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Center pillar for vehicle with improved stiffness

Abstract

A center pillar for a vehicle with improved stiffness, which has a sufficient stiffness in the event of rollover or a side collision of the vehicle, includes: a center pillar internal upper including an upper portion coupled to a roof side rail internal; and a center pillar internal lower including an upper portion coupled to a lower portion of the center pillar internal upper, and a lower portion coupled to a side sill to configure a center pillar internal, in which a center pillar reinforcement internal is coupled to an external surface of the center pillar internal, and a center pillar reinforcement external is coupled to an external surface of the center pillar reinforcement internal.

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References Cited

FOREIGN PATENT DOCUMENTS

Patent No.	Application Date	Country	CPC
112896324	12/2020	CN	B62D 25/04
102019216526	12/2019	DE	B60R 22/24
2021091311	12/2020	JP	N/A
10-2007-0063337	12/2006	KR	N/A

OTHER PUBLICATIONS

CN112896324 Text (Year: 2021). cited by examiner
DE102019216526 Text (Year: 2020). cited by examiner
JP202191311 Text (Year: 2021). cited by examiner

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATION

(1) The present application claims priority to Korean Patent Application No. 10-2022-0075024, filed on Jun. 20, 2022, the entire contents of which is incorporated herein for all purposes by this reference.

BACKGROUND OF THE PRESENT DISCLOSURE

Field of the Present Disclosure

(2) The present disclosure relates to a center pillar for a vehicle which is a structure of connecting a floor and a roof in the vehicle, and more specifically, to a center pillar for a vehicle with improved stiffness, which has sufficient stiffness in the event of the rollover or side collision of the vehicle.

Description of Related Art

(3) In a vehicle **100** as shown in FIG. **1**, a center pillar **110** has a pillar-shaped structure in which a floor and roof of the vehicle **100** are connected between a front door and a rear door.

(4) The center pillar **110** has a lower end coupled to a side sill **130** provided at a side end of the floor, and an upper end coupled to a roof side rail **120** provided at a side end of the roof.

(5) Describing the structure of the center pillar **110**, as shown in FIG. **2**, the center pillar **110** forms a structure in which a center pillar internal **111**, a center pillar reinforcement external **116**, and a center pillar reinforcement internal **117** are coupled to each other in a width direction L of the vehicle. The center pillar **110** maintains a shape of a passenger compartment in the event of the side collision or rollover of the vehicle, reducing injuries to passengers.

(6) Meanwhile, a conventional door **141** has a structure in which a glass frame **143** is formed on a circumference of a door glass **142** (see FIG. **3**). In the instant case, because it is possible to secure sufficient cross sections of the center pillar reinforcement external **116** and the center pillar reinforcement internal **117** in the center pillar **110** (indicated by an in FIG. **3**), the center pillar **110** may have sufficient stiffness.

(7) However, there is a problem in that when a frameless door is applied for a beautiful design, it is difficult to have the sufficient cross sections of the center pillar reinforcement external **116** and the center pillar reinforcement internal **117**. The frameless door in which the glass frame is not applied to the circumference of the door glass **142** may not secure the sufficient cross section as indicated by B in FIG. **4**, and thus the stiffness of the center pillar **110** is not sufficient. The frameless door **141** has a beautiful design because the glass frame is not applied above a belt line BL. However, because the glass frame is not applied and a rear end of the door glass **142** of the front door **141** is adjacent to a front end of the door glass **142** of the rear door **141**, an upper portion of the center pillar **110** has a limit to increasing the cross-sectional area. Accordingly, it is difficult to secure the passenger compartment in the event of the side collision or rollover, which causes a problem of aggravating the state of the passenger in the event of the collision or rollover.

(8) The information included in this Background of the present disclosure is only for enhancement of understanding of the general background of the present disclosure and may not be taken as an acknowledgement or any form of suggestion that this information forms the prior art already known to a person skilled in the art.

