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Inventor(s)	OHNO; Mitsuyoshi et al.

VEHICLE PASSENGER PROTECTING DEVICE

Abstract

A vehicle passenger protecting device includes: a side airbag installed in a side portion at an outer side of a seatback of a vehicle seat, and inflating and expanding toward an outer side of a passenger seated on the vehicle seat due to gas being supplied at a time of a side collision of a vehicle; and a curtain airbag installed in at least a roof side rail, and inflating and expanding toward a vehicle lower side due to gas being supplied at a time of a side collision of the vehicle. The curtain airbag has an enlarged inflating portion that overlaps a center of a head of the passenger as seen in a side view, when the vehicle seat has been slid to a predetermined position at a vehicle rear side and the seatback has been set in a relaxed posture of being reclined to a recommended limit position.

Inventors: **OHNO; Mitsuyoshi (Miyoshi-shi Aichi-ken, JP), KANEKO; Akira (Toyota-shi Aichi-ken, JP), HASHIDO; Tatsuya (Nishikasugai-gun Aichi-ken, JP)**

Applicant: **TOYOTA JIDOSHA KABUSHIKI KAISHA** (Toyota-shi Aichi-ken, JP)

Family ID: **1000008466327**

Assignee: **TOYOTA JIDOSHA KABUSHIKI KAISHA (Toyota-shi Aichi-ken, JP)**

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application is based on and claims priority under 35 USC 119 from Japanese Patent Application No. 2024-023656 filed on Feb. 20, 2024, the disclosure of which is incorporated by reference herein.

BACKGROUND

Technical Field

[0002] The present disclosure relates to a vehicle passenger protecting device.

Related Art

[0003] There is conventionally known a curtain airbag device for a vehicle having a distal end chamber that receives a supply of gas from a main chamber and inflates and expands at the vehicle front side, further toward the vehicle lower side than the door beltline (refer to Japanese Patent Application Laid-Open (JP-A) No. 2020-055465 for example).

[0004] This curtain airbag device for a vehicle has, at the lower end portion region of a curtain airbag that is contacted by the head of a passenger when the vehicle seat has been set in a relaxed state, a restraining performance improving portion (high frictional force imparting portion) that increases the reaction force at the time of restraining the head. The head of the passenger slipping-out toward the vehicle transverse direction outer side (the window side) is thereby suppressed.

[0005] However, at times of traveling such as during automatic driving of the vehicle, if the vehicle seat is slid to near the rearmost position thereof and the seatback is set in a relaxed posture of being reclined to the recommended limit position, the head of the passenger is very low toward the vehicle lower side, and therefore, there is the possibility that the head of the passenger may be out of the range of the inflating portion of the curtain airbag. Namely, there is the possibility that the head of the passenger will not be able to be protected by the curtain airbag at the time of a side collision of the vehicle.

[0006] As a countermeasure thereto, it has been thought to enlarge the inflating portion of the curtain airbag toward the vehicle lower side and broaden the head protecting region thereof. However, if the inflating portion of the curtain airbag is enlarged toward the vehicle lower side over the entire range of positions of the head of the passenger that are possible due to sliding of the vehicle seat, the curtain airbag may interfere with (hit) the side airbag that is attached to the seatback and that inflates and expands at the time of a side collision of the vehicle, and the curtain airbag may not expand normally all the way to the vehicle lower side, and the head of the passenger may be out of the range of the inflating portion of the curtain airbag.

[0007] Thus, an object of the present disclosure is to provide a vehicle passenger protecting device that, even in a case in which a vehicle seat has been slid to a predetermined position at the vehicle rear side and the seatback has been set in a relaxed posture of being reclined to the recommended limit position, can suppress the head of the passenger being out of the range of the inflating portion of the curtain airbag at the time of a side collision of the vehicle.

SUMMARY

[0008] In order to achieve the above-described object, a vehicle passenger protecting device of a first aspect relating to the present disclosure includes: a side airbag that is installed in a side portion at a vehicle transverse direction outer side of a seatback of a vehicle seat, and that inflate and expands toward a vehicle transverse direction outer side of a passenger seated on a seat cushion of the vehicle seat due to gas being supplied thereto at a time of a side collision of a vehicle; and a

curtain airbag that is installed in at least a roof side rail of the vehicle, and that inflates and expands toward a vehicle lower side due to gas being supplied thereto at a time of a side collision of the vehicle, wherein the curtain airbag has an enlarged inflating portion that overlaps with a center of a head of the passenger as seen in a side view, in a case in which the vehicle seat has been slid to a predetermined position at a vehicle rear side and the seatback has been set in a relaxed posture of being reclined to a recommended limit position.

