US00RE37026E

(19) **United States**

(12) **Reissued Patent**

Whalen

(10) **Patent Number: US RE37,026 E**

(45) **Date of Reissued Patent: Jan. 23, 2001**

(54) **PIVOT ASSEMBLY FOR A STRUCTURED VEHICLE SEAT**

(75) Inventor: **John F. Whalen**, Macomb, MI (US)

(73) Assignee: **Fisher Dynamics Corporation**, St. Clair Shores, MI (US)

(21) Appl. No.: **09/452,771**

(22) Filed: **Dec. 1, 1999**

Related U.S. Patent Documents

Reissue of:

(64) Patent No.: **5,711,577**
Issued: **Jan. 27, 1998**
Appl. No.: **08/565,987**
Filed: **Dec. 1, 1995**

(51) **Int. Cl.**[7] **B60N 2/12**

(52) **U.S. Cl.** **297/361.1**; 297/362.11; 297/362.14; 297/440.21; 297/452.18; 297/452.2

(58) **Field of Search** 297/361.1, 362.11, 297/362.14, 440.21, 452.18, 452.22

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,585,273	*	4/1986	Higgs et al.	297/452.18
4,588,228	*	5/1986	Nemoto	297/452.18
4,890,888	*	1/1990	Kostin	297/440.21
4,962,963	*	10/1990	Robinson	297/362.11
5,123,706	*	6/1992	Granzow et al.	297/362.11 X
5,199,764	*	4/1993	Robinson	297/362.11 X
5,253,923	*	10/1993	Gootee	297/440.21
5,263,767	*	11/1993	Ashjorsen et al.	297/361.1 X
5,269,589	*	12/1993	Brothers et al.	297/440.21 X
5,292,178	*	3/1994	Loose et al.	297/362.11 X
5,318,341	*	6/1994	Griswold et al.	297/362.11
5,435,624	*	7/1995	Bray et al.	297/362.11 X
5,452,941	*	9/1995	Halse et al.	297/452.2 X
5,462,332	*	10/1995	Payne et al.	297/362.14 X
5,795,024	*	8/1998	Collins et al.	297/361.1
5,806,932	*	9/1998	Zhuang	297/361.1
5,826,944	*	10/1998	Beneker et al.	297/440.21 X
5,895,090	*	4/1999	Farquhar et al.	297/362.14 X
5,918,943	*	7/1999	Mitschelen et al.	297/362.11 X

FOREIGN PATENT DOCUMENTS

4303032	*	10/1992	(JP)	297/452.18
4303034	*	10/1992	(JP)	297/452.18

OTHER PUBLICATIONS

P.L. Porter drawing for Power Recliner, Part No. DPR1250–00, Oct. 26, 1993, revised as of Dec. 21, 1993.

P.L. Porter drawing for Upper Body, Part No. DPR1255–00, Nov. 11, 1993, revised as of Dec. 21, 1993.

P.L. Porter drawing for exploded Upper Body, Part No. DPR1294–00, Jan. 4, 1994, revised as of Feb. 16, 1994.

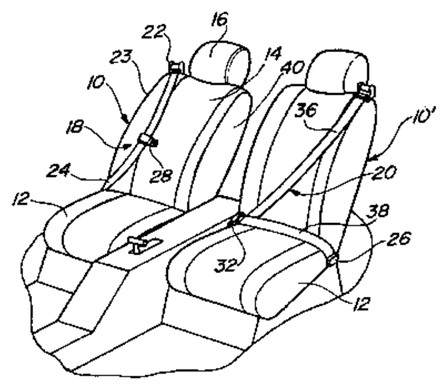
* cited by examiner

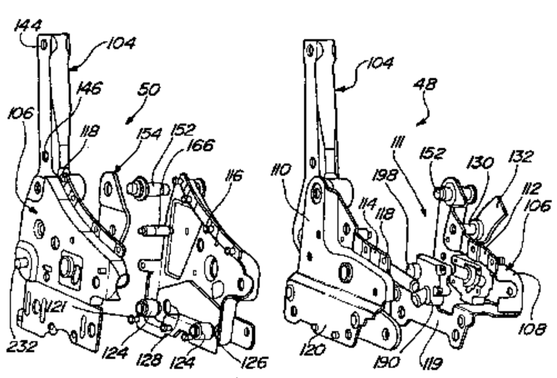
Primary Examiner—Peter M. Cuomo
Assistant Examiner—Rodney B. White
(74) *Attorney, Agent, or Firm*—Harness, Dickey & Pierce P.L.C.

(57) **ABSTRACT**

A pivot assembly for a structured vehicle seat assembly accommodates loads applied to the seatback through a safety belt restraint system carried by the seat assembly. The pivot assembly includes a connector member including an upper portion extending into a hollow channel defined by the seatback frame. The connector member is fixedly attached thereto. The pivot assembly further includes a housing attached to a lower seat structure for movement therewith between fore and aft positions. The connector member is pivotally mounted to the housing to thereby permit the seatback to rotate relative to the lower seat structure between a generally upright position and a reclined position. The pivot assembly further preferably includes a drive arrangement for rotating the connector member about a pivot axis. The pivot assembly functions to efficiently and effectively transfer loads from the seatback to the lower seat structure, and in turn, to the vehicle structure. Advantageously, the safety belt restraint system is adapted to move with the seat assembly.

