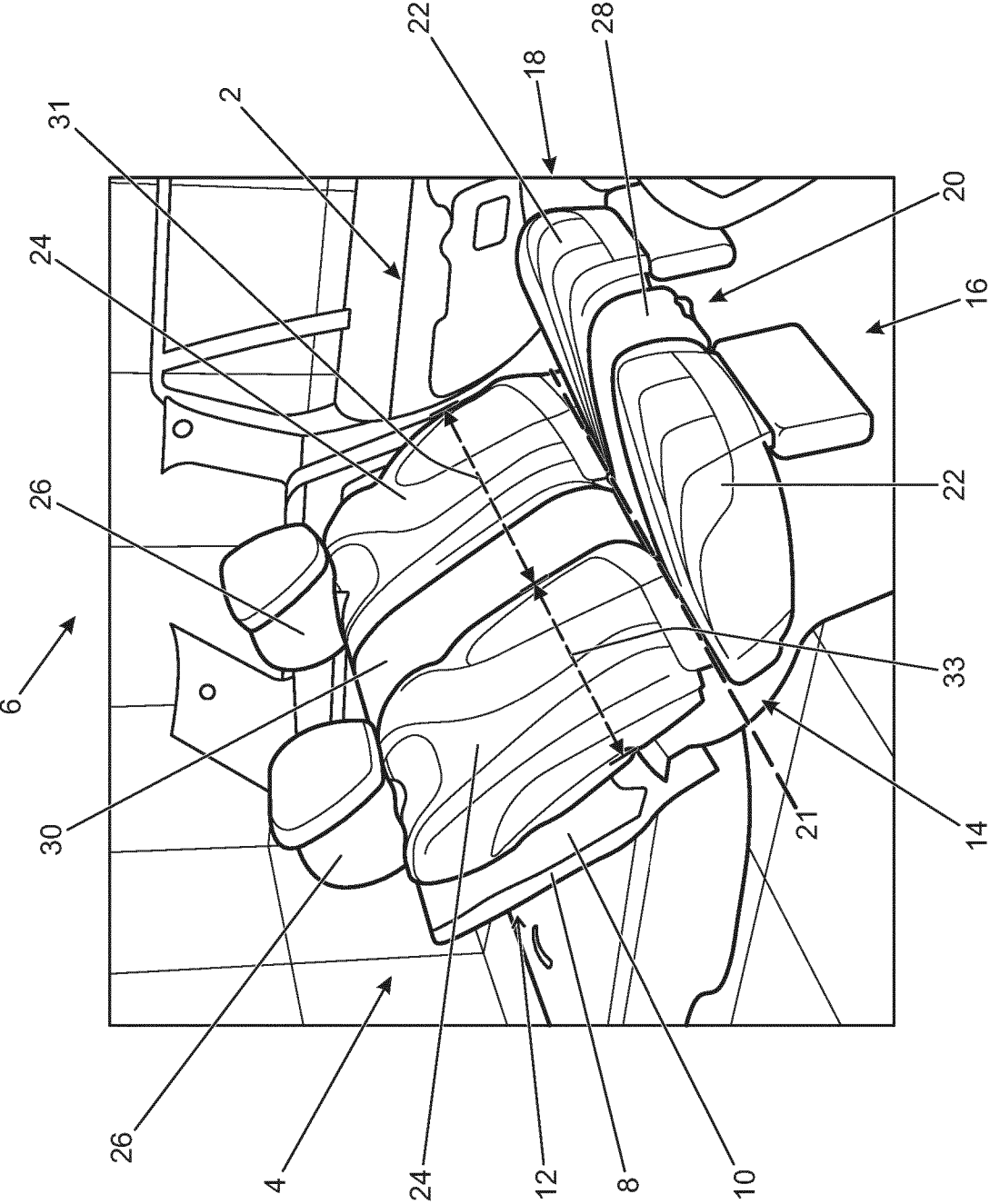


FIG. 1a

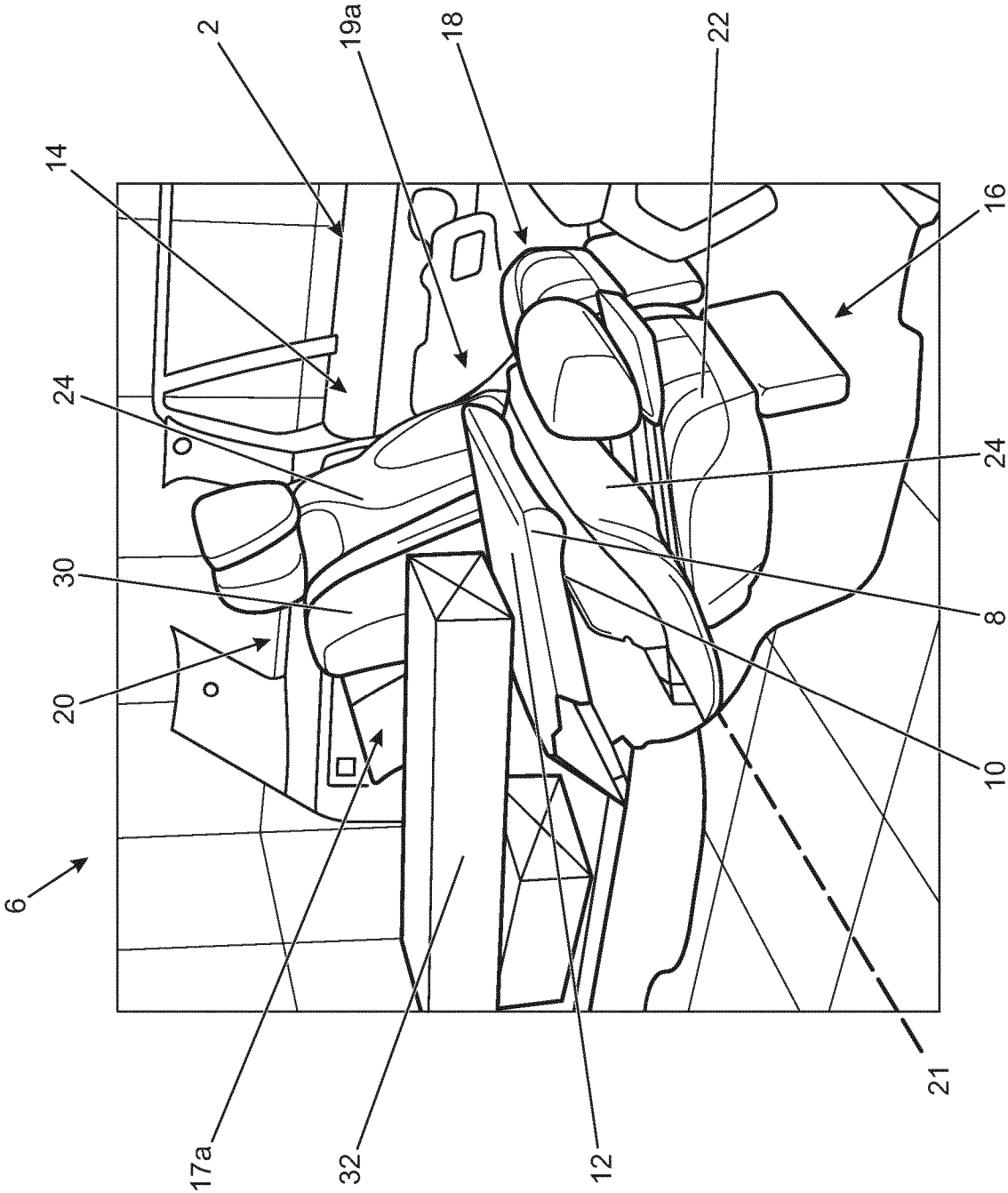


FIG. 1b

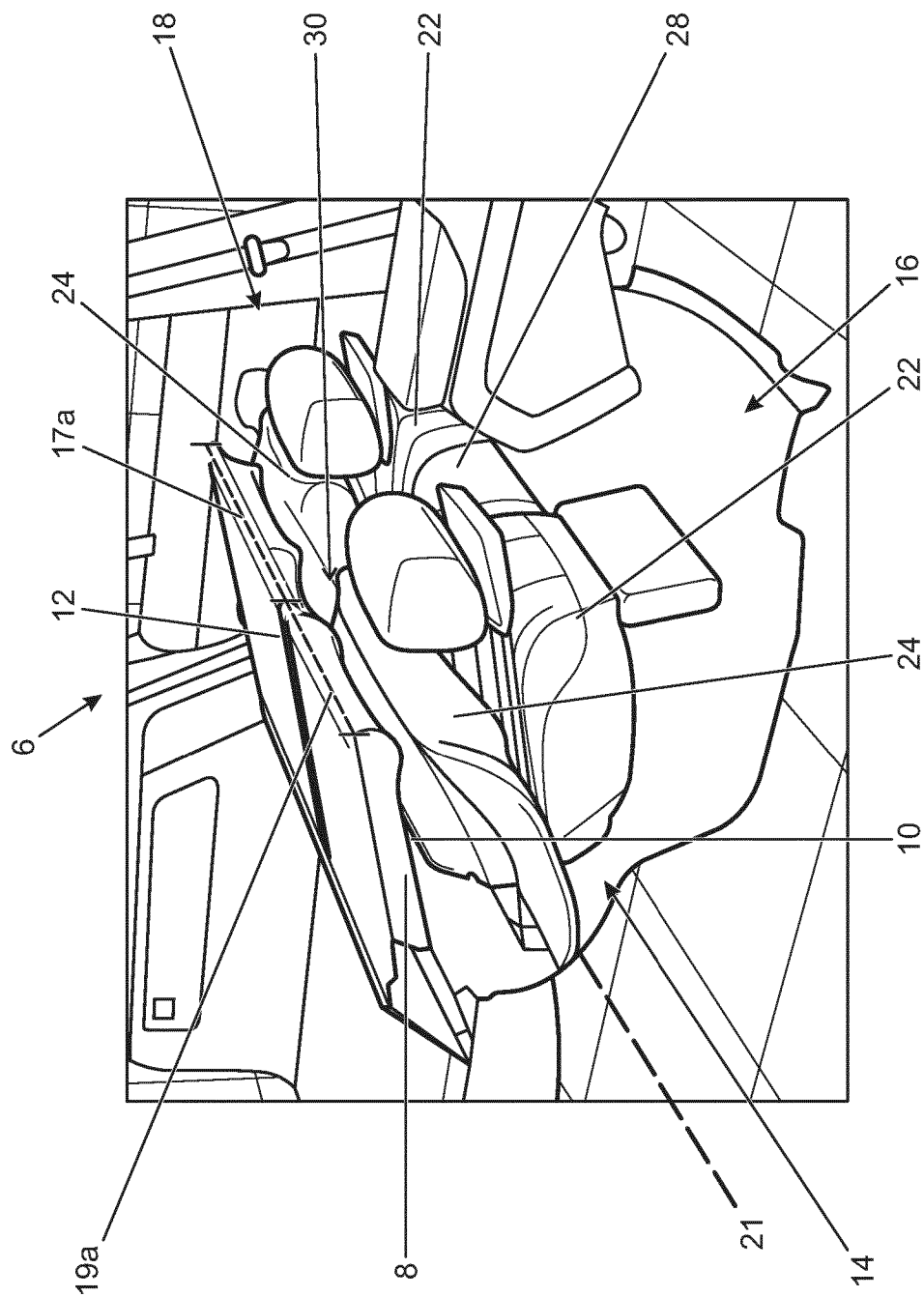


FIG. 1c

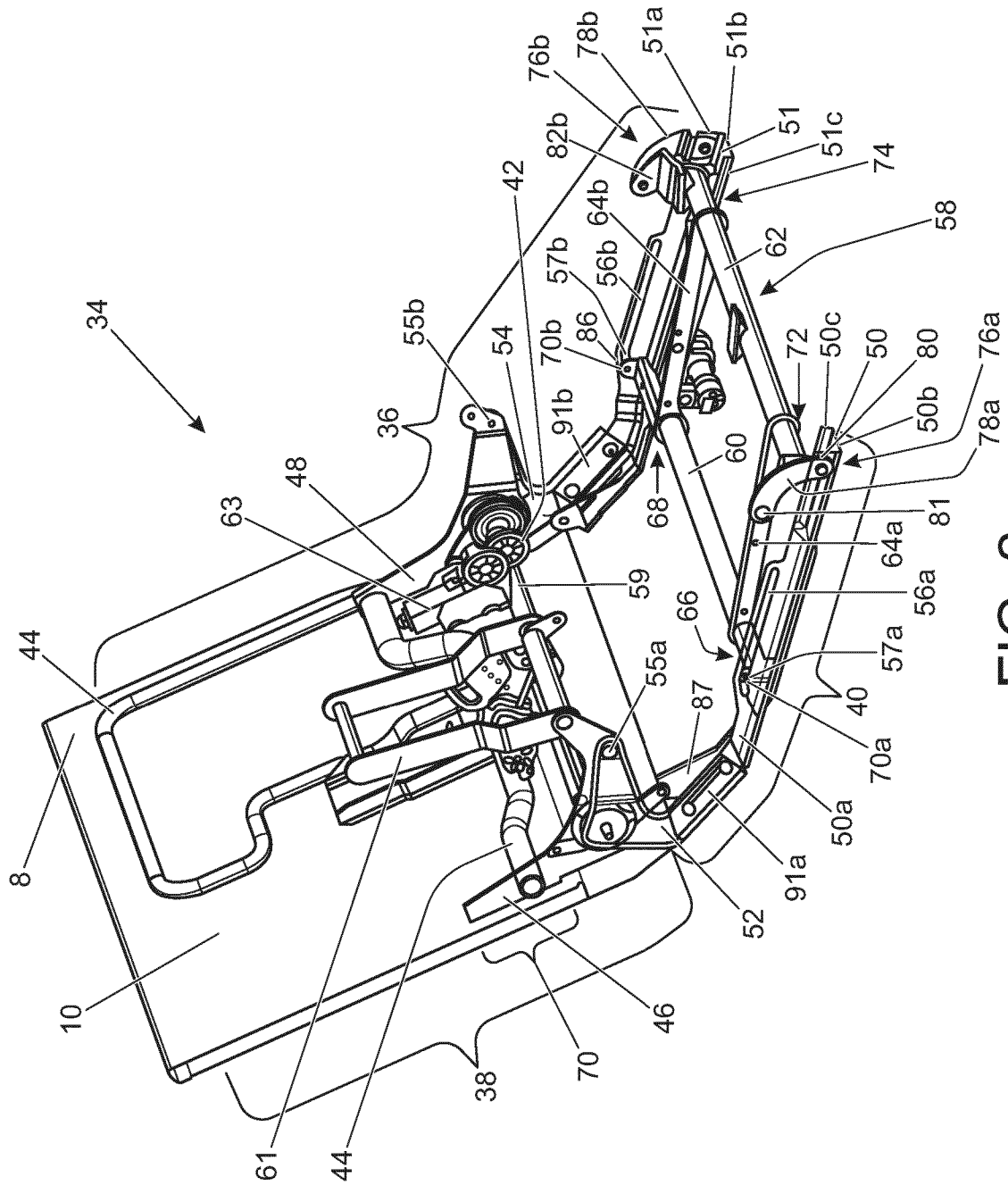


FIG. 2