[0009] In accordance with the vehicle passenger protecting device of the first aspect, the curtain airbag has an enlarged inflating portion that overlaps the center of the head of the passenger as seen in a side view, at the time when the vehicle seat has been slid to a predetermined position at the vehicle rear side and the seatback of the vehicle seat has been set in a relaxed posture of being reclined to a recommended limit position. Here, because the relaxed posture is specified as described above, the position of the center of the head of the passenger is limited. Accordingly, at the time of a side collision of the vehicle, the head of the passenger being out of the range of the inflating portion (the enlarged inflating portion) of the curtain airbag is suppressed. Note that what is called the “time of a collision” here also includes times when the inevitability of a collision is predicted (foreseen).

[0010] In a vehicle passenger protecting device of a second aspect relating to the present disclosure, in the vehicle passenger protecting device of the first aspect, the predetermined position is a rearmost position or a position up to 50 mm toward a vehicle front side from the rearmost position.

[0011] In accordance with the vehicle passenger protecting device of the second aspect, the predetermined position, at the vehicle rear side, of the vehicle seat is the rearmost position or a position that is up to 50 mm toward the vehicle front side from the rearmost position. Accordingly, the position of the center of the head of the passenger can be limited more minutely, and the position of the enlarged inflating portion that is formed at the curtain airbag can be specified more minutely. Therefore, an unnecessary increase in the volume of the curtain airbag is suppressed.

[0012] In a vehicle passenger protecting device of a third aspect relating to the present disclosure, in the vehicle passenger protecting device of the first or second aspect, the enlarged inflating portion that has been inflated and expanded is disposed at a position that, as seen in a side view, does not overlap with an inflation/expansion region of the side airbag at a time at which the vehicle seat has been slid to the predetermined position at the vehicle rear side.

[0013] In accordance with the vehicle passenger protecting device of the third aspect, the enlarged inflating portion that has been inflated and expanded is disposed at a position that, as seen in a side view, does not overlap the inflation/expansion region of the side airbag at the time when the vehicle seat has been slid to the predetermined position at the vehicle rear side. Accordingly, at the time of inflation and expansion of the curtain airbag, the enlarged inflating portion is prevented from interfering with the side airbag and inflates and expands normally. Note that what is called “does not overlap as seen in a side view” in the present disclosure means that the inflating portion at the enlarged inflating portion does not overlap the inflating portion of the side airbag. Accordingly, a case in which only outer peripheral edge portions (non-inflating portions), into which gas is not filled, of the enlarged inflating portion overlap the side airbag as seen in a side view is included in the present disclosure.

[0014] In a vehicle passenger protecting device of a fourth aspect relating to the present disclosure, in the vehicle passenger protecting device of any one of the first through third aspects, as seen in a side view, a lower end of the enlarged inflating portion that has been inflated and expanded is positioned further toward the vehicle lower side than a center of a head of a passenger corresponding to an AF05 human dummy.

[0015] In accordance with the vehicle passenger protecting device of the fourth aspect, the lower end of the enlarged inflating portion that has been inflated and expanded is, as seen in a side view, positioned further toward the vehicle lower side than the center of the head of a passenger that

corresponds to an AF05 human dummy. Accordingly, even if the seated passenger is a passenger of a small frame corresponding to an AF05 human dummy, the head of the passenger being out of the range of the inflating portion (the enlarged inflating portion) of the curtain airbag at the time of a side collision of the vehicle is suppressed.

[0016] In a vehicle passenger protecting device of a fifth aspect relating to the present disclosure, in the vehicle passenger protecting device of any one of the first through fourth aspects, the enlarged inflating portion that has been inflated and expanded contacts a door trim that is further toward the vehicle lower side than a door beltline.

[0017] In accordance with the vehicle passenger protecting device of the fifth aspect, the enlarged inflating portion that has been inflated and expanded contacts the door trim that is further toward the vehicle lower side than the door beltline. Accordingly, the ability to prevent the passenger from being thrown out of the vehicle at the time of a rollover of the vehicle is improved by the enlarged inflating portion.

[0018] In a vehicle passenger protecting device of a sixth aspect relating to the present disclosure, in the vehicle passenger protecting device of any one of the first through fifth aspects, the seatback is structured such that, at a time at which the vehicle is traveling, reclining to the relaxed posture is prohibited if the vehicle seat has not been slid to the predetermined position at the vehicle rear side.

[0019] In accordance with the vehicle passenger protecting device of the sixth aspect, if the vehicle seat has not been slid to the predetermined position at the vehicle rear side at the time when the vehicle is traveling, reclining of the seatback to the relaxed posture is prohibited. Accordingly, at the time of a side collision of the vehicle, the head of the passenger being out of the range of the inflating portion (the enlarged inflating portion) of the curtain airbag is suppressed.