BRIEF SUMMARY

(9) Various aspects of the present disclosure are directed to providing a center pillar for a vehicle with improved stiffness, which has a cross-sectional structure configured for embodying stiffness even when a cross-sectional area is reduced upwards from the center pillar while increasing the degree of freedom in design of the vehicle.

(10) Another object of the present disclosure is to provide a center pillar for a vehicle with improved stiffness, which strengthens the coupling of a portion coupled to a roof.

(11) To achieve the object, a center pillar for a vehicle with improved stiffness according to an exemplary embodiment of the present disclosure includes: a center pillar internal upper including an upper portion coupled to a roof side rail internal; and a center pillar internal lower including an upper portion coupled to a lower portion of the center pillar internal upper, and a lower portion coupled to a side sill to configure a center pillar internal, in which a center pillar reinforcement internal is coupled to an external surface of the center pillar internal, and a center pillar reinforcement external is coupled to an external surface of the center pillar reinforcement internal.

(12) A lower portion of the center pillar internal upper and the upper portion of the center pillar internal lower are disposed to overlap by a predetermined length and coupled to each other.

(13) The center pillar internal upper includes a material having a tensile strength greater than a tensile strength of the center pillar internal lower.

(14) The center pillar internal upper includes: a coupling portion formed along a circumference of the center pillar internal upper; stiffness portions formed convexly toward a vehicle interior inside the coupling portion in a height direction of the vehicle, and formed to be spaced from each other in a longitudinal direction of the vehicle; a connection portion formed to connect the coupling portion and the stiffness portions; and a belt support fastening portion formed between the stiffness portions spaced from each other in the height direction of the vehicle.

(15) A width of the connection portion is formed to be reduced toward an upper end portion and a

lower end portion of the connection portion.
(16) The center pillar internal lower includes: a coupling portion formed along a circumference of the center pillar internal lower; and stiffness portions formed convexly toward the vehicle interior inside the coupling portion in the height direction of the vehicle, and formed to be spaced from each other in the longitudinal direction of the vehicle.
(17) The stiffness portions of the center pillar internal lower and the stiffness portions of the center pillar internal upper are connected to each other.
(18) The center pillar for the vehicle with improved stiffness further includes a belt support formed in the height direction of the vehicle, and including each of upper and lower end portions thereof fastened to the belt support fastening portion.
(19) The center pillar internal upper is further provided with a connection member and a reinforcement plate at a portion coupled to the roof side rail internal, the connection member is coupled to an internal surface of the roof side rail internal, and the reinforcement plate is coupled to external surfaces of the center pillar internal upper and the roof side rail internal.
(20) The connection member is formed from an upper end portion of the center pillar internal upper toward a roof panel of a vehicle, and formed to have a cross section in which an unevenness is repeated in the longitudinal direction of the vehicle.
(21) The reinforcement plate is formed downwardly from an upper end portion of the roof side rail internal by a predetermined length, and first and second end portions of the reinforcement plate are coupled to a coupling portion formed on a circumference of the center pillar internal upper.
(22) In the reinforcement plate, an upper portion of the reinforcement plate is coupled to the connection member and the roof side rail internal.
(23) An upper end portion of the center pillar internal upper is coupled to the connection member, the roof side rail internal, and the reinforcement plate.
(24) In the center pillar internal upper, an upper portion of the center pillar internal upper is coupled to the roof side rail internal and the reinforcement plate at a portion spaced apart downwardly from the upper end portion of the center pillar internal upper.
(25) The reinforcement plate is fastened to the center pillar internal upper and an upper end portion of a belt support fastened to the center pillar internal upper in the height direction of the vehicle.
(26) The reinforcement plate is fastened to a lower end portion of a belt support fastened to the center pillar internal upper in the height direction of the vehicle.
(27) The reinforcement plate extends in front and rear directions of the vehicle and is coupled to an internal surface of the center pillar internal upper.
(28) A cross-sectional area of the center pillar internal upper is formed to be narrower upwards.
(29) A portion where the lower portion of the center pillar internal upper and the upper portion of the center pillar internal lower are coupled is positioned lower than a belt line of a vehicle.
(30) In the center pillar reinforcement inner, an upper end portion of the center pillar reinforcement internal is positioned higher than an upper end portion of the center pillar internal lower, and positioned lower than a lower end portion of a belt support fastened to the center pillar internal upper in a height direction of a vehicle.
(31) According to the center pillar for the vehicle with improved stiffness according to an exemplary embodiment of the present disclosure including the above configuration, it is possible to have the cross section with improved stiffness using the inside of the center pillar reinforcement while increasing the degree of freedom in design, reducing the deformation of the center pillar in the event of side collision or rollover to maintain the passenger compartment.
(32) It is possible to reduce the passenger's injury by maintaining the passenger compartment by the center pillar even in the event of accidents.
(33) As described above, it is possible to expand the application of the frameless door as the stiffness of the center pillar is improved, and increase the degree of freedom in the side design of the vehicle.