24 Claims, 5 Drawing Sheets





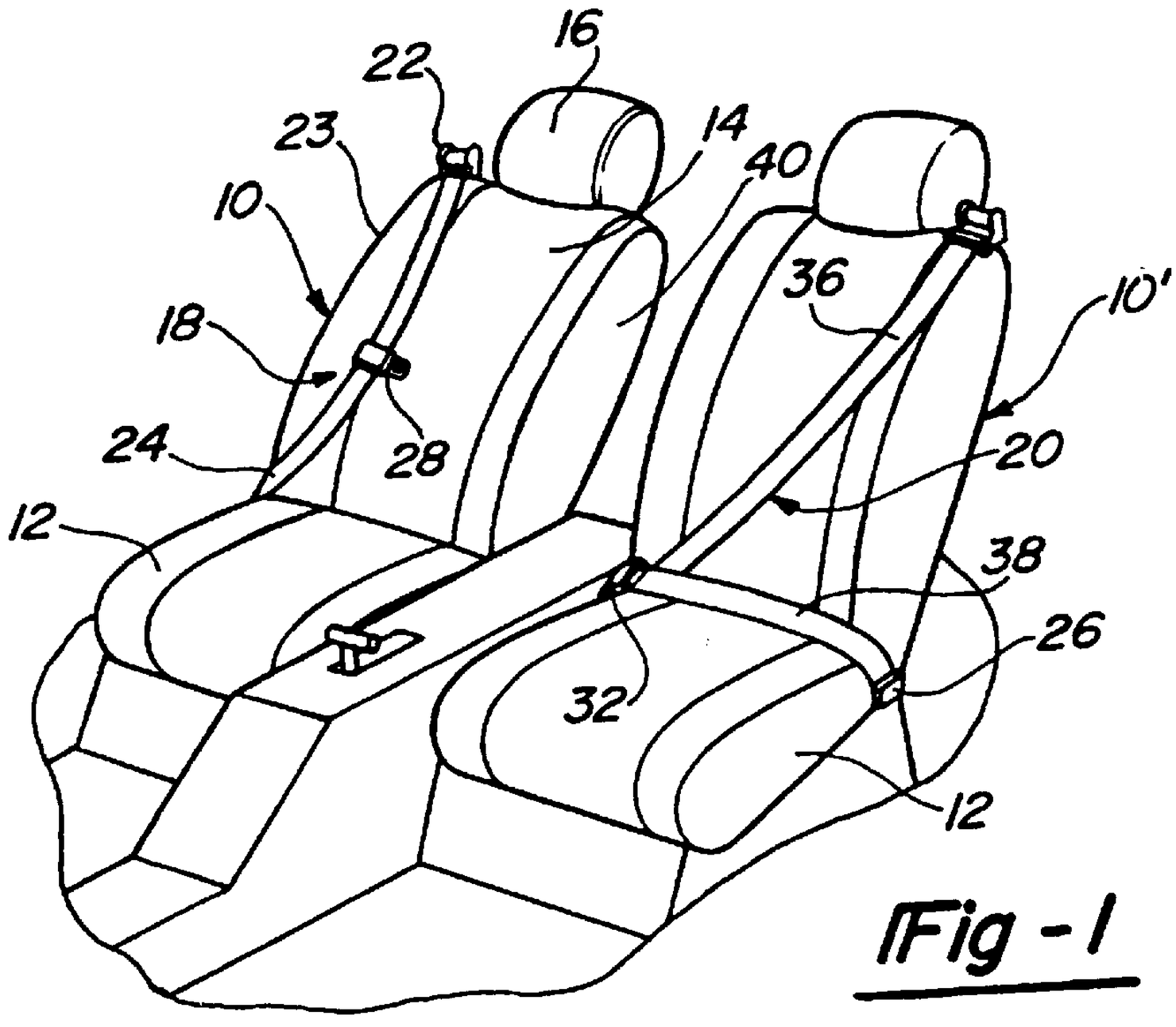

16
22
23
14
40
10
36
10'
18
24
28
20
12
38
26
32
12

Fig - 1

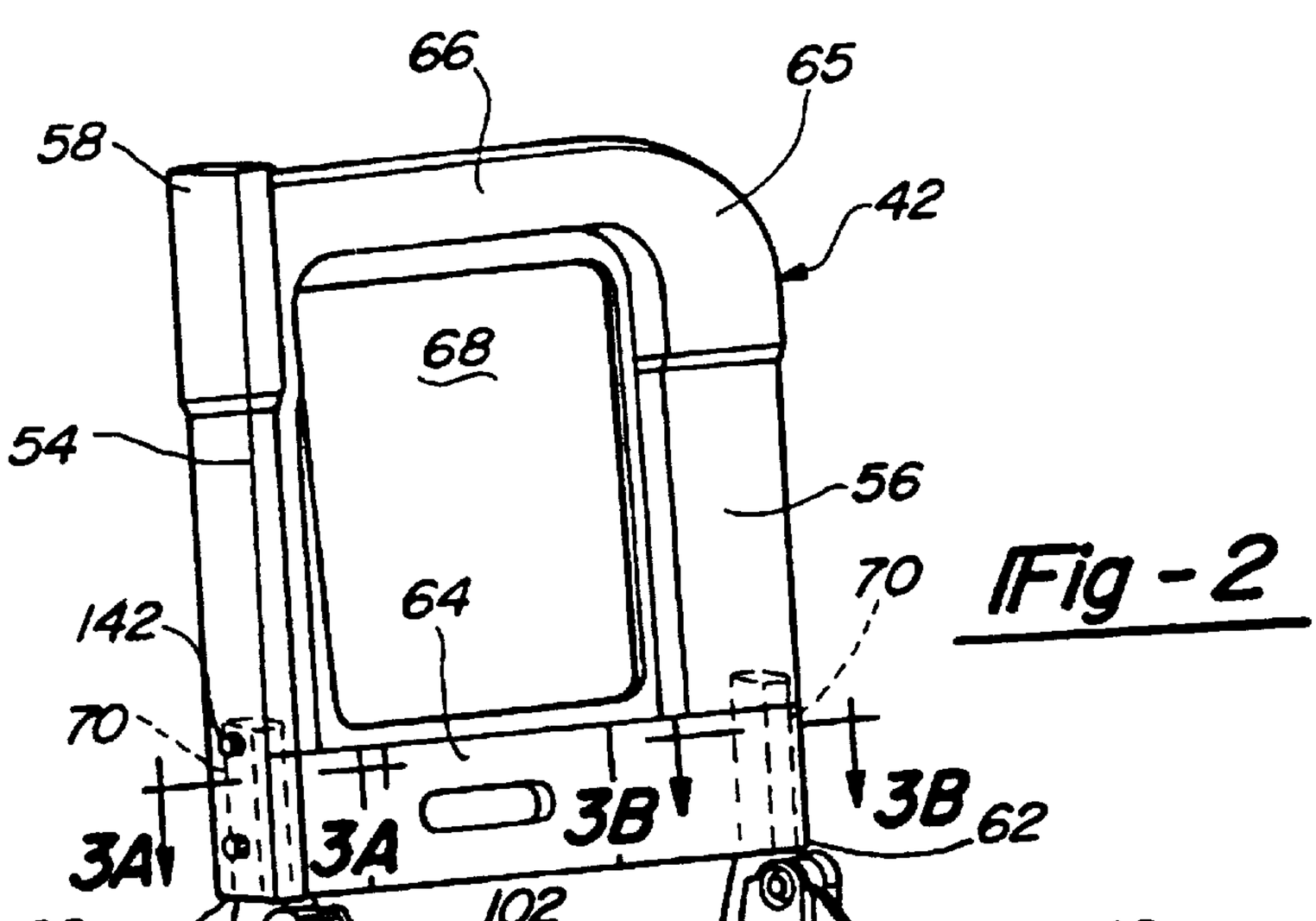

66
65
58
42
68
54
56
64
70
142
70
3A
3A
3B
3B
62
102
60
180
48
50
100
76
80
44
78
182
76
204
78
80
74

Fig - 2

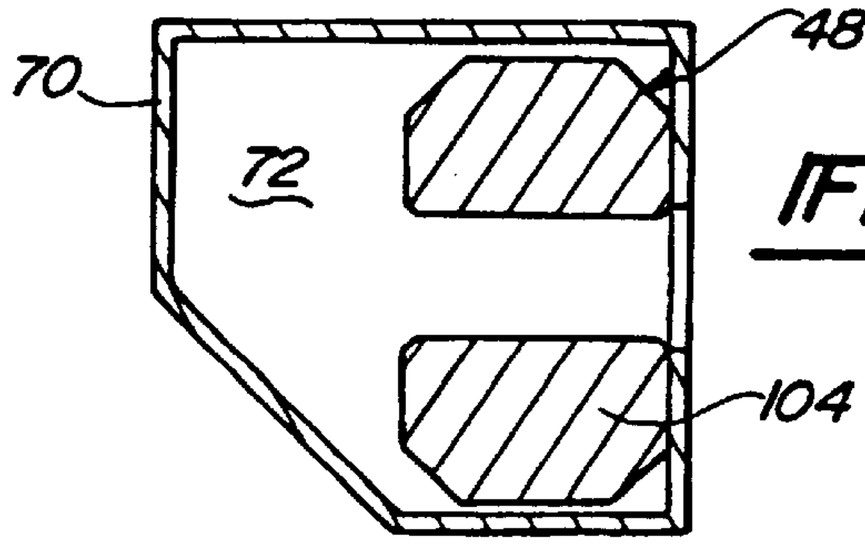
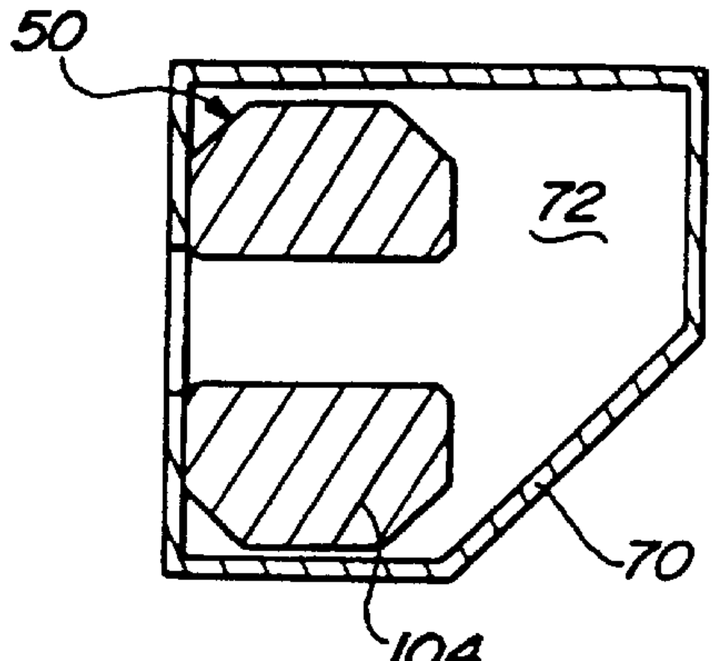