[0020] In a vehicle passenger protecting device of a seventh aspect relating to the present disclosure, in the vehicle passenger protecting device of any one of the first through fifth aspects, at a time at which the vehicle is traveling, a warning is given if the seatback is reclined to the relaxed posture in a state in which the vehicle seat has not been slid to the predetermined position at the vehicle rear side.

[0021] In accordance with the vehicle passenger protecting device of the seventh aspect, a warning is given if the seatback is reclined to the relaxed posture in a state in which the vehicle seat has not been slid to the predetermined position at the vehicle rear side at a time when the vehicle is traveling. Accordingly, the passenger can be urged to slide the vehicle seat all the way to the predetermined position at the vehicle rear side, and the head of the passenger being out of the range of the inflating portion (the enlarged inflating portion) of the curtain airbag at the time of a side collision of the vehicle is suppressed.

[0022] In a vehicle passenger protecting device of an eighth aspect relating to the present disclosure, in the vehicle passenger protecting device of any one of the first through seventh aspects, the seatback is configured to, at a time at which the vehicle is traveling, be stood up automatically if the vehicle seat is slid toward a vehicle front side in a state in which the seatback has been set in the relaxed posture.

[0023] In accordance with the vehicle passenger protecting device of the eighth aspect, at a time when the vehicle is traveling, the seatback is stood up automatically if the vehicle seat is slid toward the vehicle front side in a state in which the seatback has been set in the relaxed posture. Accordingly, the head of the passenger being out of the range of the inflating portion (the enlarged inflating portion) of the curtain airbag at the time of a side collision of the vehicle is suppressed.

[0024] As described above, in accordance with the present disclosure, the head of the passenger being out of the range of the inflating portion of the curtain airbag at the time of a side collision of the vehicle can be suppressed even in a case in which the vehicle seat has been slid to a predetermined position at the vehicle rear side and the seatback has been set in a relaxed posture of being reclined to the recommended limit position.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] An exemplary embodiment of the present disclosure will be described in detail based on the following figures, wherein:

[0026] FIG. **1** is a schematic side view illustrating inflated and expanded states of a curtain airbag and a side airbag relating to a present embodiment at the time when a vehicle seat is positioned at a frontmost position;

[0027] FIG. **2** is a schematic side view illustrating inflated and expanded states of the curtain airbag and the side airbag relating to the present embodiment at a time when the vehicle seat is positioned at a rearmost position;

[0028] FIG. **3** is a schematic side view illustrating inflated and expanded states of the curtain airbag and the side airbag relating to the present embodiment at a time when the vehicle seat is positioned at the rearmost position and a seatback thereof has been reclined to a limit position; and

[0029] FIG. **4** is a schematic side view illustrating the positional relationship between an enlarged inflating portion of the curtain airbag and the side airbag relating to the present embodiment.

DETAILED DESCRIPTION

[0030] An embodiment relating to the present disclosure is described in detail hereinafter on the basis of the drawings. Note that, for convenience, arrow UP that is shown appropriately in the respective drawings indicates the vehicle upward direction, and arrow FR indicates the vehicle frontward direction. Accordingly, in the following explanation, when vertical and longitudinal directions are used without being specified otherwise, they refer to the vertical and the longitudinal of the vehicle. Further, the left-right direction is the same as the vehicle transverse direction.

[0031] Further, in a vehicle passenger protecting device **10** relating to the present embodiment, an automobile **12** at which automatic driving is possible is used as an example of the vehicle, and a case in which passenger P is seated in vehicle seat **14** at the right side that is a front seat (the driver's seat) of the automobile **12** is used as an example. Note that the passenger P is a human dummy for a crash test, and this human dummy is, for example, an AF05 (5th percentile U.S. adult female) internationally standardized side crash dummy (World Side Impact Dummy: World SID).

[0032] As illustrated in FIG. **1** through FIG. **3**, the vehicle seat **14** has a seat cushion **15** that supports the buttocks and thighs of the passenger P, a seatback **16** that supports the back of the passenger P, and a headrest **17** that supports head H of the passenger P. The passenger P is seated in the vehicle seat **14** in a manner of seating prescribed by a side impact test method, and is restrained in the vehicle seat **14** by the seatbelt of an unillustrated 3-point seatbelt device.

[0033] Further, the seat cushion **15** of the vehicle seat **14** is structured so as to be able to slide in the longitudinal direction by electric power, and the seatback **16** of the vehicle seat **14** is structured so as to be able to tilt in the longitudinal direction by electric power. Note that, hereinafter, the state in which the seatback **16** has been reclined to the recommended limit position is called the “relaxed posture”. Further, what is called the “recommended limit position” here means a position that is stood-up slightly more than the limit position to which the seatback **16** can actually be reclined.