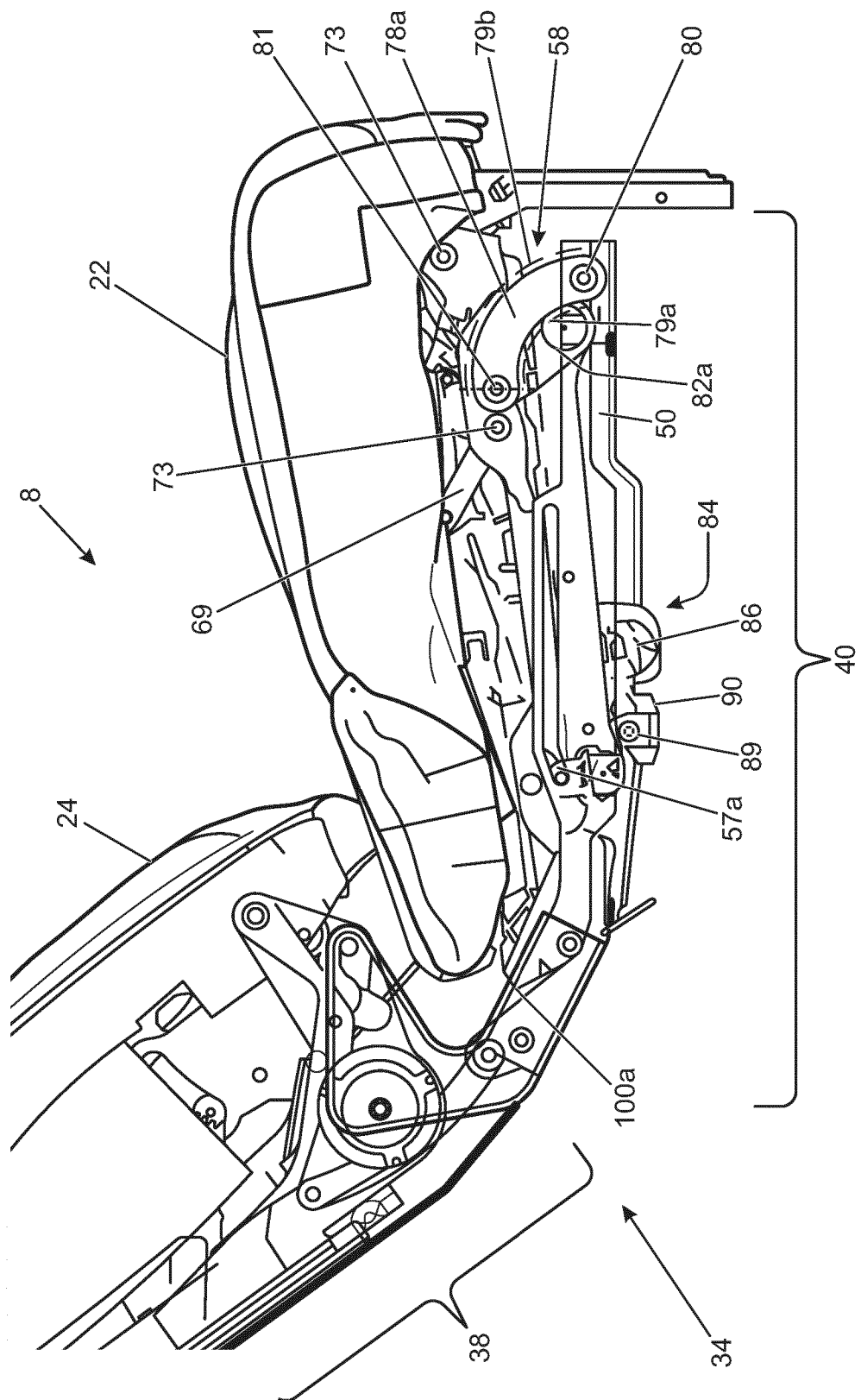


Figure 3

6/13

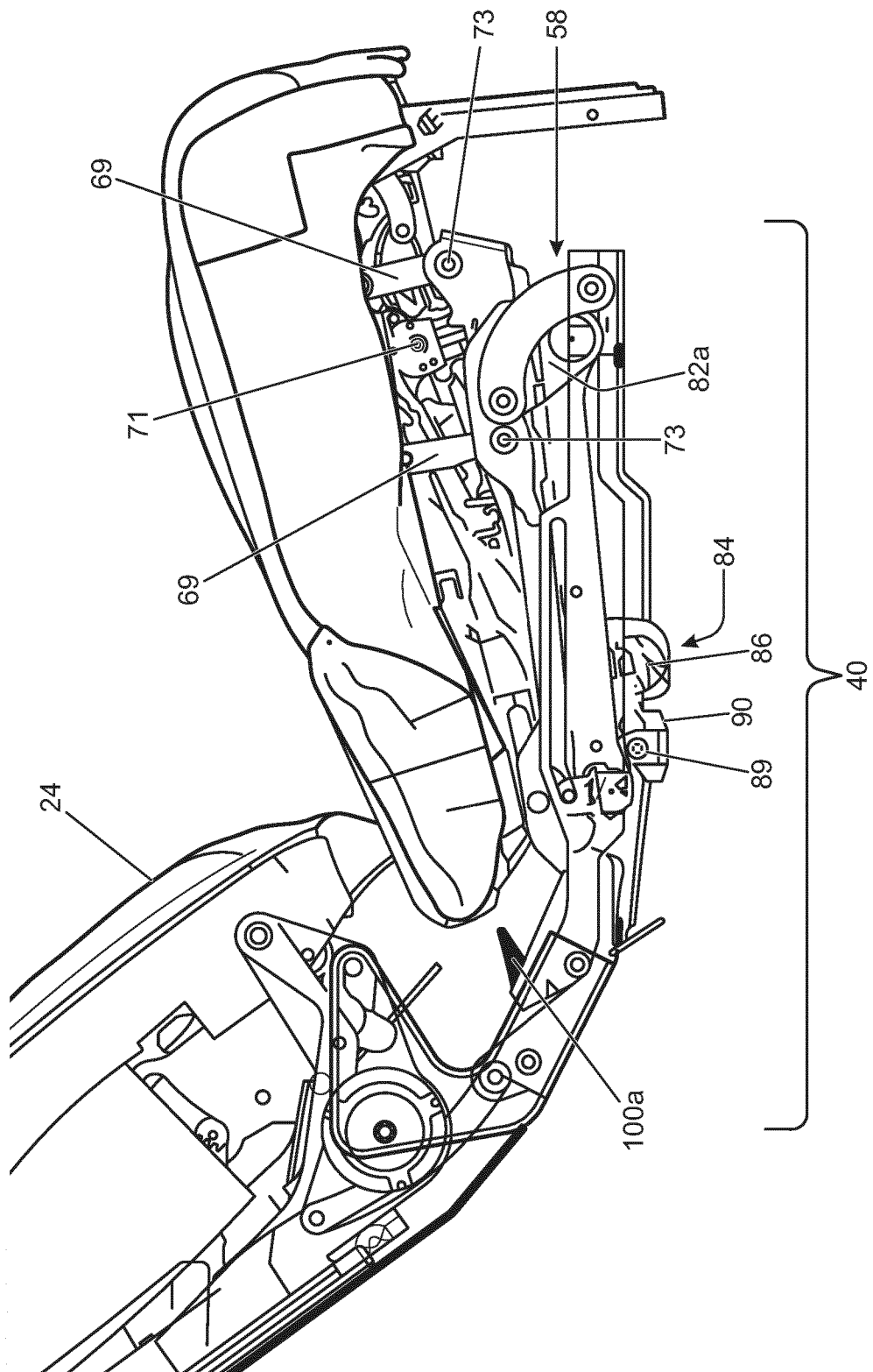


Figure 4

7/13

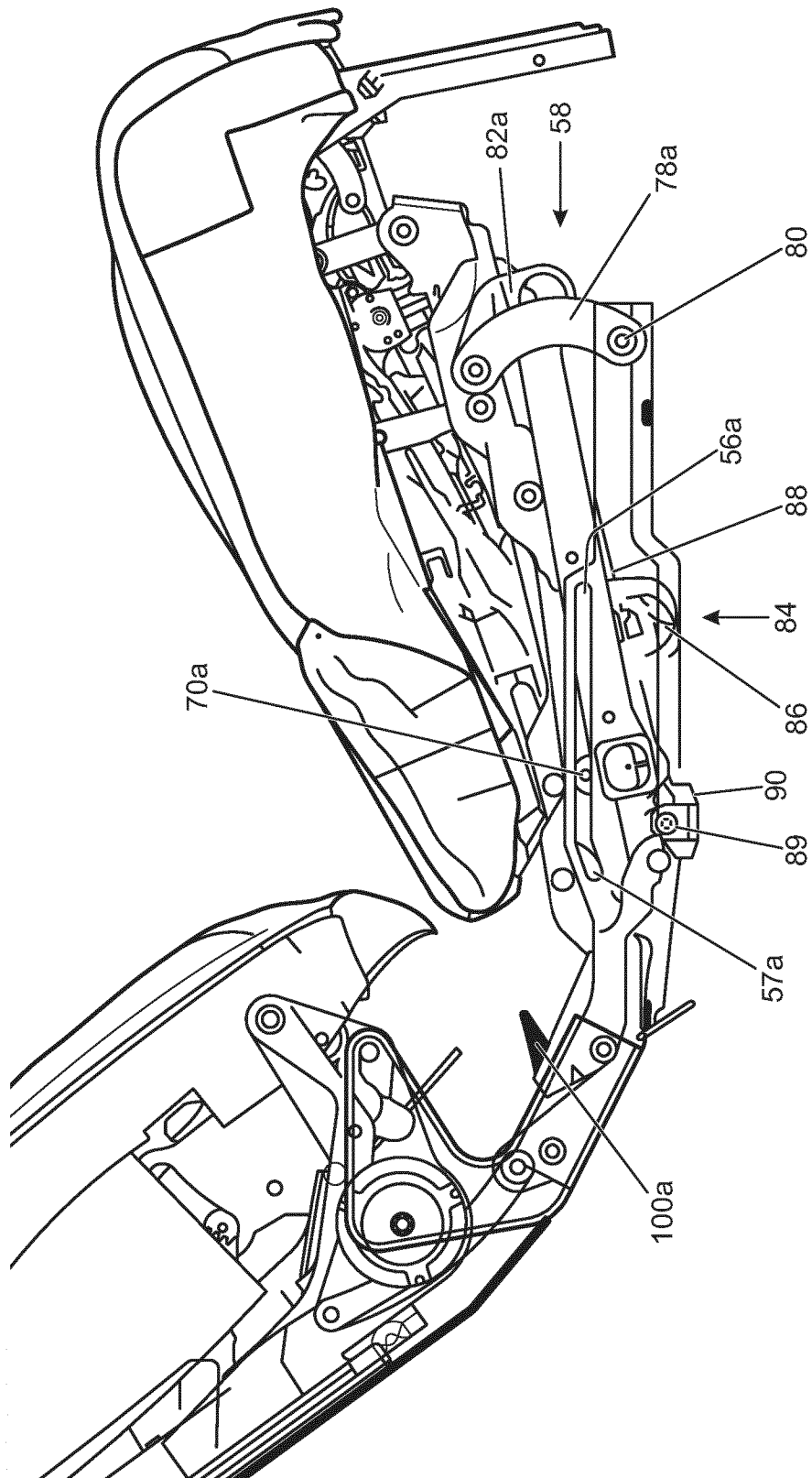


Figure 5

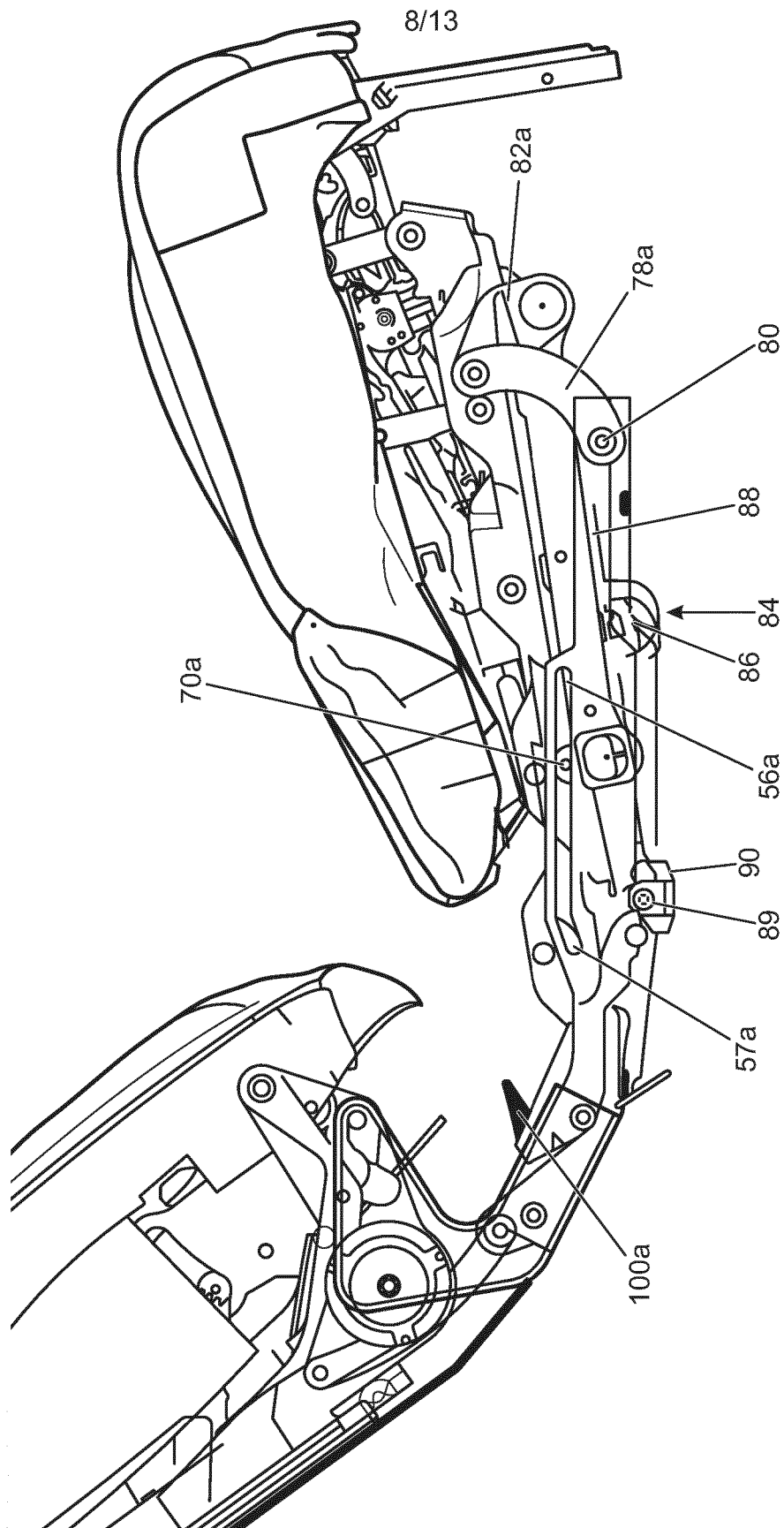


Figure 6