Fig - 3A

Fig - 3B



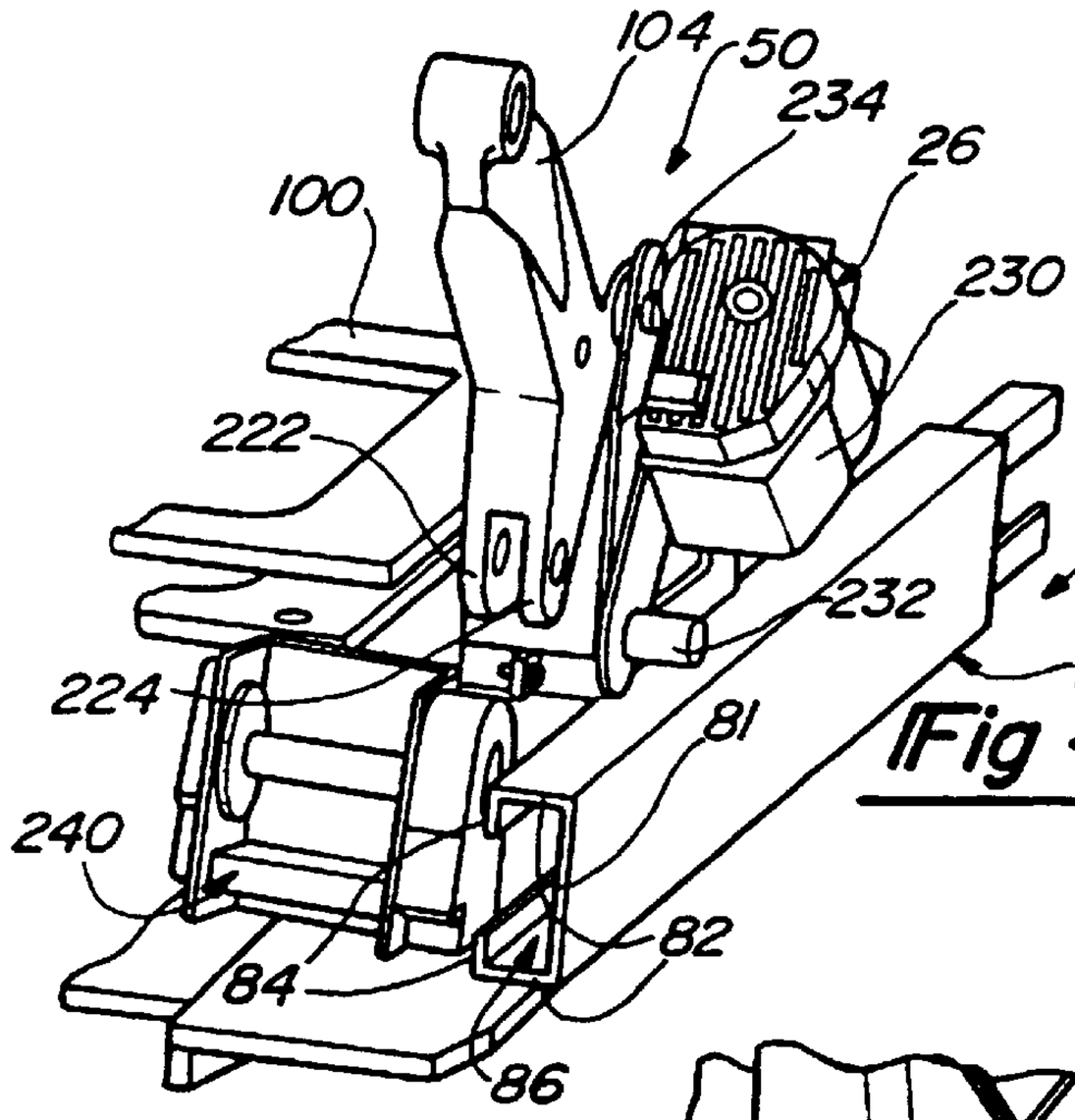


Fig - 6

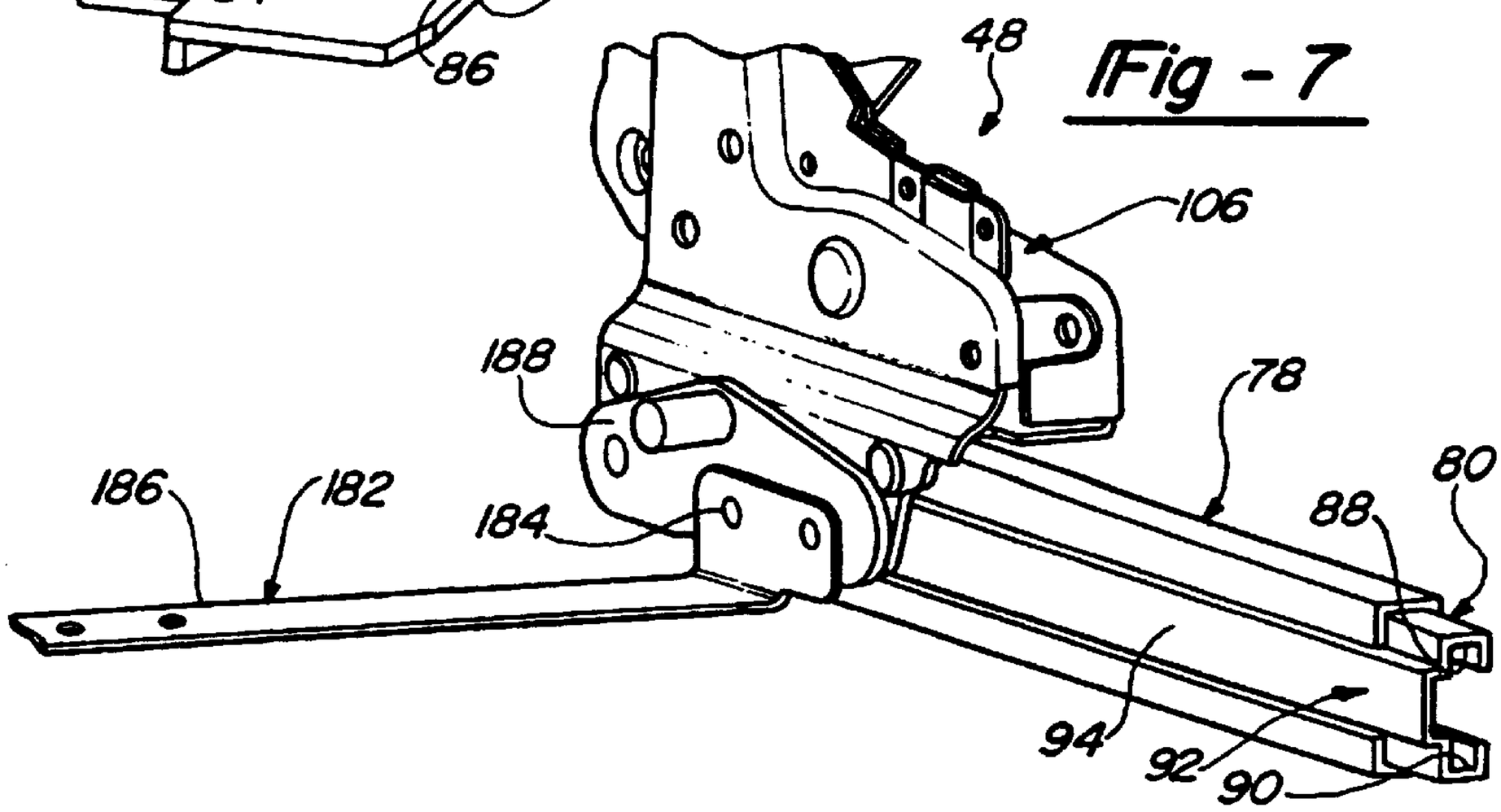


Fig - 7

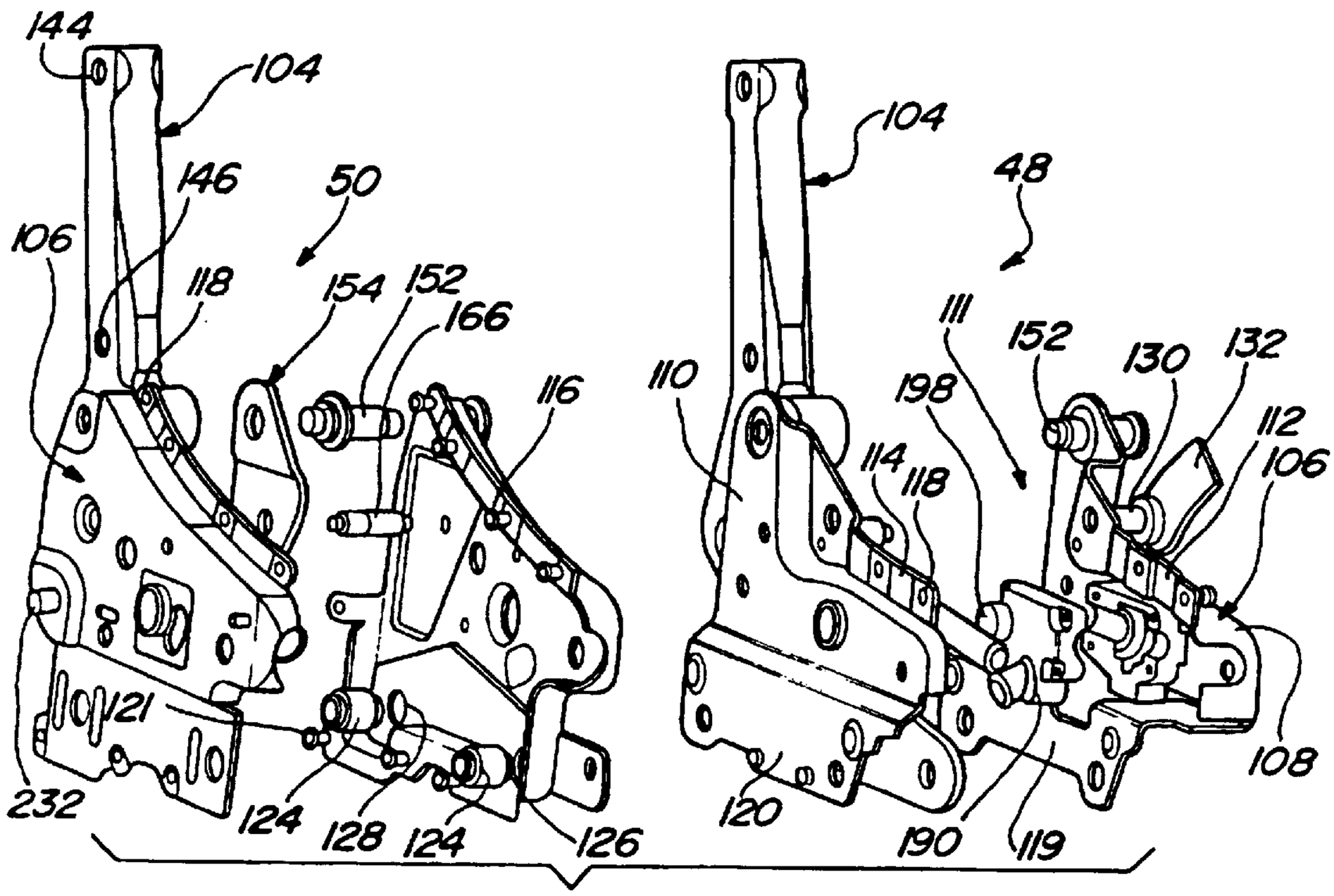
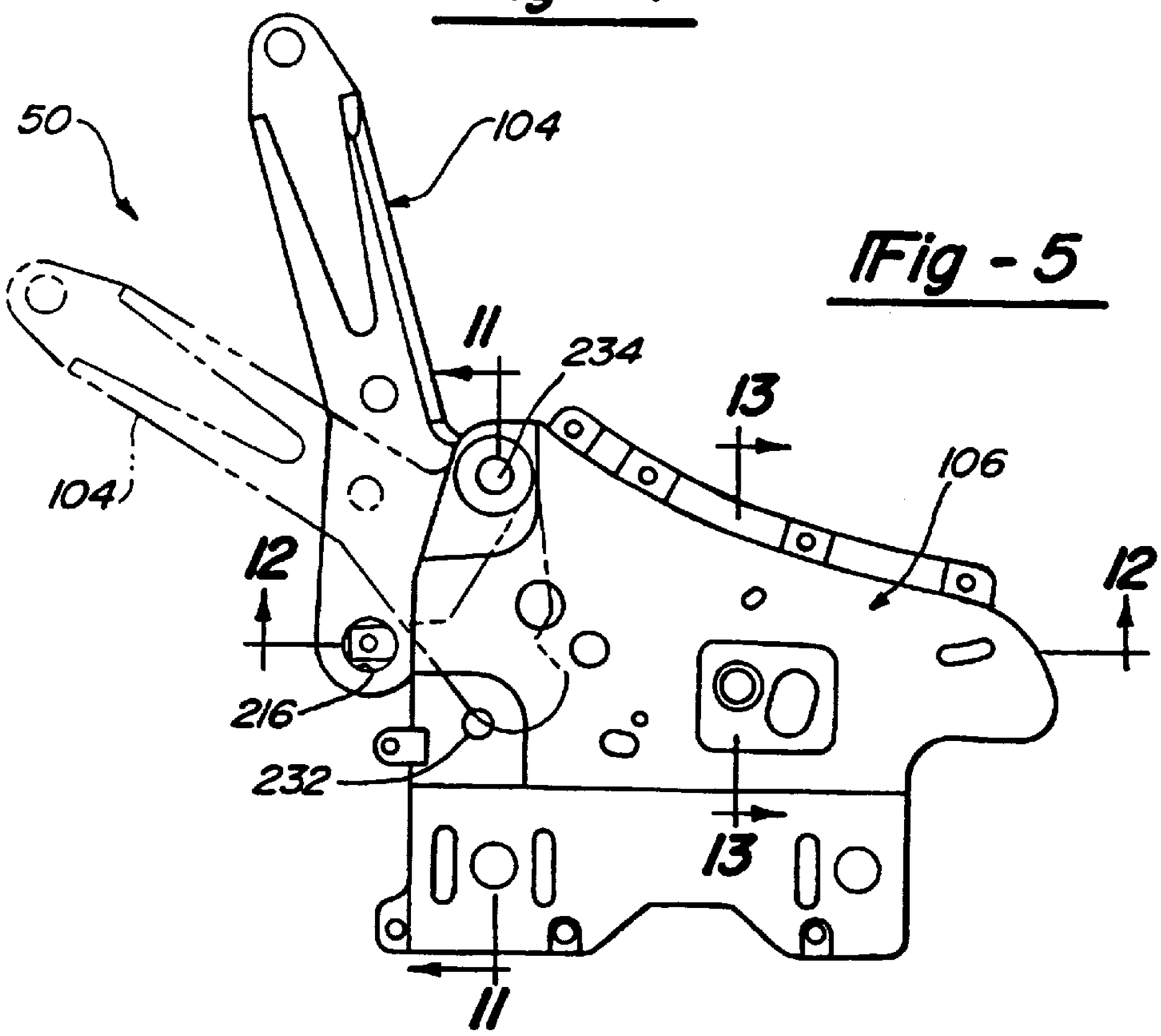

144
104
146
50
106
118
154
152
166
116
121
232
124
128
124
126
104
111
152
130
132
110
198
112
114
118
106
108
120
190
119