[0034] A side airbag device **20** is installed in the side portion at the vehicle transverse direction outer side of the seatback **16** of the vehicle seat **14**. This side airbag device **20** is structured to include an inflator (not illustrated) embedded in a side portion of the seatback **16**, and a side airbag **22** that inflates and expands due to gas that is jetted-out from the inflator being supplied to the interior of the side airbag **22**.

[0035] The inflator is a cylinder-type gas generating device that is formed substantially in the shape of a cylindrical tube for example, and is embedded such that the axial direction thereof is a direction running substantially along the vertical direction that is the extending direction of side frames (not illustrated) that structure the frame at the left and right both side portions of the

seatback **16**. The inflator operates when a side collision of the automobile **12** is sensed or predicted (hereinafter called "at the time of a side collision" upon occasion), and gas can be supplied instantaneously into the interior of the side airbag **22**.

[0036] The side airbag **22** is formed in the shape of a simple bag due to the outer peripheral edge portions of two base fabrics being sewn together. The side airbag **22** is structured so as to, due to gas that is jetted-out from the inflator being supplied into the interior thereof, inflate and expand toward the vehicle transverse direction outer side of the passenger P seated in the vehicle seat **14**. Note that, in a side view seen from the vehicle transverse direction, the side airbag **22** is formed to a size of an extent such that the side airbag **22** can cover at least the region from the waist region to the shoulder portion of the passenger P.

[0037] Further, curtain airbag devices **30** are installed respectively in at least roof side rails **28** at the left and the right of the automobile **12**, and in detail, from the rear end portions of left and right front pillars **23** through the roof side rails **28** to the front end portions of rear pillars (not illustrated). Note that, because the curtain airbag devices **30** have the same structures but are symmetrical at the left and the right, only the curtain airbag device **30** at the right side is described hereinafter.

[0038] This curtain airbag device **30** is structured to include an inflator (not illustrated) embedded in, for example, the substantially central portion in the longitudinal direction of the roof side rail **28**, and a curtain airbag **32** that inflates and expands due to gas that is jetted-out from the inflator being supplied to the interior of the curtain airbag **32**.

[0039] This inflator also is a cylinder-type gas generating device that is formed substantially in the shape of a cylindrical tube for example, and is embedded such that the axial direction thereof is a direction running substantially along the longitudinal direction that is the extending direction of the roof side rail **28**. The inflator operates at the time of a side collision of the automobile **12**, and gas can be supplied instantaneously into the interior of the curtain airbag **32**.

[0040] The curtain airbag **32** is structured integrally by double weaving by, for example, the one piece woven (abbreviated as OPW) method. In the OPW method, while two base fabrics are simultaneously woven by using a Jacquard machine, necessary places of the two base fabrics are multi-ply woven, and a bag body that is not sewn is thereby formed.

[0041] Note that the method of manufacturing the curtain airbag **32** is not limited to the above-described OPW method. For example, the curtain airbag **32** may be manufactured by sewing, in the form of a bag, one or plural base fabrics that are formed by cutting out polyamide or polyester fabric materials.

[0042] Further, at the time of a side collision or at the time of a rollover of the automobile **12**, the curtain airbag **32** inflates and expands toward the lower side due to gas that is jetted-out from the inflator being supplied to the interior of the curtain airbag **32**. The curtain airbag **32** is formed to be a size of an extent that, as seen in a side view, can cover at least the head H of the passenger P seated in the vehicle seat **14** that is a front seat and at least the head of a passenger (not illustrated) seated in a vehicle seat **18** that is a rear seat (in FIG. **1** through FIG. **3**, only the front end portion of the seat cushion of the vehicle seat **18** is illustrated).

[0043] Namely, the curtain airbag **32** is structured so as to inflate and expand in the form of a curtain along a front side glass **24**W of a front side door **24**, and substantially the upper half of a center pillar **25** that extends in the vertical direction, and a rear side glass **26**W of a rear side door **26**. Accordingly, the longitudinal direction is the length direction of the curtain airbag **32**. Note that the specific structure of the curtain airbag **32** is described in detail later.

[0044] The inflator of the side airbag device **20** and the inflator of the curtain airbag device **30** respectively are electrically connected to an airbag ECU (Electronic Control Unit, not illustrated) provided at the automobile **12**. Side collision sensors and rollover sensors (both including cameras and the like, and none of which are illustrated) that are provided at the automobile **12** respectively are electrically connected to the airbag ECU.