(34) Furthermore, it is possible to reduce the weight of the center pillar as the length of the center pillar reinforcement internal is reduced, improving fuel efficiency of the vehicle.
(35) The methods and apparatuses of the present disclosure have other features and advantages which will be apparent from or are set forth in more detail in the accompanying drawings, which are incorporated herein, and the following Detailed Description, which together serve to explain certain principles of the present disclosure.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) FIG. **1** is a perspective view showing a vehicle body structure of a general vehicle.
(2) FIG. **2** is an exploded perspective view of a general center pillar.
(3) FIG. **3** is a perspective view showing a center pillar for a vehicle to which a glass frame is applied.
(4) FIG. **4** is a perspective view showing a center pillar for a vehicle to which a frameless door is applied.
(5) FIG. **5** is an exploded perspective view showing a center pillar for a vehicle with improved stiffness according to an exemplary embodiment of the present disclosure.
(6) FIG. **6** is an exploded perspective view showing a center pillar internal in the center pillar for the vehicle with improved stiffness according to an exemplary embodiment of the present disclosure.
(7) FIG. **7** is a perspective view showing the center pillar for the vehicle with improved stiffness according to an exemplary embodiment of the present disclosure.
(8) FIG. **8** is a perspective view showing that an upper portion of the center pillar for the vehicle with improved stiffness according to an exemplary embodiment of the present disclosure is coupled to a roof side thereof.
(9) FIG. **9** is a cross-sectional view taken along line I-I in FIG. **7**.
(10) FIG. **10** is a front view showing a state in which the center pillar for the vehicle with improved stiffness according to an exemplary embodiment of the present disclosure is coupled to a roof side and a side sill.
(11) FIG. **11** is an enlarged perspective view showing portion C in FIG. **10**.
(12) FIG. **12** is an enlarged perspective view showing portion D in FIG. **10**.
(13) FIG. **13** is a perspective view showing an upper portion of a center pillar for a vehicle with improved stiffness according to another exemplary embodiment of the present disclosure.
(14) FIG. **14** is a perspective view showing an upper portion of a center pillar for a vehicle with improved stiffness according to various exemplary embodiments of the present disclosure.
(15) It may be understood that the appended drawings are not necessarily to scale, presenting a somewhat simplified representation of various features illustrative of the basic principles of the present disclosure. The specific design features of the present disclosure as included herein, including, for example, specific dimensions, orientations, locations, and shapes will be determined in part by the particularly intended application and use environment.
(16) In the figures, reference numbers refer to a same or equivalent parts of the present disclosure throughout the several figures of the drawing.
DETAILED DESCRIPTION
(17) Reference will now be made in detail to various embodiments of the present disclosure(s), examples of which are illustrated in the accompanying drawings and described below. While the present disclosure(s) will be described in conjunction with exemplary embodiments of the present disclosure, it will be understood that the present description is not intended to limit the present disclosure(s) to those exemplary embodiments of the present disclosure. On the other hand, the

present disclosure(s) is/are intended to cover not only the exemplary embodiments of the present disclosure, but also various alternatives, modifications, equivalents and other embodiments, which may be included within the spirit and scope of the present disclosure as defined by the appended claims.