Fig - 4

Fig - 5


50
104
104
11
234
13
106
12
12
216
232
13
11

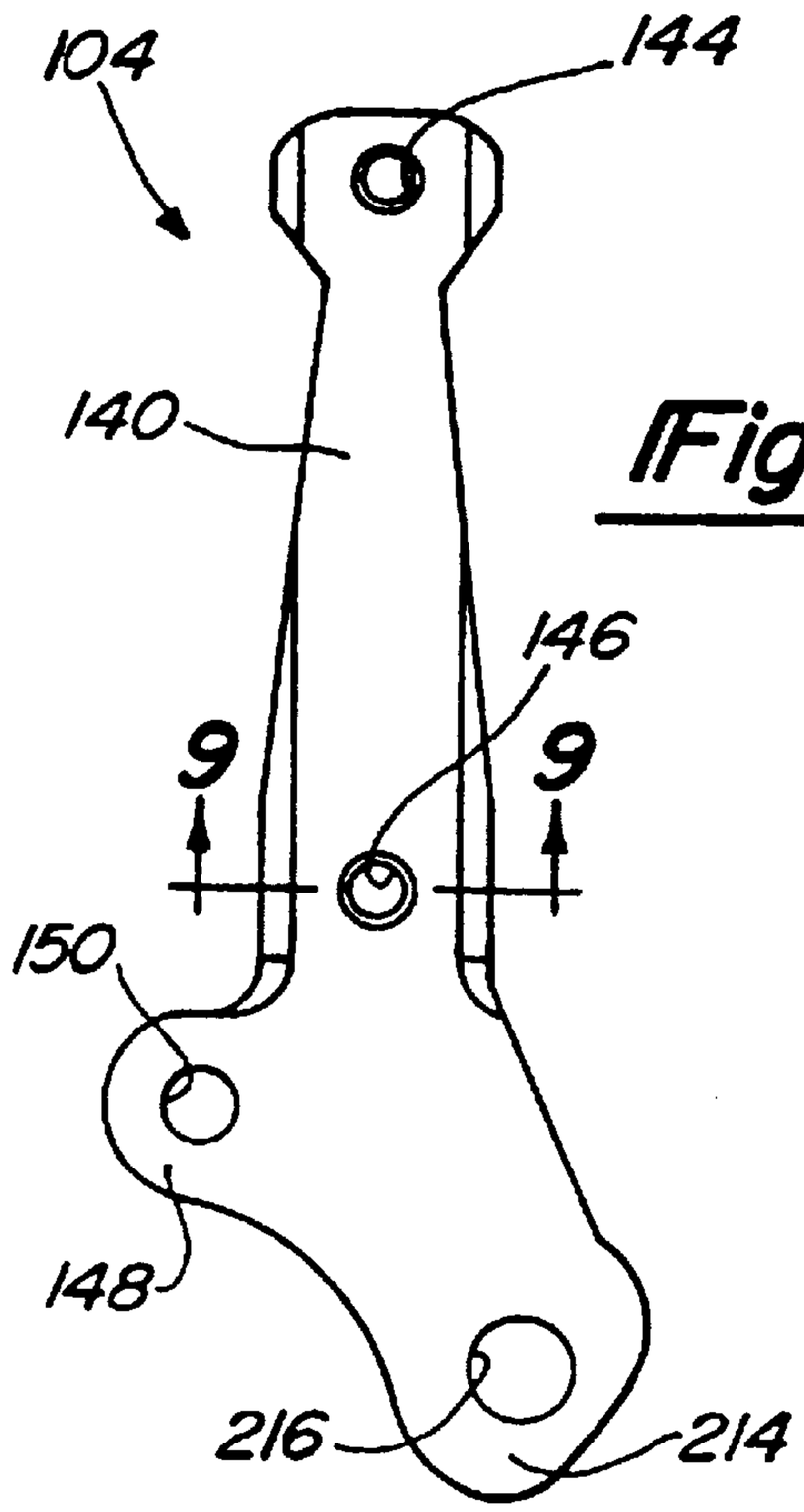


Fig - 8

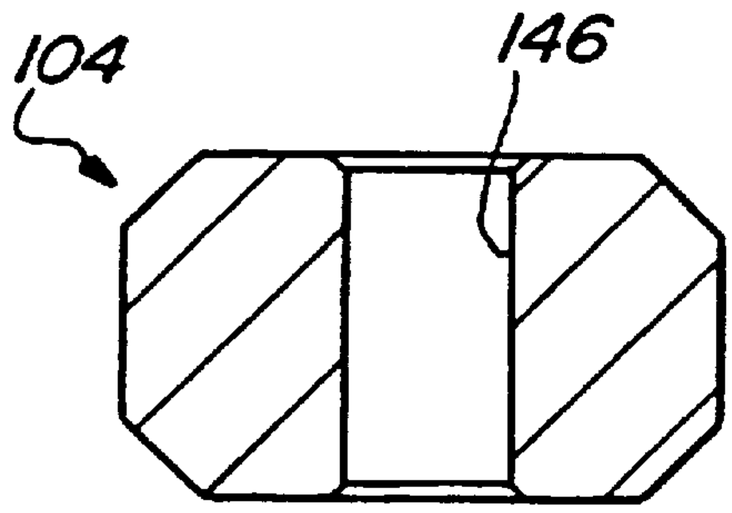


Fig - 9

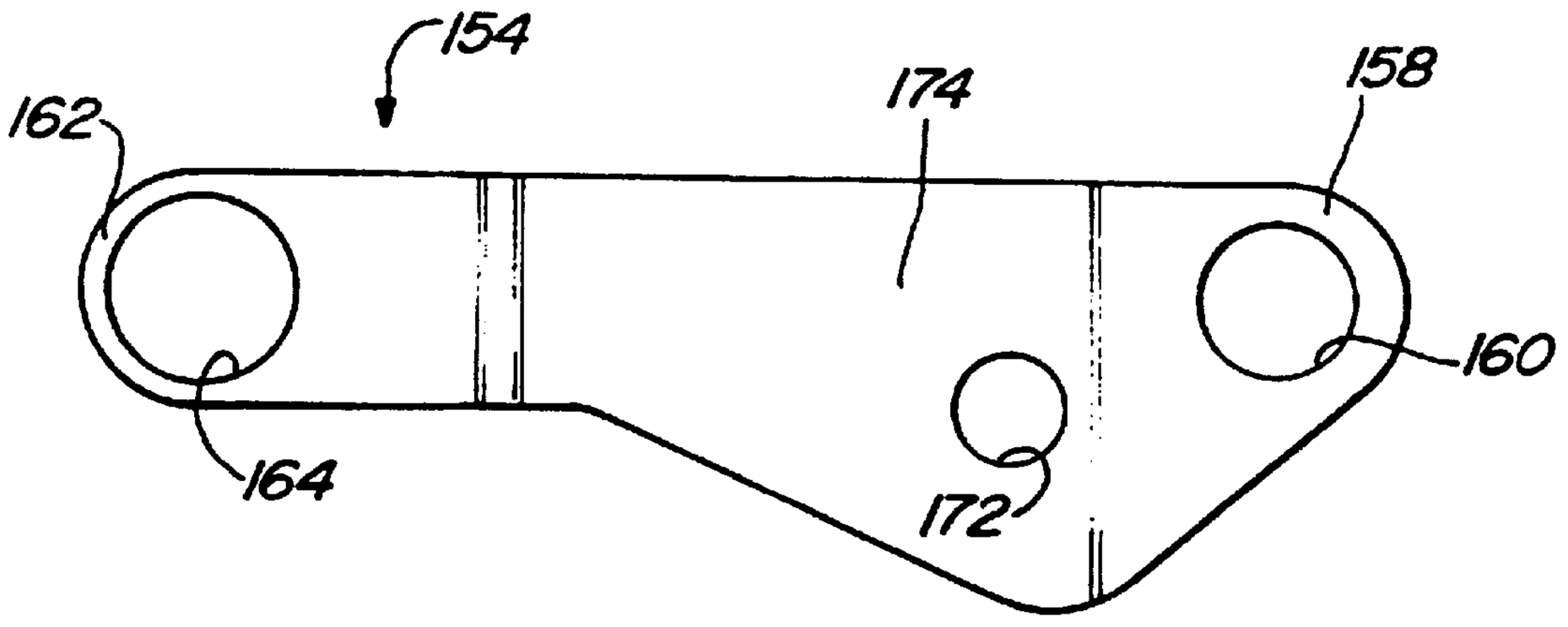


Fig - 10

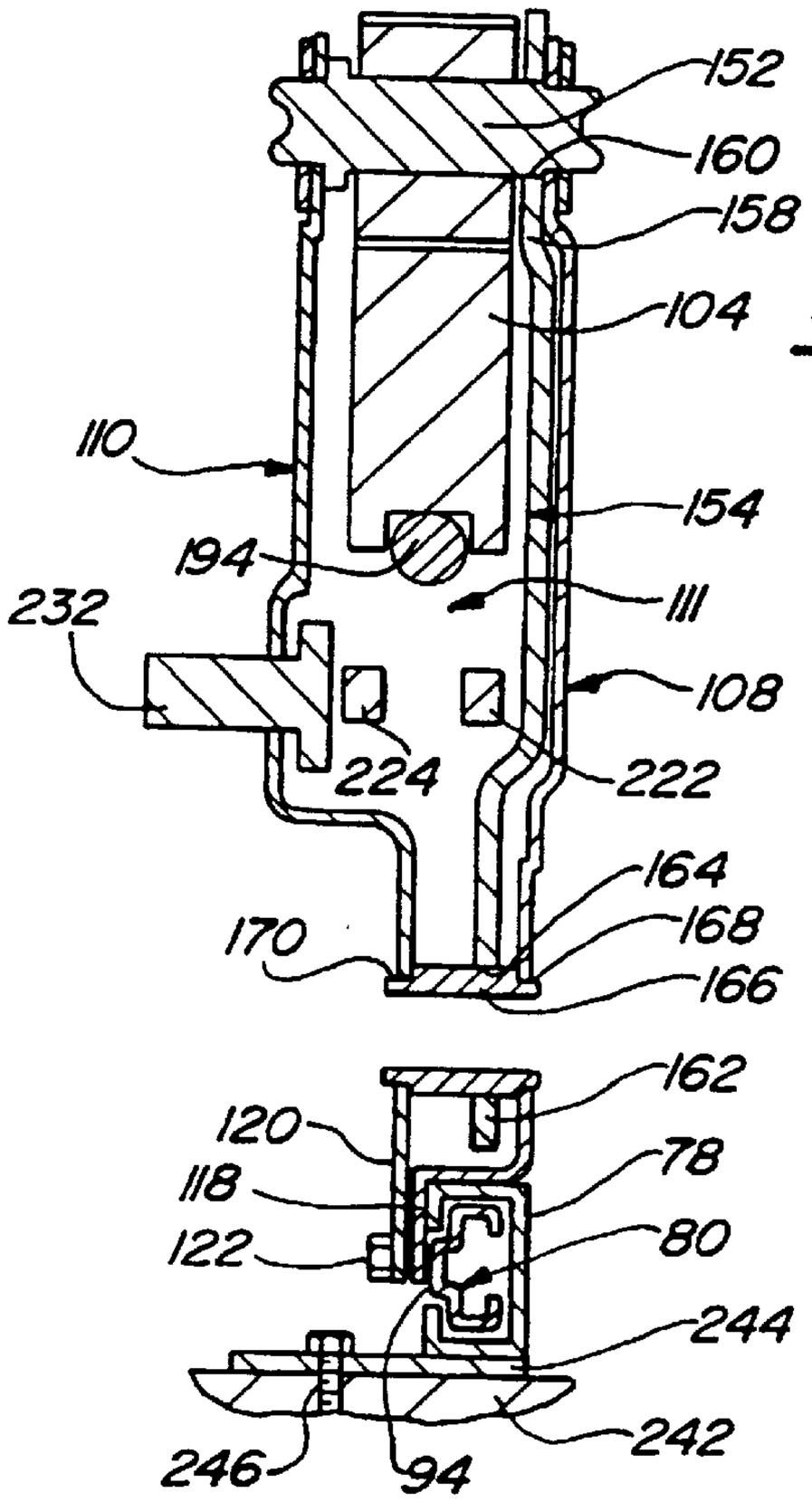


Fig - 11

Fig - 13

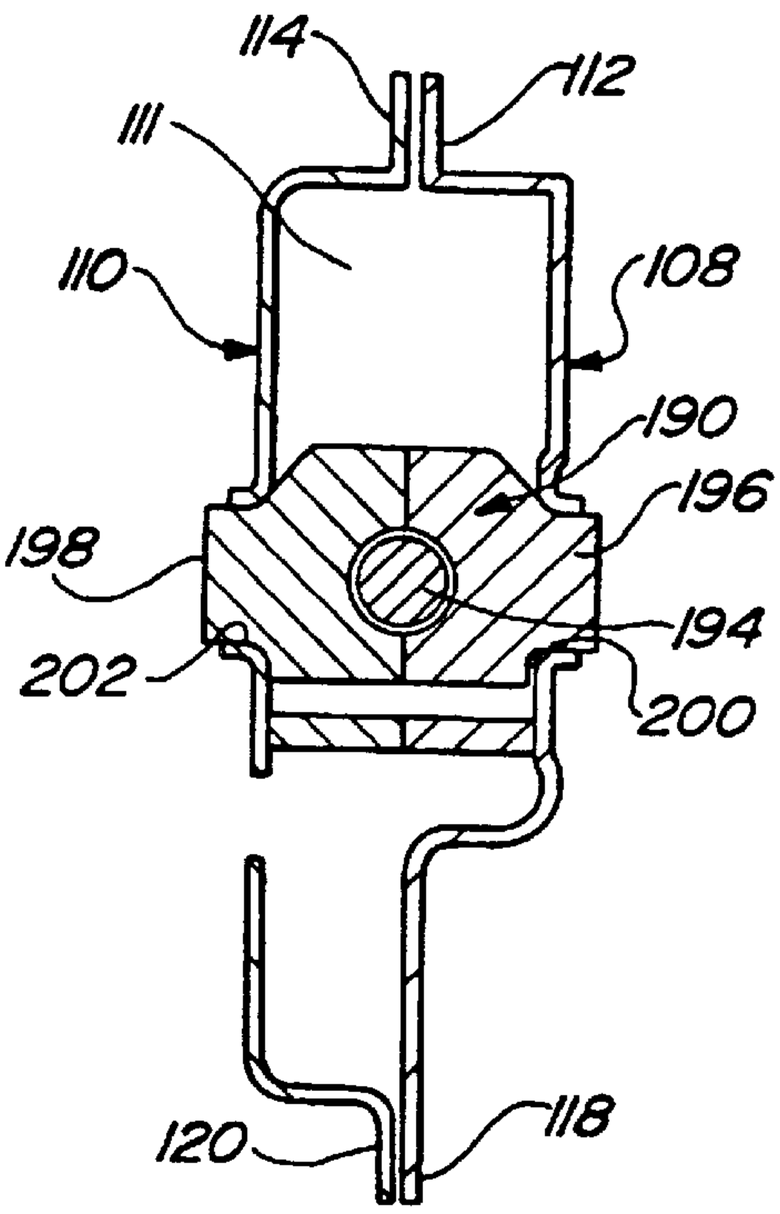
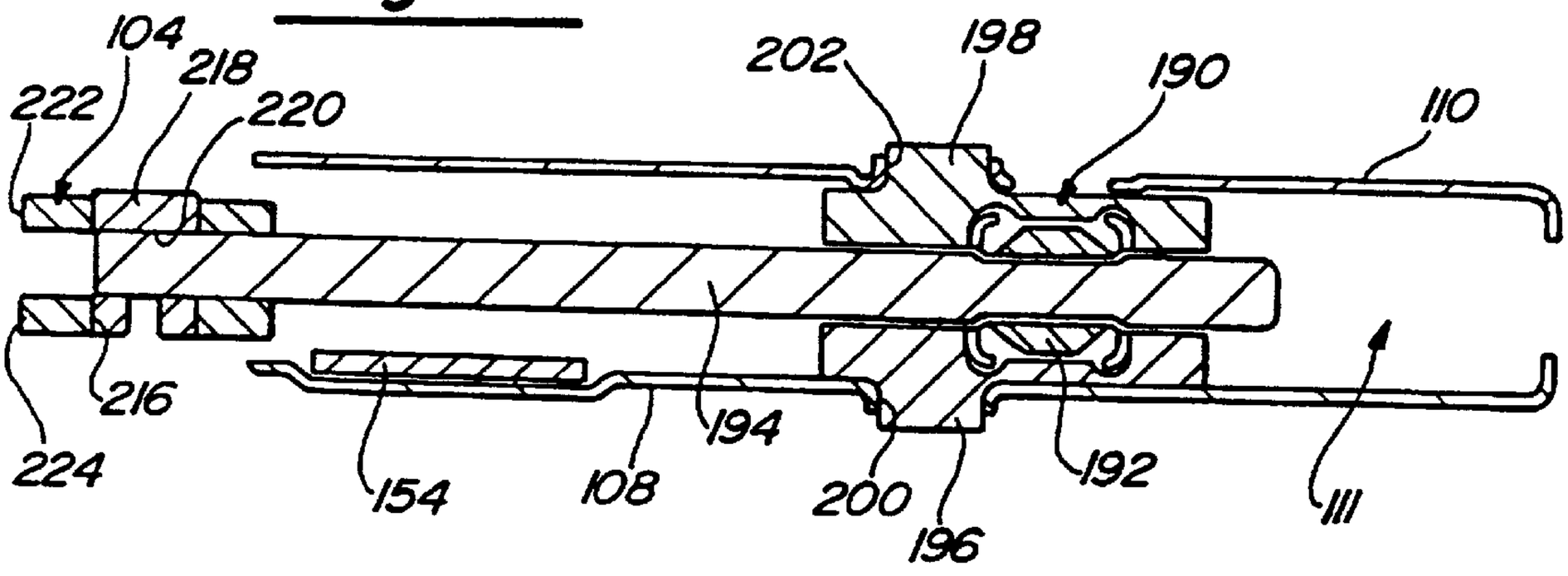


Fig - 12



PIVOT ASSEMBLY FOR A STRUCTURED VEHICLE SEAT

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

BACKGROUND OF THE INVENTION

The present invention relates in general to a seat assembly for a motor vehicle. More particularly, the present invention relates to a pivot assembly for a structured vehicle seat of the type that carries a retractable safety belt and includes a seatback pivotally interconnected to a lower seat structure. The pivot assembly is configured to transfer the potentially significant safety belt loads that may be incurred during severe deceleration or vehicle collision from the seatback to the lower seat structure, and in turn, to the vehicle frame.

Virtually all motor vehicles are equipped with restraint systems including a retractable safety belt for physically restraining a seat occupant when the vehicle is subjected to a high rate of deceleration which may occur, for example, during a vehicle collision or during severe braking. In conventional vehicles, the retractable safety belts are predominantly attached directly to the vehicle structure. For example, most modern safety belt systems utilize a belt retractor mounted to the vehicle floor pan which adjustably receives the retractable belt. The retractable belt extends upward from the belt retractor along the B-pillar of the vehicle to a guide ring mounted to the B-pillar. The retractable belt then extends downward from the B-pillar guide ring adjacent to the belt retractor where an end of the retractable belt is connected to the vehicle floor. A tongue plate is mounted on the safety belt and is slidably movable therein between the end anchored to the vehicle floor and the guide ring on the B-pillar. A buckle is interconnected with the vehicle floor on the opposite side of the occupant seat.

When the tongue plate is pulled across the occupant and releasably inserted into the buckle, the retractable belt forms a lap belt portion across the occupant's midsection and a shoulder belt portion extending diagonally across the occupant's torso. The lap belt portion and shoulder belt portion cooperate to retain the occupant in the seat. While mounted to the vehicle frame independently from the seat, the safety belt restraint system is intended to be positioned in such a proximity to cooperate with the seat for effectively and comfortably restraining the seat occupant during severe deceleration.

While conventional safety belt restraint systems, such as the type described above, have proven to be commercial acceptable for many applications, each is attendant with drawbacks and subject to improvement. In many applications, the operation and comfort of such a conventional safety belt restraint system conflicts with the operational requirements of modern vehicle seat assemblies. In this regard, virtually all modern vehicles are equipped with seating assemblies that can be selectively adjusted in at least the fore and aft direction for providing increased comfort and convenience to the seat occupant. Furthermore, modern vehicle seat assemblies, particularly those intended for front seat applications, are almost exclusively constructed to include a seatback mounted for pivotal movement relative to a seat cushion for selective articulation between a generally upright position and a fully reclined position.

Through conventional adjustment of a seat assembly in the fore or aft direction, an occupant seated on the seat assembly is effectively translated relative to the mounting points (i.e, belt retractor, B-pillar guide ring, belt end connection, and tongue plate) of the safety belt restraint system. As a result, it frequently becomes inconvenient and uncomfortable for a seat occupant to correctly employ and/or utilize the safety belt restraint system, thereby often discouraging use of the safety belt restraint system. For example, if the vehicle seat assembly is selectively moved to a forwardmost position, it is often difficult for the seat occupant to reach back to grasp the seat belt tongue plate carried adjacent the B-pillar. This difficulty is particularly true with elderly occupants, occupants with physical disabilities and occupants of smaller physical stature. Furthermore, when the position of the vehicle seat assembly is forwardly adjusted, the shoulder belt portion of the retractable belt may abrade the seat occupant's neck, thereby resulting in occupant irritation or discomfort.