[0045] The side collision sensors are structured so as sense or predict a side collision of the automobile **12** and output a side collision signal to the airbag ECU. The rollover sensors are structured so as to sense or predict a rollover of the automobile **12** and output a rollover signal to the airbag ECU.

[0046] When a side collision signal is inputted thereto, the airbag ECU operates the inflator of the side airbag device **20** and the inflator of the curtain airbag device **30** that are at the side of the side collision (the near side). Due thereto, the side airbag **22** and the curtain airbag **32** at the near side receive supplies of gas and inflate and expand. Note that, when a rollover signal is inputted thereto, the airbag ECU operates the inflators of the left and right curtain airbag devices **30**.

[0047] Further, when a rollover signal is inputted after a side collision, the airbag ECU operates the inflator of the curtain airbag device **30** that is at the side (the far side) opposite the near side at which the airbag devices are already operating. A control device (not illustrated) that controls respective sections is installed in the automobile **12** separately from the airbag ECU.

[0048] The curtain airbag **32** is structured to include a curtain airbag main body **34** that extends in the longitudinal direction, and an enlarged inflating portion **36** formed integrally and continuously with the lower end of the rear portion of the curtain airbag main body **34**. The curtain airbag main body **34** is a known structure. Inflating portions (not illustrated) in which gas is filled and non-inflating portions (not illustrated) for partitioning gas supply paths are formed at predetermined, plural regions of the curtain airbag main body **34**.

[0049] At least the head of the passenger P seated in the vehicle seat **14** that is a front seat and at least the head of the passenger seated in the vehicle seat **18** that is a rear seat are restrained and protected by inflating portions formed at the curtain airbag main body **34**. Note that gas is not filled into the outer peripheral edge portions of the curtain airbag **32**, i.e., an upper edge portion **34**U, a lower edge portion **34**D, a front edge portion **34**F and a rear edge portion (not illustrated) of the curtain airbag main body **34**, and a front edge portion **36**F, a lower edge portion **36**D and a rear edge portion **36**B of the enlarged inflating portion **36**, and these portions are non-inflating portions.

[0050] Plural fixing tabs **33** extend out toward the upper side at the upper edge portion **34**U of the curtain airbag main body **34**. The respective fixing tabs **33** are structures formed by a base fabric, which is similar to the base fabric of the curtain airbag main body **34**, being cut-out in substantially rectangular forms, and are joined to the upper edge portion **34**U of the curtain airbag main body **34** by being sewn thereto. Note that the respective fixing tabs **33** may be structures that extend out integrally from the upper edge portion **34**U of the curtain airbag main body **34**.

[0051] The respective fixing tabs **33** are positioned at the roof side rail **28** including at the rear end portion of the front pillar **23** and the front end portion of the rear pillar. Namely, the respective fixing tabs **33** are fixed to the roof side rail **28** that reaches from the rear end portion of the front pillar **23** to the front end portion of the rear pillar, by fasteners (not illustrated) such as clips or nuts and bolts for example. Note that, at usual times, the curtain airbag **32** is accommodated in the roof side rail **28** together with the inflator in a state of being formed in an elongated shape by being rolled-up in the form of a roll whose axial direction is substantially the longitudinal direction.

[0052] When the vehicle seat **14** has been slid to a predetermined position at the rear side and the seatback **16** is set in the relaxed posture of being reclined to the recommended limit position, the enlarged inflating portion **36** of the curtain airbag **32** is disposed at a position overlapping center Hc of the head of the passenger P as seen in a side view. Note that what is called the "predetermined position" here is the rearmost position of the vehicle seat **14** or a position that is up to 50 mm forward from the rearmost position. Further, the "center Hc of the head" is the central portion of the head H of the passenger as seen in a side view, and is the portion indicated by the circular dashed line in FIG. **3**.

[0053] Further, as seen in a side view, the enlarged inflating portion **36** that has been inflated and expanded is formed in a substantially trapezoidal shape that extends further toward the lower side than door beltline BL, and contacts a door trim **26**T of the rear side door **26** (see