(18) Hereinafter, a center pillar for a vehicle with improved stiffness according to an exemplary embodiment of the present disclosure will be described in detail with reference to the accompanying drawings.

(19) A center pillar for a vehicle with improved stiffness according to an exemplary embodiment of the present disclosure includes a center pillar internal upper **12** including an upper portion coupled to a roof side rail internal **22**, and a center pillar internal lower **13** including an upper portion coupled to a lower portion of the center pillar upper **12**, and including a lower portion coupled to a side sill to configure a center pillar internal **11**, in which a center pillar reinforcement internal **17** is coupled to an external surface of the center pillar internal **11**, and a center pillar reinforcement external **16** is coupled to an external surface of the center pillar reinforcement internal **17**.

(20) In the present disclosure, among the center pillar internal **11**, center pillar reinforcement external **16**, and center pillar reinforcement internal **17** configuring the center pillar **10** for the vehicle, the center pillar internal **11** is perpendicularly divided into the center pillar internal upper **12** and the center pillar internal lower **13**, and the center pillar internal **11** is formed by coupling the center pillar internal upper **12** and the center pillar internal lower **13**.

(21) By dividing the center pillar internal **11** into the center pillar internal upper **12** and the center pillar internal lower **13**, the center pillar internal **11** has different characteristics in the upper and lower portions. By increasing the stiffness of the center pillar internal upper **12**, the center pillar **10** may have sufficient stiffness in a narrow cross-sectional area.

(22) The center pillar internal upper **12** is formed in a predetermined length downwardly from the roof side rail internal **22** for the vehicle. The center pillar internal upper **12** has an upper end portion coupled to the roof side rail internal **22** side, and the lower end portion coupled to the center pillar internal lower **13**, and the center pillar reinforcement internal **17** and the center pillar reinforcement external **16** are coupled to the outside of the center pillar internal upper **12**.

(23) The center pillar internal upper **12** includes a coupling portion **12***b* formed along a circumference of the center pillar internal upper **12**, stiffness portions **12***a* formed convexly toward a vehicle interior inside the coupling portion **12***b* in a height direction of the vehicle, and formed to be spaced from each other in a longitudinal direction of the vehicle, a connection portion **12***d* formed to connect the coupling portion **12***b* and the stiffness portions **12***a*, and a belt support fastening portion **12***c* formed between the stiffness portions **12***a* spaced from each other in the height direction of the vehicle.

(24) The coupling portion **12***b* is formed in a flange shape along the circumference of the center pillar internal upper **12** so that the center pillar internal upper **12** is coupled to other members. The center pillar internal upper **12** is bonded to other members using the coupling portion **12***b* by welding, bolting, adhesive, or the like.

(25) The stiffness portions **12***a* are formed to have a convex cross section from the center pillar internal upper **12** toward the vehicle interior. The stiffness portions **12***a* are formed in the height direction of the vehicle in the center pillar internal **11**. Furthermore, a plurality of stiffness portions **12***a* are formed to be spaced from each other in the longitudinal direction of the vehicle.

(26) The connection portion **12***d* connects the coupling portion **12***b* and the stiffness portions **12***a*. The connection portion **12***d* is a portion exposed forwards and backwards in a longitudinal direction T of the vehicle in the center pillar internal upper **12** and is formed in a plane shape. The connection portion **12***d* is formed to be narrower in width from a middle portion of the center pillar internal upper **12** toward an upper end portion and a lower end portion thereof. The connection portion **12***d* is formed to be narrower in width from the middle portion of the center pillar internal upper **12** toward the upper end portion thereof. FIG. **12** shows that a width w**2** of the connection