Other difficulties and problems are encountered when a conventional seat assembly is adjusted to its rearwardmost position. For example, the shoulder belt portion of the retractable belt is more susceptible to slight displacement from the upper torso of the restrained occupant. As a result, the occupant may be undesirably permitted to momentarily shift forward unrestrained by the shoulder belt portion of the retractable belt when the vehicle is subject to severe deceleration forces. Similar inconveniences are encountered by the vehicle occupant when the seatback is pivotally articulated from a standard operating position towards its fully reclined position. Furthermore, a restrained seat occupant having the vehicle seat in the rearwardmost position may be unable to move the seat to a more forward position without first readjusting the retractable belt.

The noted difficulties and inconveniences associated with conventional seat assemblies and safety belt restraint systems are further complicated in seating applications for convertible vehicles. In this regard, for obvious reasons, it is desirable for convertible vehicles to eliminate an upwardly extending B-pillar. As a result, the upper B-pillar mounting point for the retractable belt is often inconveniently positioned relative to the seat occupant, frequently resulting in less than ideal belt fit and occupant discomfort.

It is also known to mount a safety belt restraint system directly to a seat assembly. In such an arrangement, the structure of the seat assembly must be of sufficient strength to accommodate the potentially significant loads that may be generated as a result of vehicle deceleration from impact, severe braking, or the like. However, known "structured" seat assemblies have also been associated with various disadvantages. The primary problem with such known constructions resides in an inability to efficiently and effectively transfer deceleration loads received by the seatback to the vehicle structure. More specifically, known constructions for structured seat assemblies have been unable to fully retain the operation features (e.g., pivotally mounted seatback, fore and aft translation, etc.) demanded by consumers without utilizing complex arrangements for pivotally mounting the seatback to the lower seat structure. When functionally acceptable, these complex arrangements are often weight prohibitive, cost prohibitive, or both.

In view of the foregoing, a need clearly exists to develop a pivot assembly for vehicle seat assembly having a structured frame for absorbing loads received from an attached safety belt restraint system and transferring such loads to the vehicle frame. More specifically, a need exists to develop a vehicle seat assembly which efficiently and effectively overcomes the known shortcomings associated with vehicle seat constructions and yet which can be readily adapted for use in various vehicular seating applications.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide an improved pivot assembly for a structured vehicle seat that is relatively simple in design and construction, inexpensive to fabricate and assemble, and yet is durable and highly reliable.

A more detailed object of the present invention is to provide a pivot assembly for a vehicle seat assembly having a belt restraint system mounted to and carried by the seat assembly so that regardless of the position of the seat assembly in the vehicle, the belt restraint system remains in a constant position relative to the seat occupant.

It is another object of the invention to provide a pivot assembly for a vehicle seat assembly capable of withstanding the safety belt loads incurred during a vehicle collision and transferring such loads to a lower seat structure and, in turn, to the vehicle frame.

It is a further object of the present invention to provide a pivot assembly fixedly attached to a seatback frame of a vehicle seat for interconnecting the seatback frame to a lower seat structure.