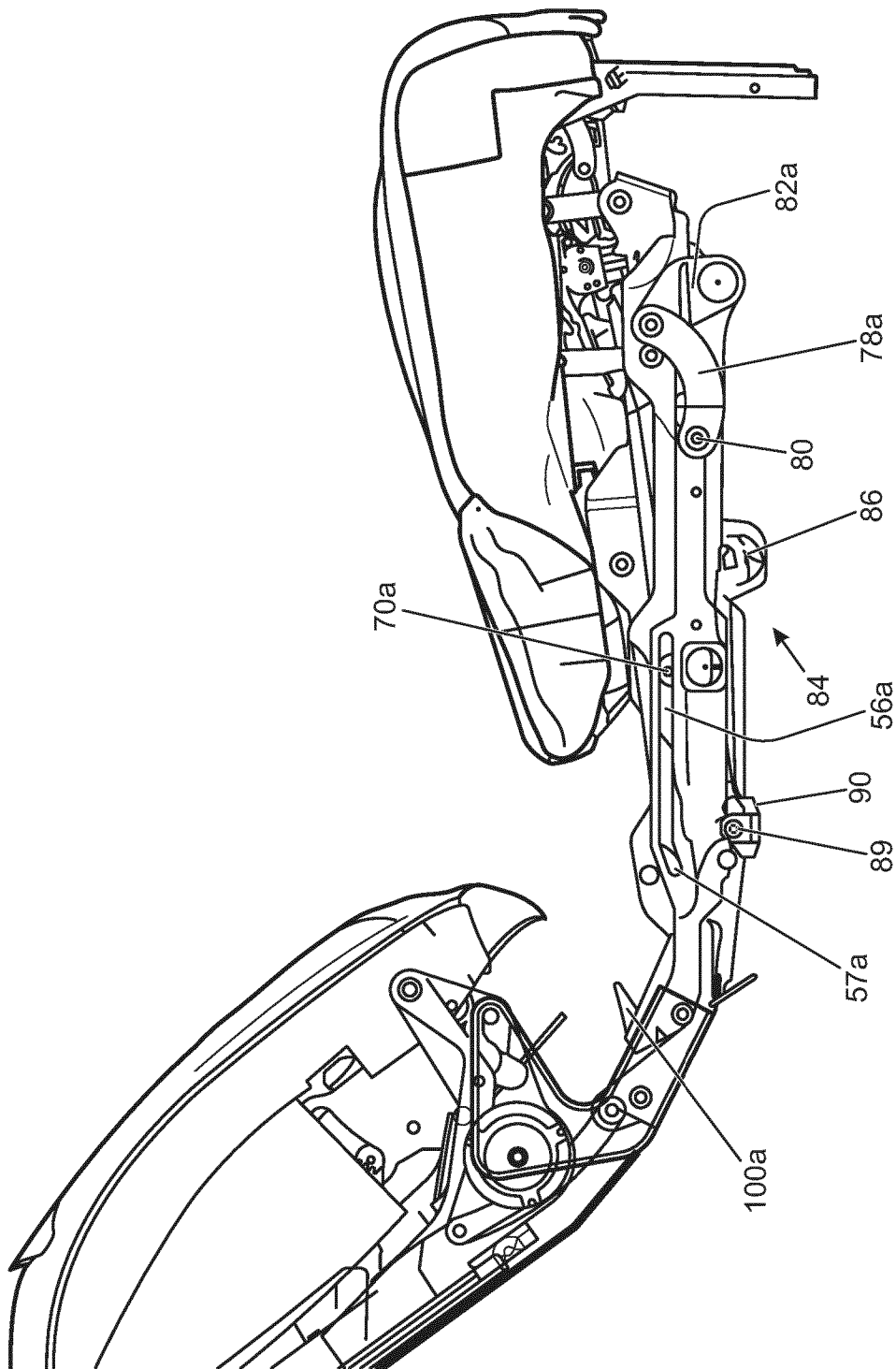


Figure 7

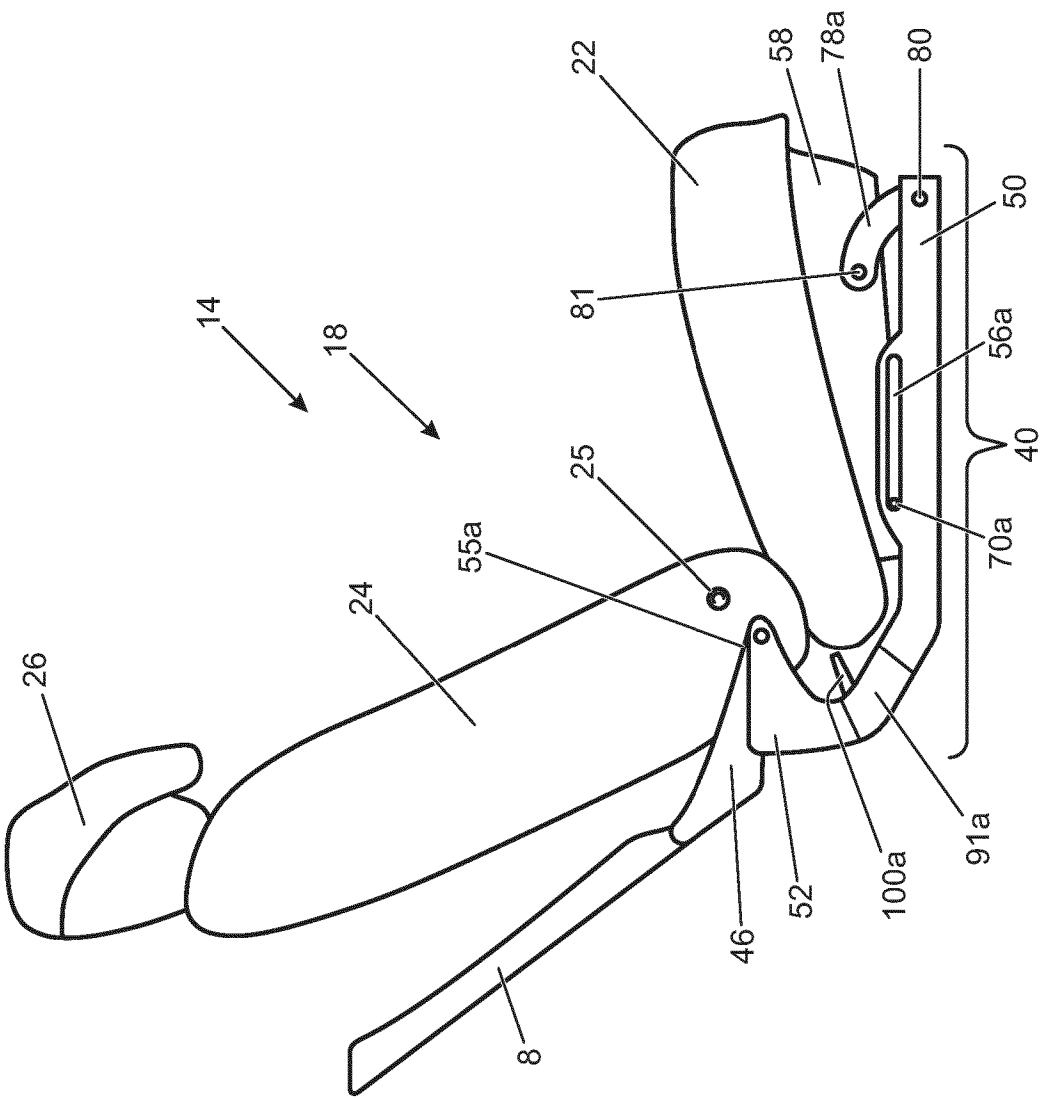


FIGURE 8

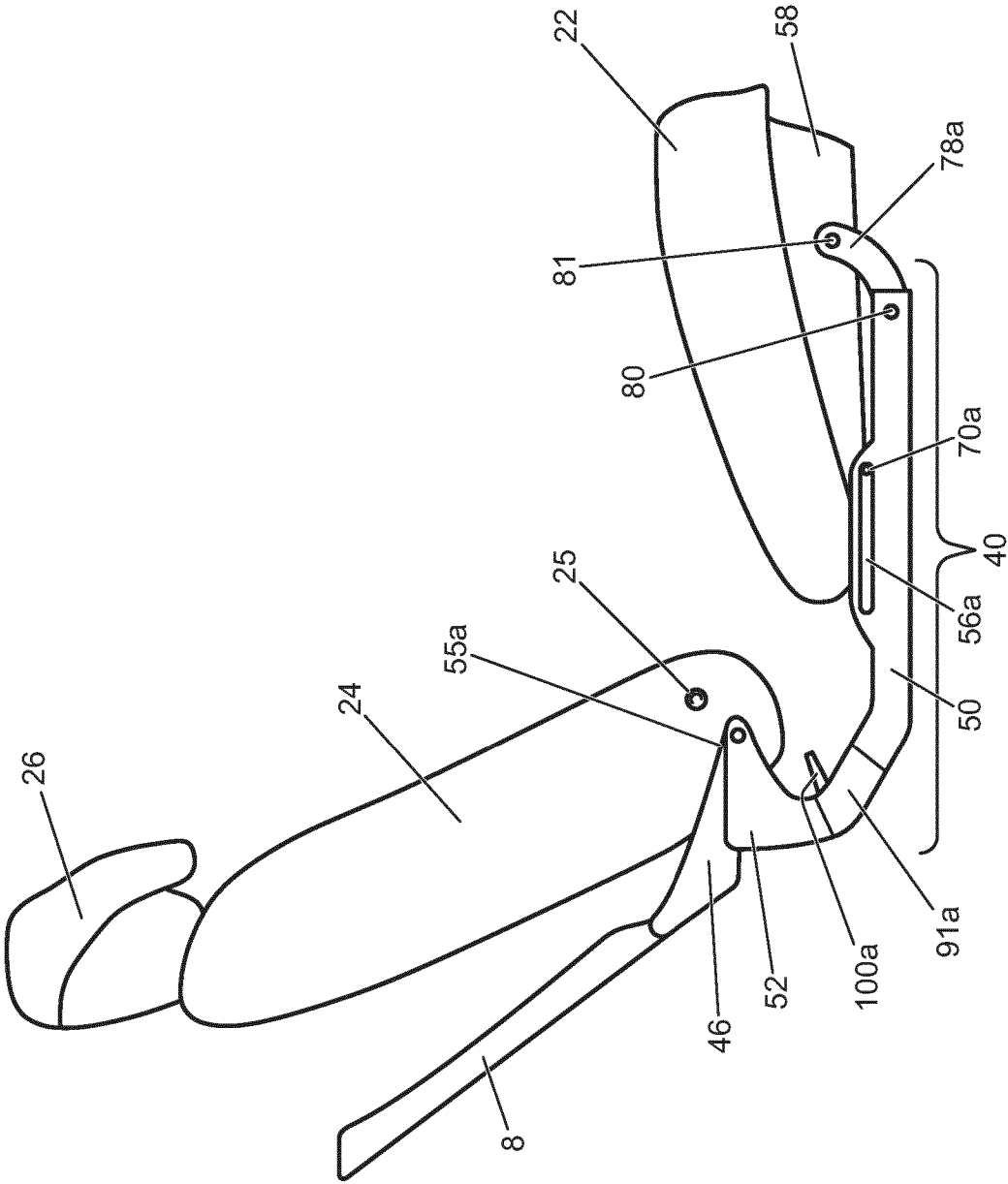


FIGURE 9

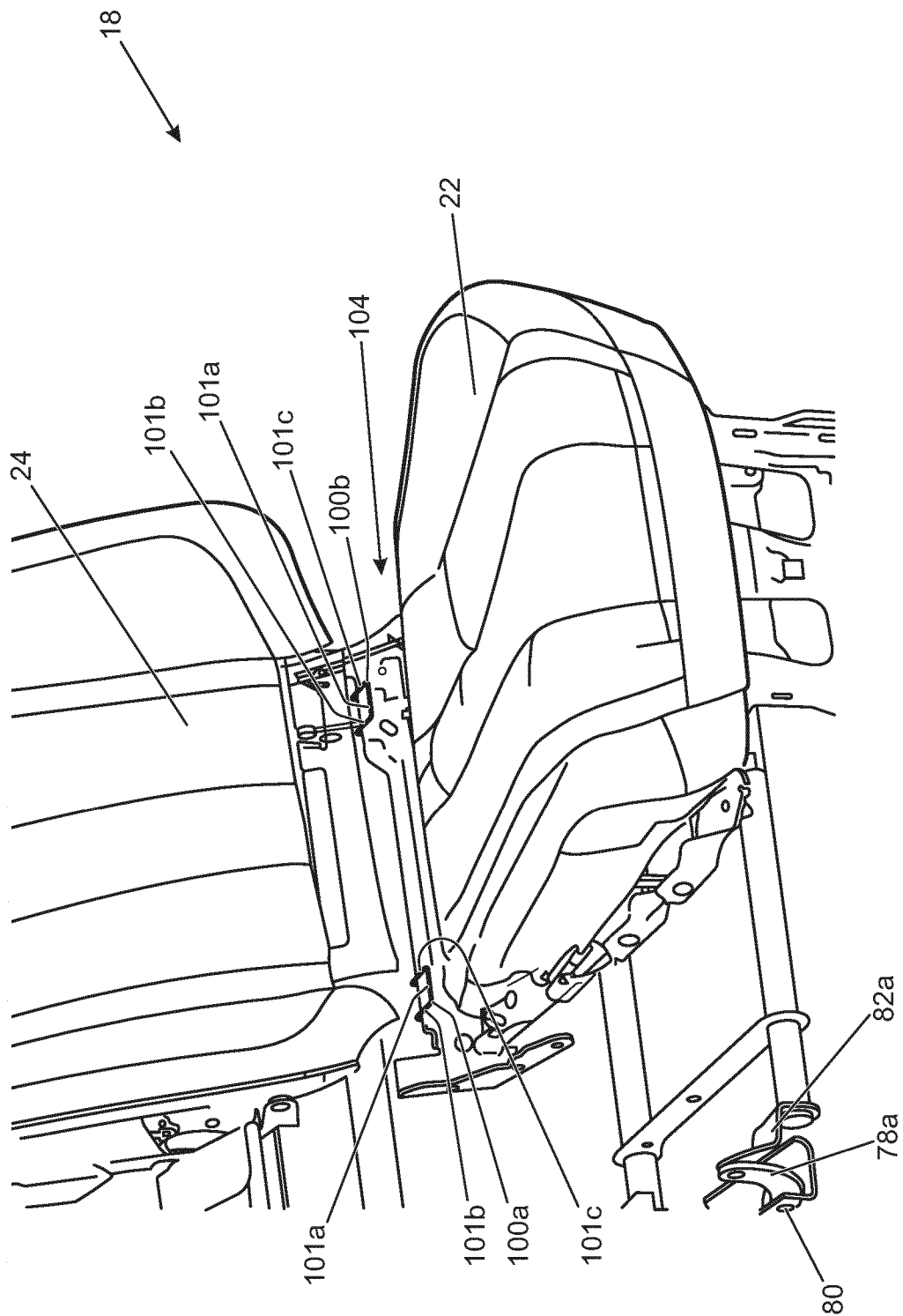


Figure 10