[0054] FIG. **1**). Due thereto, sliding resistance (frictional force) of the enlarged inflating portion **36** with respect to the door trim **26**T is obtained, and movement of the enlarged inflating portion **36** toward the vehicle transverse direction outer side is suppressed or prevented.
[0055] Further, as illustrated in FIG. **3**, the lower end (the lower edge portion **36**D) of an inflating portion **36**A, into which gas has been filled, of the enlarged inflating portion **36** that has been inflated and expanded is positioned further toward the lower side than the center Hc of the head of the passenger P as seen in a side view. Specifically, the lower end of the inflating portion **36**A at the enlarged inflating portion **36** is positioned, for example, 40 mm or more toward the lower side from the center Hc of the head of the passenger P as seen in a side view. Accordingly, at the head H of the passenger P, reaction force is reliably obtained from the enlarged inflating portion **36**, and the head H of the passenger P is suitably restrained and protected by the enlarged inflating portion **36**.
[0056] Further, as illustrated in FIG. **4**, the enlarged inflating portion **36** that has been inflated and expanded is disposed at a position that, as seen in a side view, does not overlap the inflated/expanded region of the side airbag **22** at the time when the vehicle seat **14** has been slid to the aforementioned predetermined position at the rear side.
[0057] More specifically, as illustrated by the imaginary line in FIG. **4**, the side airbag **22** that has been inflated and expanded moves parallel within the region in which the vehicle seat **14** moves from the frontmost position to the rearmost position. Further, at this rearmost position, when the seatback **16** is reclined to the relaxed posture, the side airbag **22** that is inflated and expanded moves toward the lower side with the lower end portion side thereof being the supporting point of the rotation, as illustrated by the solid line in FIG. **4**.
[0058] In this way, the region of movement of the side airbag **22**, which is inflated and expanded at the time when the vehicle seat **14** has been slid to the rearmost position and thereafter the seatback **16** has been reclined to the relaxed posture, is the aforementioned inflation/expansion region of the side airbag **22**. However, the front edge portion **36**F of the enlarged inflating portion **36** is positioned further toward the rear side than substantially arc-shaped locus of movement K of the upper end of the side airbag **22**.
[0059] Note that what is called “does not overlap as seen in a side view” here means that the inflating portion **36**A of the enlarged inflating portion **36** does not overlap the inflating portion of the side airbag **22**. Accordingly, at the enlarged inflating portion **36**, a case in which only the front edge portion **36**F or the lower edge portion **36**D, which are non-inflating portions into which gas is not filled, overlap the side airbag **22** as seen in a side view is included in the “does not overlap as seen in a side view”.
[0060] Namely, the front edge portion **36**F of the enlarged inflating portion **36** illustrated in FIG. **4** does not overlap the substantially arc-shaped locus of movement K of the upper end of the side airbag **22**. However, if only this front edge portion **36**F (e.g., less than or equal to 30 mm if the width of the front edge portion **36**F is 30 mm) overlaps the locus of movement K, there is no concern that that the front edge portion **36**F will impede the inflation and expansion of the side airbag **22**, and therefore, there may be a structure in which the front edge portion **36**F does overlap the locus of movement K.
[0061] Further, there is a structure in which reclining of the seatback **16** to the relaxed posture is prohibited if the vehicle seat **14** has not been slid to the aforementioned predetermined position at the rear side at the time when the automobile **12** travels. Namely, a position sensor (not illustrated) senses that the vehicle seat **14** has not been slid all the way to the aforementioned predetermined position at the rear side, and control is carried out by a control device such that, at times of this state, even if a switch for reclining the seatback **16** is turned on, the motor (not illustrated) that tilts the seatback **16** is not energized.
[0062] Note that there may be a structure in which, in a state in which the vehicle seat **14** has not been slid to the aforementioned predetermined position at the rear side when the automobile **12** is traveling, a warning is given if the seatback **16** is reclined to the relaxed posture. Namely, there

may be a structure in which the position sensor senses that the vehicle seat **14** has not been slid to the aforementioned predetermined position at the rear side, and control is carried out by a control device such that, at times of this state, if the switch for reclining the seatback **16** is turned on, for example, a warning noise or a warning by voice is issued from a speaker (not illustrated) provided in the vehicle cabin, or a warning is displayed on a display (not illustrated) provided in the vehicle cabin.

[0063] Further, the vehicle passenger protecting device **10** relating to the present embodiment is structured such that, in a state in which the seatback **16** has been set in the relaxed posture at the time when the automobile **12** is traveling by automatic driving, if the vehicle seat **14** is slid forward, it is considered that the center Hc of the head of the passenger P is out of the range of the inflation/expansion region of the enlarged inflating portion **36** as seen in a side view, and the seatback **16** is stood up automatically.

[0064] Namely, there is a structure in which an angle sensor (not illustrated) senses that the seatback **16** has been set in the relaxed posture, and, at times of this state, control is carried out by a control device such that, when the position sensor senses that the vehicle seat **14** has been slid forward, the motor that tilts the seatback **16** is automatically energized, and the seatback **16** is stood up automatically.

[0065] Operation of the vehicle passenger protecting device **10** relating to the present embodiment that is structured as described above is described next.