It is yet a further object of the present invention is to provide a pivot assembly incorporating an improved drive arrangement for rotating a seatback of a structured vehicle seat between a generally upright position and a fully reclined position.

These and other objects are provided by a structured vehicle seat assembly which includes an improved pivot assembly operative for transferring loads from an upper seatback frame to a lower seat structure. In a presently preferred arrangement, a vehicle seat assembly is constructed to include a first pivot assembly adjacent an inboard side and a second pivot assembly adjacent an outboard side. Each of the pivot assemblies preferably includes an integrally formed connector member which functions to interconnect the seatback frame and a lower seat structure.

In one form, the structured vehicle seat assembly of the present invention includes a lower seat structure and a seatback frame. The seatback frame is pivotally mounted relative to the lower seat structure for selective movement to angular reclined positions defined between a generally upright position and a fully reclined position. A safety belt restraint system is carried by the lower seat structure and the seatback frame. The structure vehicle seat assembly further includes a pivot assembly for pivotally interconnecting the seatback frame to the lower seat structure. Preferably, the pivot assembly is fixedly attached to the seatback frame.

In a more preferred form, the structured vehicle seat assembly of the present invention includes a lower seat structure having a seatpan frame and a slide assembly for selectively translating the seatpan frame in fore and aft directions. The structured vehicle seat assembly further includes a seatback frame pivotally interconnected to the lower seat structure for selective movement between plural angular positions relative to the lower seat structure. The seatback frame includes a lower end and an upwardly extending channel adjacent one of an inboard side and an outboard side of the seatback frame. The upwardly extending channel is open adjacent the lower end. A safety belt restraint system is attached to and carried by the lower seat structure and the seatback frame. The structured vehicle seat assembly further includes a pivot assembly for pivotally interconnecting the seatback frame to the lower seat structure for selectively rotation between a generally upright position and a fully reclined position. The pivot assembly

includes a housing attached to the slide assembly and a generally boot-shaped connector member pivotally mounted to the housing for rotation about a pivot pin. The generally boot-shaped connector member includes an upper portion and which at least partially extends into the upwardly extending channel of the seatback frame. Preferably, the boot-shaped connector member is fixedly attached to the seatback frame.

BRIEF DESCRIPTION OF THE DRAWINGS

Further objects, features and advantages of the present invention will become apparent from analysis of the following written specification and the accompanying drawing and the appended claims in which:

FIG. **1** is a front perspective view of a portion of a passenger seating area in an exemplary motor vehicle illustrating an exemplary pair of structured vehicle seat assemblies constructed in accordance with the teachings of a preferred embodiment of the present invention;

FIG. **2** is an enlarged front perspective view of the passenger seat assembly shown in FIG. **1**, with the upholstery, cushions, and safety belt restraint system removed to illustrate in detail its components;

FIGS. **3**A and **3**B are cross sections through the support tubes shown in phantom in FIG. **2**;

FIG. **4** is a partially exploded view of the inboard and outboard pivot assemblies of the pivot arrangement shown in FIG. **2**;

FIG. **5** is an enlarged side view of the outboard pivot assembly of FIGS. **2** and **4** showing its components in greater detail and illustrating the associated connector member in a standard operating position and in phantom illustrating the connector member rotated toward a reclined position;

FIG. **6** is a rear perspective view of a portion of the lower seat structure and outboard pivot assembly of the passenger seat assembly of FIG. **2** further illustrated to include a shoulder belt retractor and a lap belt retractor;

FIG. **7** is a partial front perspective view of the seat assembly of FIG. **2** illustrating the interconnection between the inboard pivot assembly, the lateral support member, and the slide assembly;

FIG. **8** is an enlarged side view of one of the inboard connector member shown in FIGS. **2** through **6**;

FIG. **9** is a cross-sectional view taken along the line **9—9** of FIG. **8**;

FIG. **10** is an enlarged side view of the tie bar shown in FIG. **2**;

FIG. **11** is a cross-sectional view generally taken along the line **11—11** of FIG. **5** and further shown to include the associated slide assembly and mounting to the vehicle structure;

FIG. **12** is a cross-sectional view taken along the line **12—12** of FIG. **5**; and

FIG. **13** is a cross-sectional view taken along the line **13—13** of FIG. **5**.

The following detailed description utilizes various terminology intended to indicate general direction for purposes of describing the figures to which reference is being made. For example, it will be understood that the terminology "inboard" and "outboard" will be used as a convenience to designate the lateral sides of the seat assembly. It will be further understood that the terminology "fore" and "aft" will be used to refer to directional movement of the seat toward

the front of the vehicle and away from the front of the vehicle, respectively.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention is directed to a structured seat assembly that is particularly well-suited for use in motor vehicle seating applications. More specifically, the present invention is directed to an improved pivot assembly for such a structured seat assembly. The exemplary seating arrangement shown throughout the drawings is illustrated to be specifically adapted for application in the front seating area of a motor vehicle as front driver and passenger seat assemblies. However, it is to be understood that the teachings of the present invention are not limited to the particular vehicle seating arrangement shown. That is, the illustrated application is merely an exemplary representation of the general type of environment into which the present invention may be incorporated.

Referring now generally to the drawings in which like elements are identified with identical reference numerals throughout, and particularly to FIG. **1**, a portion of a front seating area of a motor vehicle is shown to include a pair of independently positionable seat assemblies constructed to include pivot assemblies in accordance with the teachings of the present invention. For ease of reference, the passenger seat assembly shown on the left-hand side of FIG. **1** is identified throughout the drawings as reference numeral **10** and the similarly constructed driver seat assembly is identified with reference numeral **10'**. It will be understood that passenger seat assembly **10** and driver seat assembly **10'** are functionally identical, and further that the construction of driver seat assembly **10'** is a mirror image to that of passenger seat assembly **10**. Thus, while the remainder of this detailed description will focus primarily on the construction and operation of passenger seat assembly **10**, a thorough understanding of driver seat assembly **10'** will be apparent therefrom.

Seat assembly **10** is illustrated to include a seat cushion **12**, a padded seatback **14**, and a headrest **16** for supporting a vehicle occupant (not shown) in a conventional manner. When in a standard operating position as illustrated in FIG. **1**, seatback **14** extends upwardly at the rear of seat cushion **12** and is angled slightly rearward. As will be discussed in further detail below, seatback **14** is mounted for pivotal adjustment relative to its corresponding seat cushion **12** for occupant convenience and comfort. That is, seatback **14** is pivotally adjustable to plural angular positions defined between the standard operating position, or generally upright position, and a fully reclined position (not specifically shown).

Seat assembly **10** is further shown to include a safety belt restraint system **18** mounted to and carried by seat assembly **10**. In the exemplary embodiment illustrated in FIG. **1**, safety belt restraint system **18** is shown to include a retractable belt **20** adapted for restraining the seat occupant in a seated position adjacent seat cushion **12** and padded seatback **14** when the vehicle is subject to severe deceleration forces due to severe braking or a vehicle collision. Retractable belt **20** is shown to extend outwardly from seat assembly **10** adjacent a top outboard corner of seatback **14** where it engages a belt slide assembly **22**. It will be appreciated by those skilled in the art, that belt slide assembly **22** is vertically adjustable to comfortably accommodate seat occupants of varying heights.

As shown with respect to the seat assembly **10**, retractable belt **20** extends downwardly along an outboard side **23** of seat assembly **10** when not in use. An end **24** of retractable belt **20** is interconnected to seat assembly **10** through a lower belt retractor **26** (shown in FIG. **1** in connection with driver seat assembly **10'**). A tongue plate **28** is adjustably positioned on retractable belt **20** between belt slide assembly **22** and lower belt retractor **26**. A cooperating buckle component **32** is attached to an inboard side **40** of seat assembly **10** and is specifically adapted for releasable engagement of tongue plate **28** in a generally convention manner.

As illustrated with respect to driver side seat assembly **10'**, when tongue plate **28** is inserted into buckle component **32**, retractable belt **20** forms an adjustable shoulder belt portion **36** for diagonally traversing the torso of the seat occupant and an adjustable lap belt portion **38** for traversing the seat occupant's waist. Shoulder belt portion **36** extends from belt slide assembly **22** to the lower portion of inboard side **40** of seat assembly **10**. Safety belt restraint system **18** of seat assembly **10** of the present invention has been shown and described in this manner. However, nothing herein should be construed so as to limit seat assembly **10** of the present invention to any specific safety belt restraint system. That is, the teachings of the present invention are applicable for use with any of a number of safety belt restraint systems and the system illustrated should merely be considered to be exemplary.

With reference to FIGS. **2** through **5**, seat assembly **10** shown in FIG. **1** is illustrated with its upholstery, padding, headrest **16** and safety belt restraint system **18** removed to more clearly illustrate the novel structure and operational features of the present invention. Seat assembly **10** is shown generally to include a seatback frame **42** and a lower seat structure **44**. Seat assembly **10** is shown to further include a pivot arrangement **46** which preferably comprises an inboard board assembly **48** and an outboard pivot assembly **50**. As will become more apparent below, inboard and outboard pivot assemblies **48** and **50** cooperatively operate for pivotally mounting seatback frame **42**, and in turn seatback **14**, relative to lower seat structure **44** for rotation between plural angular positions.

Through inboard and outboard pivot assemblies **48** and **50**, seatback frame **42** is pivotally movable between the standard operating position and the fully reclined position. Inboard and outboard pivot assemblies **48** and **50** further cooperate to transfer loads applied to seatback frame **42** (e.g., directly from the seat occupant or indirectly through retractable belt **20**) to lower seat structure **44**. The primary focus of the present invention is directed to the construction and operation of inboard and outboard pivot assemblies **48** and **50** and their interconnection with cooperating structure of seatback frame **42** and lower seat structure **44**. However, a further understanding of the exemplary seatback frame **42** and lower seat structure **44** with which pivot assemblies **48** and **50** are specifically adapted to cooperate is warranted prior to turning to the details of pivot assemblies **48** and **50**.

With specific reference to FIG. **2**, seatback frame **42** is generally rectangular in shape and includes a hollow outboard beam **54** upwardly extending along outboard side **23** of seat assembly **10** and a corresponding hollow inboard beam **56** upwardly extending along inboard side **40** of seat assembly **10**. Outboard beam **54** is open at an upper end **58** and is adapted to receive safety belt slide assembly **22**. Adjacent their respective lower ends **60** and **62**, inboard and outboard beams **54** and **56** are interconnected by a lower intermediate member **64**. Lower ends **60** and **62** of inboard and outboard beams **54** and **56**, respectively, are open, thereby defining two parallel channels (not specifically shown) accessible from the lower end of seatback frame **42**.

Upper end **58** of outboard beam **54** and an upper end **65** of inboard beam **56** are interconnected by an upper intermediate member **66**. As will be appreciated more fully below, inboard and outboard beams **54** and **56** are specifically adapted to receive a portion of pivot assemblies **48** and **50**, respectively, and thereby interconnect seatback frame **42** with lower seat structure **44**. Seatback frame **42** is preferably unitarily constructed of steel or other suitable high strength material.