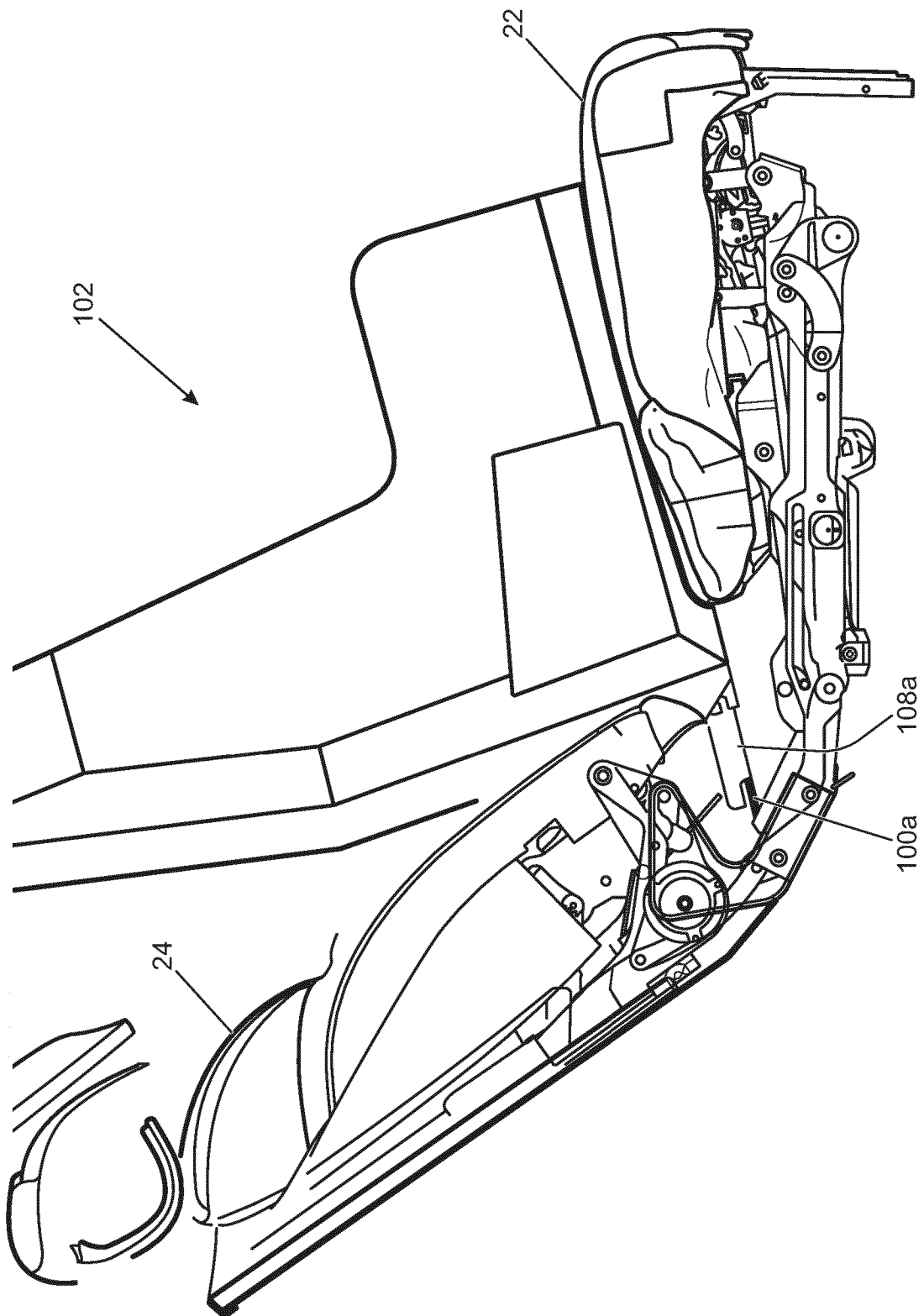


FIGURE 11

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2016/063480

A. CLASSIFICATION OF SUBJECT MATTER
INV. B60N2/28 B60N2/30
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B60N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2008/238162 A1 (SUZUKI HIROYUKI [JP] ET AL) 2 October 2008 (2008-10-02) the whole document	1-32
X	JP 2001 270355 A (JOHNSON CONTR AUTOMOTIVE SYS) 2 October 2001 (2001-10-02) abstract	1,30



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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"E" earlier application or patent but published on or after the international filing date

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

16 September 2016

Date of mailing of the international search report

27/09/2016

Name and mailing address of the ISA/

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Authorized officer

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2016/063480

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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