[0066] When the collision sensor senses that the automobile **12** has been collided with from the side, a side collision signal is transmitted from the side collision sensor to the airbag ECU. When the side collision signal is inputted to the airbag ECU, the airbag ECU operates the inflator of the side airbag device **20** and the inflator of the curtain airbag device **30** that are at the side of the side collision (the right side in the illustrated structure), and gas is instantaneously jetted-out into the side airbag **22** and into the curtain airbag **32**. Namely, the airbag ECU inflates and expands the side airbag **22** and the curtain airbag **32**.

[0067] Due thereto, both in a case in which the vehicle seat **14** is positioned at the frontmost position as illustrated in FIG. **1** for example, and in a case in which the vehicle seat **14** is positioned at the rearmost position as illustrated in FIG. **2** for example, as seen in a side view, at least the region from the waist region to the shoulder portion of the passenger P is restrained and protected by the side airbag **22**, and at least the head H of the passenger P is restrained and protected by the curtain airbag main body **34** of the curtain airbag **32**.

[0068] By the way, when the automobile **12** is traveling by automatic driving, there are cases in which, as illustrated in FIG. **3** for example, the vehicle seat **14** is positioned at the rearmost position and the seatback **16** is set in the relaxed posture in which it is reclined to the recommended limit position. At times of this state, when the side collision sensor senses that the automobile **12** has been collided with from the side, in the same way as described above, the airbag ECU inflates and expands the side airbag **22** and the curtain airbag **32**, and the enlarged inflating portion **36** is provided at the curtain airbag **32**.

[0069] Here, because it has been specified that the seatback **16** of the vehicle seat **14** has been reclined to the relaxed posture as described above, the position of the headrest **17** is limited to a specific position at the lower side. Namely, the position of the center Hc of the head of the passenger P, and by extension, the position of the entire head H of the passenger P, is limited to a position of overlapping the enlarged inflating portion **36** of the curtain airbag **32** as seen in a side view.

[0070] Accordingly, at the time of a side collision of the automobile **12**, the head H of the passenger P being outside of the range of the enlarged inflating portion **36** that is one inflating portion of the curtain airbag **32** can be suppressed or prevented. Namely, a deterioration in the performance of restraining the head H of the passenger P by the curtain airbag **32** can be suppressed or prevented, and the head H of the passenger P can be restrained and protected by the

enlarged inflating portion **36**.

[0071] Moreover, if the predetermined position, at the rear side, of the vehicle seat **14** is the rearmost position or a position that is up to 50 mm toward the front side of the vehicle from the rearmost position, the position of the center Hc of the head of the passenger P, and by extension, the position of the entire head H of the passenger P, can be limited more minutely, and the position of the enlarged inflating portion **36** that is formed integrally with the curtain airbag **32** can be specified more minutely. Therefore, an unnecessary increase in the volume of the curtain airbag **32**, and an accompanying increase in the output of the inflator, can be suppressed.

[0072] Further, the enlarged inflating portion **36**, which has been inflated and expanded, of the curtain airbag **32** is disposed at a position that, as seen in a side view, does not overlap the inflation/expansion region of the side airbag **22** at the time when the vehicle seat **14** has been slid to the aforementioned predetermined position at the rear side. Accordingly, at the time of inflation and expansion of the curtain airbag **32**, this enlarged inflating portion **36** interfering with (hitting) the side airbag **22** can be prevented, and the enlarged inflating portion **36** can inflate and expand normally all the way to the lower side.

[0073] Further, as seen in a side view, the lower end of the enlarged inflating portion **36**, which has been inflated and expanded, of the curtain airbag **32** is positioned further toward the lower side than the center Hc of the head of the passenger P that corresponds to an AF05 human dummy. Accordingly, even if the passenger P seated on the seat cushion **15** of the vehicle seat **14** is a passenger of a small frame corresponding to an AF05 human dummy, the head H of the passenger P being out of the range of the enlarged inflating portion **36** of the curtain airbag **32** at the time of a side collision of the automobile **12** can be suppressed or prevented.

[0074] Further, the enlarged inflating portion **36**, which has been inflated and expanded, of the curtain airbag **32** contacts the door trim **26**T that is at the lower side of the door beltline BL. Accordingly, the enlarged inflating portion **36** moving toward the vehicle transverse direction outer side can be suppressed or prevented, and a deterioration in the performance of restraining the head H of the passenger P by the enlarged inflating portion **36** can be suppressed or prevented, and the ability to prevent the passenger P from being thrown out of the vehicle at the time of a rollover of the automobile **12** can be improved.

[0075] Further, in the vehicle passenger protecting device **10** relating to the present embodiment, if the vehicle seat **14** has not been slid to the aforementioned predetermined position at the rear side when the automobile **12** is traveling, reclining of the seatback **16** to the relaxed posture is prohibited. In accordance therewith, the head H of the passenger P being outside of the range of the enlarged inflating portion **36** of the curtain airbag **32** at the time of a side collision of the automobile **12** can be suppressed more reliably.