Seatback frame **42**, while providing the additional structure and strength necessary to accommodate potentially significant seat belt loads, utilizes efficient management of material, thereby avoiding the use of excess material where not required. One example of this efficient management of material is that seatback frame **42** is generally rectangular in shape having a substantially rectangular central aperture **68** for purposes of weight reduction and functions to direct loads downward to pivot assemblies **48** and **50**. A second example of this material management is that seatback frame **42** further is constructed to include a pair of support tubes **70**, shown in phantom in FIG. **2** and further shown in the cross-sectional views of FIGS. **3**A and **3**B, located in inboard and outboard beams **54** and **56**. Support tubes **70** function to sufficiently strengthen seatback frame **42** for interconnection with and transferring seat belt loads to pivot arrangement **46** without adding unnecessary weight or interfering structure. As shown in the cross-sectional views of FIGS. **3**A and **3**B, support tubes **70** define channels **72** for directly receiving a portion of inboard and outboard pivot assemblies **48** and **50**. The specific interconnection between support tubes **70**, inboard and outboard beams **54** and **56** and pivot assemblies **48** and **50** will be discussed in detail below.

With continued reference to FIG. **2** and additional reference to FIGS. **6** and **7**, lower seat structure **44** of seat assembly **10** is shown to include a seat adjustment mechanism **74** of the type commonly referred to as "two-way" adjuster that is adapted to permit a seat occupant to selectively adjust the longitudinal (i.e., "fore" and "aft) position of a seat cushion **12** and seatback **14**. To provide means for such a longitudinal adjustment, seat adjustment mechanism **74** includes a pair of laterally spaced seat slide devices **76** which each include an outer track member **78** and an inner track member **80**. While not specifically illustrated, it will be understood by those skilled in the art that seat adjustment mechanism **74** further includes a generally conventional device (not shown) operably coupled to inner track members **80**. The device is selectively actuable for permitting synchronous movement of inner track members **80** relative to outer track members **78**.

In the embodiment illustrated, outer track members **78** are elongated structural members which are similarly configured to include a generally C-shaped cross-section. Outer track member **78** more specifically includes a side wall **81** and a pair of horizontally spaced legs **82** extending therefrom. Formed at the distal end of each horizontally spaced leg **82** is an inwardly bent lip or flange **84**. Thus, outer track members **78** cooperate to define elongated slide channels **86** having an inwardly facing open portion.

Inner track members **80** are shown as elongated structural members having a modified C-shaped cross-sections. Inner track members **80** are sized to be cooperatively received within elongated slide channels **86** of the respective outer track members **78**. More specifically, inner track members **80** are identically constructed to each include an upper U-shaped segment **88** and a lower U-shaped segment **90** retained within the slide channels **86** defined by the corresponding outer track members **80**. Inner track member **78** further includes a mounting segment **92** interdisposed therebetween. Mounting segment **92**, which interconnects segment **88** and segment **90**, also has a U-shape and further includes a generally vertical side **94** slidably disposed within the inwardly facing open portion of outer track member **78**. Thus, inner track members **80** are interlocking interfitted with their corresponding outer track member **78** in a manner which facilities the transfer of vertically directed loads to the vehicle's sill or floor structure.

As noted, each inner track member **80** is slidably mounted with respect to its corresponding outer track member **78** for relative bi-directional movement in the fore and aft directions as indicated by Arrow A in FIG. **6**. As will be appreciated by those skilled in the art, suitable bearings (not shown) or other functionally equivalent structure may be incorporated between outer track member **78** and inner track member **80** to facilitate sliding movement therebetween.

Lower seat structure **44** is further shown to include a reinforced seatpan frame **100**. Seatpan frame **100** is generally rectangular in construction and includes a rectangular aperture **102** for purposes of overall weight reduction and to facilitate mounting of appropriate springs and padding (not shown). Seat mounting fasteners (not shown), such as threaded studs and nuts, serve to secure seatpan frame **100** to a mounting bracket (not shown), which is in turn secured to inner track member **80**. In this manner, seatpan frame **100** is mounted for sliding movement with inner track members **80** on outer track members **78**.

With general reference to FIGS. **2–13**, inboard and outboard pivot assemblies **48** and **50** of the present invention will now be described. To a significant degree, inboard pivot assembly **48** and outboard pivot assembly **50** are identical in construction and function. To facilitate description thereof, inboard pivot assembly **48** will first be described and subsequently the differences of outboard pivot assembly **50** will be addressed. Common reference numerals will be used between the pivot assemblies **48** and **50** to denote substantially identical components.

Inboard pivot assembly **48** is illustrated to include a connector member **104**, or pivot arm, which is pivotally attached to a housing **106**. In a manner which will be described below, housing **106** is, in turn, attached to the inboard inner track member **80** of slide device **72**. Housing **106** is shown to be preferably constructed to include an outer plate member **108** and an inner plate member **110** which cooperate to define a housing cavity **111**. Outer plate member **108** and inner plate member **110** each include a main body portion having a generally shoe-shape.

Outer and inner plate members **108** and **110** are joined at their respective upper edges through a pair of cooperating mounting flanges **112** and **114** integrally formed with outer and inner plate members **108** and **110**, respectively. Suitable fasteners **116**, such as rivets, pass through apertures **118** formed in each of the pair of mounting flanges **112** and **114**. Adjacent its lower end, outer plate member **108** includes a mounting flange **119** for cooperating with a downwardly extending lower edge **120** of inner plate member **110**. Lower edge **120** and flange **119** are joined by way of suitable fasteners such as rivets **121** and, in turn, jointly attached to vertical side **94** of inner track member **80** with bolts **122**. Thus, inboard pivot assembly **48** is mounted for bi-directional translational movement with inner track member **80** between fore and aft positions.

Spacing is maintained between the outer and inner plate members **108** and **110** through a pair of generally cylindrical mounting spacer **124** (shown in FIG. **4**). Each mounting

spacer **124** includes a reduced diameter portion **126** at each of its ends which is adapted to be received into corresponding cylindrical apertures **128** formed on the inner sides of the outer plate member **108** and inner plate member **110**. A mounting stud **130** outwardly extends from outer plate **108** to which a belt portion (partially shown at **132**) is interconnected. Belt portion **132** is attached to buckle member **32**.

As specifically shown in FIG. **8**, connector member **104** is illustrated to be generally boot-shaped in construction and is configured so as to be partially extended into upwardly extending channel **72** defined by support tube **70**. More particularly, connector member **104** is shown to include an upwardly extending portion **140**, or arm, adapted to be received into upwardly extending channel **72** as shown in FIG. **3**. Connector member **104** is fixedly interconnected with seatback frame **42** through a pair of threaded bolts **142** (shown in FIG. **2**) or other suitable fasteners which pass through a pair of threaded apertures **144** and **146** in connector member **104** and aligning apertures (not shown) formed in support tube **70** and inboard beam **56** of seatback frame **42**. Apertures **144** and **146** provide two point contact for fixedly interconnecting connector member **104** with seatback frame **42**.

Connector member **104** includes a heel portion **148** including an aperture **150** defining a pivot axis about which connector member **104** can be selectively rotated. In this regard, as shown in FIG. **5**, connector member **104** is shown in solid lines in its standard operating position and in phantom lines in a reclined position. A pivot pin **152** passes through aperture **150** and serves to pivotally interconnect connector member **104** and pivot assembly housing **106**.

In the preferred embodiment, connector member **104** is unitarily constructed of aluminum through an extrusion process. However, it will be appreciated by those skilled in the art that connector member **104** may be alternatively constructed by forging, casting or by any other well known manner from aluminum or other suitable material exhibiting sufficient strength requirements. Aluminum is the material of choice due to its physical characteristics and relatively light weight. In addition, aluminum is a relatively inexpensive material which is easily formed. In one application, connector member **104** is approximately eleven inches in length.

As noted above, outboard pivot assembly **50** is similar in construction and function to inboard pivot assembly **48**. With specific reference to FIGS. **4**, **10** and **11**, the differences residing in outboard pivot assembly **50** will now be discussed. Outboard pivot assembly **50** incorporates a slightly altered construction to accommodate the attachment of retractable belt **20** to the outboard side **23** of seatback **42**. Specifically, outboard pivot assembly **50** is illustrated to additionally incorporate means for distributing force loads received from seatback frame **42** and localized at pivot pin **152** which passes through the pivot axis of connector member **104**. In the preferred embodiment, the means for distributing loads received from seatback **42** comprises a generally planar tie bar member **154**. Tie bar member **154** is preferably shown to be unitarily constructed of high strength steel or other suitable material and functions to reduce loads concentrated about a pivot axis define by pivot pin **152**. A portion of the loads is transferred to multiple points of the pivot assembly housing **106**. As a result, the overall weight and dimensions of pivot assembly housing **106** are able to be reduced compared to a housing construction otherwise capable of accommodating the potentially significant loads from seatback **42**.

Tie bar member **154** is disposed within cavity **111** adjacent the inner side of outer plate member **108**. To facilitate general mating of tie bar member **154** with outer plate member **108**, tie bar member **154** is formed to include an upper stepped portion and a lower stepped portion. Tie bar member **154** is further formed to include a mounting aperture **160** adjacent a first end **158**, or upper end, which receives pivot pin **152**. Similarly, adjacent a second end **162**, or lower end, tie bar member **154** is formed to include a mounting aperture **164**. Mounting aperture **164** receives a mounting spacer **166** which is received in apertures **168** and **170** located in outer plate member **108** and inner plate member **110**, respectively. A clearance hole **172** is provided in a central portion **174** of tie bar member **154**.

Seat assembly **10** is further shown to include a drive arrangement for selectively rotating connector member **104** about its pivot axis and thereby rotating seatback **14** between its operating position and its reclined position. The drive arrangement is illustrated to include a drive motor (partially shown at **180**) mounted to a lateral stabilization bracket **182** by bolts (not shown) or other suitable fasteners. Lateral stabilization bracket **182**, shown most clearly in FIG. **7**, includes a pair of mounting portions **184** disposed at opposite ends of a central portion **186** which are generally perpendicular to central portion **186**. The mounting portions **184** are secured to mounting flanges **188**, which are in turn secured to one of the pivot assembly housings **106**.

Drive arrangement is further illustrated to include a drive unit **190** located in each of the cavities **111** of the inboard and outboard pivot assemblies **48** and **50**. In the embodiment illustrated, drive unit **190** is a right angle drive unit including a 45° bevel gear **192** interconnected with a threaded lead screw **194**. Drive unit **190** includes a pair of cylindrical extensions **196** and **198** which partially extend through apertures **200** and **202** formed in outer plate member **108** and inner plate member **110**, respectively. Cylindrical extensions **196** and **198** function to locate drive unit **190** within cavity **111**. Drive unit **190** is interconnected with motor **180** through a drive cable **204**. In a manner that will be understood by those skilled in the art, selective actuation of drive motor **180** causes drive cable to rotate in one of two opposite directions, thereby turning bevel gear **192** in one of two opposite directions. Such turning of bevel gear **192** results in corresponding rotation of lead screw **194**.

Lead screw **194** is interconnected with connector member **104** for driving connector member **104** about its pivot axis. In this regard, connector member **104** includes a toe portion **214** including an internally threaded aperture **216** which receives an externally threaded pin **218**. Pin **218** is formed to include an internally threaded aperture **220** disposed generally perpendicular to the axis defined by pin **218**. The internal threads of aperture **220** are operative for engaging the threads of lead screw **194**. Toe portion **214** of connector member **104** is further shown to include a pair of flange-like portions **222** and **224** which are spaced apart and through which aperture **216** passes. A space between flanges **222** and **224** provides operational clearance for threaded lead screw **194**.