[0076] Note that, if the seatback **16** is reclined to the relaxed posture in a state in which the vehicle seat **14** has not been slid to the aforementioned predetermined position at the rear side when the automobile **12** is traveling, a warning noise or a voice warning may be emitted, or a warning may be displayed on a display. In this case, the passenger P can be urged to slide the vehicle seat **14** all the way to the aforementioned predetermined position at the rear side. Therefore, the head H of the passenger P being out of the range of the enlarged inflating portion **36** of the curtain airbag **32** at the time of a side collision of the automobile **12** can be suppressed.

[0077] Further, in the vehicle passenger protecting device **10** relating to the present embodiment, when the automobile **12** is traveling by automatic driving, if the vehicle seat **14** is slid toward the front side in the state in which the seatback **16** has been set in the relaxed posture, it is considered that the center Hc of the head of the passenger P is outside of the range of the inflation/expansion region of the enlarged inflating portion **36** of the curtain airbag **32** as seen in a side view, and the seatback **16** is stood-up automatically. In accordance therewith, the head H of the passenger P being out of the range of the enlarged inflating portion **36** of the curtain airbag **32** at the time of a side collision of the automobile **12** can be suppressed more reliably.

[0078] The vehicle passenger protecting device **10** relating to the present embodiment has been described above on the basis of the drawings, but the vehicle passenger protecting device **10** relating to the present embodiment is not limited to the illustrated structure, and the design thereof can be changed appropriately within a scope that does not depart from the gist of the present disclosure. For example, the vehicle passenger protecting device **10** relating to the present embodiment can also be applied to cases of the vehicle seat **14** that is the front passenger's seat. Accordingly, the vehicle relating to the present embodiment is not limited to the automobile **12** that can be driven automatically.

[0079] Further, the vehicle seat **14** is not limited to a structure that is slid or tilted by electric power, and may be a structure that is slid or tilted manually. In this case, it suffices to sense the position and the reclining angle of the vehicle seat **14** by sensing device such as a camera provided in the vehicle cabin. Further, in this case, because the seatback **16** does not tilt automatically, the above-described function of giving a warning is incorporated.

Claims

1. A vehicle passenger protecting device, comprising: a side airbag that is installed in a side portion at a vehicle transverse direction outer side of a seatback of a vehicle seat, and that inflates and expands toward a vehicle transverse direction outer side of a passenger seated on a seat cushion of the vehicle seat due to gas being supplied thereto at a time of a side collision of a vehicle; and a curtain airbag that is installed in at least a roof side rail of the vehicle, and that inflates and expands toward a vehicle lower side due to gas being supplied thereto at a time of a side collision of the vehicle, wherein the curtain airbag has an enlarged inflating portion that overlaps with a center of a head of the passenger as seen in a side view, in a case in which the vehicle seat has been slid to a predetermined position at a vehicle rear side and the seatback has been set in a relaxed posture of being reclined to a recommended limit position.

2. The vehicle passenger protecting device of claim 1, wherein the predetermined position is a rearmost position or a position up to 50 mm toward a vehicle front side from the rearmost position.

3. The vehicle passenger protecting device of claim 1, wherein the enlarged inflating portion that has been inflated and expanded is disposed at a position that, as seen in a side view, does not overlap with an inflation/expansion region of the side airbag at a time at which the vehicle seat has been slid to the predetermined position at the vehicle rear side.

4. The vehicle passenger protecting device of claim 1, wherein, as seen in a side view, a lower end of the enlarged inflating portion that has been inflated and expanded is positioned further toward the vehicle lower side than a center of a head of a passenger corresponding to an AF05 human dummy.

5. The vehicle passenger protecting device of claim 1, wherein the enlarged inflating portion that has been inflated and expanded contacts a door trim that is further toward the vehicle lower side than a door beltline.

6. The vehicle passenger protecting device of claim 1, wherein the seatback is structured such that, at a time at which the vehicle is traveling, reclining to the relaxed posture is prohibited when the vehicle seat has not been slid to the predetermined position at the vehicle rear side.

7. The vehicle passenger protecting device of claim 1, wherein, at a time at which the vehicle is traveling, a warning is given when the seatback is reclined to the relaxed posture in a state in which the vehicle seat has not been slid to the predetermined position at the vehicle rear side.

8. The vehicle passenger protecting device of claim 1, wherein the seatback is configured to, at a time at which the vehicle is traveling, be stood up automatically when the vehicle seat is slid toward a vehicle front side in a state in which the seatback has been set in the relaxed posture.