A manually actuated button (not shown) accessible by the seat occupant in a conventional manner operates to selectively control drive motor **180** and thereby rotate lead screw **194**. As is now apparent, rotation of lead screw **194** in turn causes connector member **104** to pivot about its pivot pin **152**. In so doing, seatback **14** can be selectively rotated between its standard upright position and various inclined positions, with the degree of reclination of seatback **14** being a function of the rotated position of lead screw **194**.

As shown in FIG. **6**, lower belt retractor **26** is attached to outboard pivot assembly **50** through a bracket **230**. Bracket

230 is mounted to a threaded stud 232 and an outwardly extending end 234 of pivot pin 152. Retractable belt 20 extends upwardly from lower belt retractor 26. Seat assembly 10 is further shown to include an upper belt retractor 240 mounted to inner track member 80 with bolts (not shown) or other suitable fasteners. Upper belt retractor 240 adjustably receives an end (not shown) of retractable belt 20. Retractable belt 20 extends upwardly therefrom to belt slide assembly 22.

With reference to the cross-sectional view of FIG. 11, seat assembly 10 is illustrated to be attached to the vehicle floor 242, or sill, through a mounting bracket 244. In this regard, outer track member 78 of slide assembly 76 is fixedly attached to mounting bracket 224 by bolts or rivets (not shown). In turn, mounting bracket 244 is attached to vehicle floor 242 with suitable threaded fasteners 246. Thus, safety belt restraint system 18 is interconnected with the vehicle structure through seat assembly 10.

During a vehicle collision or severe deceleration, the loads applied to seatback 14 by shoulder belt portion 36 of retractable belt 20 produce significant loads in seatback frame 42. The loads in seatback frame 42 are transferred to lower seat structure 44 through pivot arrangement 46. Loads are similarly transferred from seatback 42 to lower seat structure 44 if the vehicle is subject to a rear-end collision. Thus, an improved design for a pivot arrangement which efficiently and effectively transfers seatback loads to vehicle structure through a structured vehicle seat is provided.

The pivot assembly of the present invention thus accomplishes the aforementioned objects by contributing to seat assembly 10 to which safety belt restraint system 18 is carried to efficiently and effectively overcome the discussed inconveniences of having a retractable belt 20 directly coupled to the vehicle structure with seat assembly 10 movable relative to safety belt restraint system 18. In accomplishing these objectives, seat assembly 10 has retained the functional requirements of traditional vehicle seating structures while providing the necessary strength to accommodate the potentially significant loads which may be applied thereto by the safety belt restraint system 18.

While a specific embodiment of the invention has been shown and described in detail to illustrate the principles of the present invention, it will be understood that the invention may be embodied otherwise without departing from such principles. For example, one skilled in the art will readily recognize from such discussion and from the accompanying drawings and claims that various changes, modifications and variations can be made therein without departing from the spirit and scope of the invention as defined in the following claims.

I claim:

1. A structured vehicle seat, comprising:

a lower seat structure;

a seatback frame defining an upwardly extending channel;

a safety belt restraint system mounted to and carried by the structured vehicle seat; and

a pivot assembly interconnecting said seatback frame to said lower seat structure, said pivot assembly including a rotatable connector member *unitarily constructed of aluminum and* having a seatback mounting portion fixedly interconnected to the seatback frame and a seat mounting portion pivotally interconnected to the lower seat structure, said seatback mounting portion of said pivot assembly extending within said upwardly extending channel;

said seatback mounting portion of said rotatable connector member includes a pair of spaced apertures which align with a pair of correspondingly spaced apertures in said seatback frame for receiving a pair of fasteners to interconnect said seatback mounting portion and said seatback frame; and

whereby said pivot assembly is operative for interconnecting said seatback frame to said lower seat structure such that the seatback frame is selectively adjustable to a plurality of angular positions.

2. The structured vehicle seat of claim 1, wherein said seat mounting portion includes an aperture rotatably receiving a pivot pin interconnected to said lower seat structure.

3. The structured vehicle seat of claim 2, wherein said aperture of said seat mounting portion is spaced from a line passing through said pair of spaced apertures in said seatback mounting portion of said rotable connector member.

4. The structured vehicle seat of claim 1, further comprising a pivot housing fixedly attached to said lower seat structure and a tie bar member, said tie bar member interconnected at a first point to said rotatable connector member and interconnected to said pivot housing at a second point, said second point being spaced apart from said first point.

5. The structured vehicle seat of claim 1, further comprising a drive mechanism for rotating said rotatable connector member about said pivot axis and thereby pivoting said seatback frame relative to said lower seat structure to adjust the angular position of said seatback frame relative to said lower seat structure.

6. The structured vehicle seat of claim 5, wherein said drive mechanism is pivotally coupled to said rotatable connector member.

7. The structured vehicle seat of claim 6, wherein said drive mechanism includes a lead screw rotationally mounted to said lower seat frame and longitudinally extending relative to the seat assembly, said lead screw including a plurality of external threads and a distal end coupled to said connector member, whereby rotation of said lead screw in a first direction upwardly pivots said seatback frame and rotation in a second direction downwardly pivots said seatback frame.

8. A structured vehicle seat assembly comprising:

a lower seat structure;

a seatback frame having an inboard side and an outboard side, said seatback frame including an upwardly extending channel adjacent one of said inboard side and said outboard side;

a safety belt restraint system mounted to and carried by the seat assembly;

a pivot assembly for interconnecting said seatback frame to said lower seat structure, said pivot assembly including a rotatable connector member *unitarily constructed of aluminum and* having an upper portion extending into said upwardly extending channel and fixedly attached to said seatback frame and a lower portion having an aperture receiving a pivot pin non-rotatably interconnected to said lower seat structure; and

a drive mechanism for rotatably driving said rotatable connector member about said pivot pin, said drive mechanism includes a lead screw rotationally mounted to said lower seat frame and longitudinally extending relative to the seat assembly, said lead screw including a plurality of external threads and a distal end coupled to said rotatable connector member;

whereby said pivot assembly is operative for interconnecting said seatback frame to said lower seat structure such that said seatback frame is selectively adjustable to a plurality of angular positions.

9. The structured vehicle seat of claim **8**, wherein said rotatable connector member includes an internally threaded aperture in meshing engagement with said plurality of external threads of said lead screw.

10. The structured vehicle seat of claim **8**, wherein said rotatable member includes a drive aperture receiving a pivot pin, said pivot pin including an internally threaded aperture in meshing engagement with said plurality of external threads of said lead screw.

11. The structured vehicle seat of claim **8**, further comprising a pivot housing fixedly attached to said lower seat structure and a tie bar member, said tie bar member interconnected at a first point to said rotatable connector member and interconnected to said pivot housing at a second point, said second point being spaced apart from said first point.

12. The structured vehicle seat of claim **8**, wherein said upper portion of said rotatable connector member includes a pair of spaced apertures which align with a pair of correspondingly spaced apertures in said seatback frame for receiving a pair of fasteners to interconnect said upper portion and said seatback frame.

13. The structured vehicle seat of claim **12**, wherein said aperture of said lower portion is spaced from a line passing through said pair of spaced apertures in said upper portion of said rotatable connector member.

14. The structured vehicle seat of claim **13**, wherein said drive aperture and said aperture of said lower portion are on opposing sides of the line passing through said pair of spaced apertures in said upper portion.

15. A structured vehicle seat assembly comprising:

a lower seat structure including a seatpan frame and a slide assembly for selectively translating said seatpan frame in a fore direction and an aft direction;

a seatback frame including an inboard side and an outboard side, said seatback frame at least partially defining a first upwardly extending channel adjacent said inboard side and a second upwardly extending channel adjacent said outboard side;

a safety belt restraint system mounted to and carried by said seat assembly;

a pivot arrangement interconnecting said seatback frame and said lower seat structure for selective adjustment between a plurality of angular positions relative to said lower seat structure, said pivot arrangement including an inboard pivot assembly and an outboard pivot assembly, each of said inboard and outboard pivot assemblies having a housing interconnected with said slide assembly and a connector member *unitarily constructed of aluminum and* pivotally mounted to said housing for rotation about a pivot pin, said connector member of said inboard pivot assembly at least partially extending into said first upwardly extending channel and said connector member of said outboard pivot assembly at least partially extending into said second upwardly extending channel; and

a drive mechanism for rotating at least one of said connector members about its respective pivot axis and thereby pivot said seatback frame relative to said lower seat structure to adjust the angular position of said seatback frame relative to said lower seat structure, said drive mechanism includes a lead screw rotationally mounted to said lower seat frame and longitudinally extending relative to the seat assembly, said lead screw including a plurality of external threads and a distal end coupled to said connector member, whereby rotation of said lead screw in a first direction upwardly pivots said seatback frame and rotation in a second direction downwardly pivots said seatback frame.

16. The structured vehicle seat of claim **15**, wherein said pivot pin is non-rotatably interconnected to said lower seat structure.

17. The structured vehicle seat of claim **16**, wherein said connector member includes an internally threaded aperture in meshing engagement with said plurality of external threads of said lead screw.

18. A structured vehicle seat, comprising:

a lower seat structure;

a seatback frame defining an upwardly extending channel;

a safety belt restraint system mounted to and carried by the structured vehicle seat;

a pivot assembly interconnecting said seatback frame to said lower seat structure, said pivot assembly including a pivot housing fixedly attached to said lower seat structure, a rotatable connector member, and a tie bar member interconnected at a first point to said rotatable connector member and interconnected to said pivot housing at a second point, said second point being spaced apart from said first point, said connector member having a seatback mounting portion fixedly interconnected to the seatback frame and a seat mounting portion pivotally interconnected to the lower seat structure, said seatback mounting portion of said pivot assembly extending within said upwardly extending channel;

said seatback mounting portion of said rotatable connector member includes a pair of spaced apertures which align with a pair of correspondingly spaced apertures in said seatback frame for receiving a pair of fasteners to interconnect said seatback mounting portion and said seatback frame; and

whereby said pivot assembly is operative for interconnecting said seatback frame to said lower seat structure such that the seatback frame is selectively adjustable to a plurality of angular positions.

19. The structured vehicle seat of claim 18, wherein said pivot housing further includes a first plate member, a second plate member, and a cavity between said first and second plate members, wherein said tie bar member is disposed in said cavity, wherein said first plate member, second plate member, rotatable connector member, and tie bar member each include a passage, and wherein said pivot assembly further includes a fastener disposed in each of said passages to intercouple said first plate member, second plate member, rotatable connector and tie bar member.

20. The structured vehicle seat of claim 19 wherein said first plate member is an outer plate member and said tie bar member is between said outer plate member and said rotatable connector member.

21. The structured vehicle seat of claim 20 wherein said tie bar member has a first end with said passage and a second end coupled to said outer plate member whereby said tie bar member distributes force loads from said fastener to said pivot housing.

22. The structured vehicle seat of claim 1 wherein said rotatable connector member is unitarily constructed of extruded aluminum.

23. The structured vehicle seat assembly of claim 8 wherein said rotatable connector member is unitarily constructed of extruded aluminum.

24. The structured vehicle seat assembly of claim 15 wherein said rotatable connector member is unitarily constructed of extruded aluminum.

* * * * *