portion **12***d* at the upper portion of the center pillar internal upper **12** is narrower than a width w**1** of the connection portion **12***d* at the middle portion of the center pillar internal upper **12**.
(27) The belt support fastening portion **12***c* is formed between the stiffness portions **12***a*. The belt support fastening portion **12***c* is formed to be relatively concave compared to the stiffness portions **12***a*. The belt support fastening portion **12***c* is also formed in a height direction H of the vehicle, like the stiffness portions **12***a*. A belt support **18** to which a seat belt is fastened to the belt support fastening portion **12***c*.
(28) The center pillar internal upper **12** has the sufficient stiffness as a convex portion and a concave portion are repeatedly formed by the stiffness portions **12***a* and the belt support fastening portion **12***c* formed between the stiffness portions **12***a* toward the vehicle interior.
(29) The center pillar internal upper **12** is formed to have a narrower cross-sectional area upwards. When the center pillar internal upper **12** is cut in a direction perpendicular to the height direction (H direction) of the vehicle, the center pillar internal upper **12** has an open cross section, but assuming that the coupling portions **12***b* are connected to each other, a cross-sectional area formed by the center pillar internal upper **12** is formed to be narrower upwards from the center pillar internal upper **12**.
(30) The center pillar internal lower **13** has an upper portion coupled to the lower portion of the center pillar internal upper **12**, and a lower portion coupled to the side sill. The upper portion of the center pillar internal lower **13** is coupled with the lower portion of the center pillar internal upper **12** to form the center pillar internal **11**.
(31) The center pillar internal lower **13** includes a coupling portion **13***b* formed along a circumference of the center pillar internal lower **13**, and stiffness portions **13***a* formed convexly toward the vehicle interior inside the coupling portion **13***b* in the height direction of the vehicle, and formed to be spaced from each other in the longitudinal direction of the vehicle.
(32) Like the coupling portion **12***b* of the center pillar internal upper **12**, the coupling portion **13***b* of the center pillar internal lower **13** is formed in a flange shape along the circumference of the center pillar internal lower **13** and is coupled with other members.
(33) The stiffness portions **13***a* of the center pillar internal lower **13** are also formed to protrude convexly toward the vehicle interior. Furthermore, the stiffness portions **13***a* are formed to be spaced from each other in the longitudinal direction T of the vehicle.
(34) The stiffness portions **13***a* of the center pillar internal lower **13** and the stiffness portions **12***a* of the center pillar internal upper **12** are connected to each other. Because the center pillar internal upper **12** and the center pillar internal lower **13** are coupled to each other to form the center pillar internal **11**, the stiffness portions **12***a* and **13***a* are formed to be continuous with each other when coupled by the center pillar internal **11**.
(35) The lower portion of the center pillar internal lower **13** is coupled to a side sill **30** forming a side structure of a floor of the vehicle.
(36) The center pillar internal upper **12** is made of a material having a tensile strength greater than a tensile strength of the center pillar internal lower **13**. Because the center pillar internal upper **12** is required to support a portion where the door glass **42** is positioned in the vehicle to which the frameless door is applied, the upper portion of the center pillar internal **11** is required to have high stiffness to secure collision performance.
(37) Because the center pillar internal upper **12** has a rapid cross-sectional change, the center pillar internal upper **12** needs to secure formability and have high tensile strength, so that a metal plate is processed by hot stamping.
(38) The center pillar internal lower **13** is processed by rolling the metal plate as in the case of manufacturing a typical center pillar internal.
(39) The lower portion of the center pillar internal upper **12** and the upper portion of the center pillar internal lower **13** are disposed to overlap each other by a predetermined length and are coupled to each other to form the center pillar internal **11**. FIG. **6** shows that the lower portion of

the center pillar internal upper **12** and the upper portion of the center pillar internal lower **13** overlap each other by a height and are coupled to each other.

(40) Meanwhile, a portion where the lower portion of the center pillar internal upper **12** and the upper portion of the center pillar internal lower **13** are coupled (a portion indicated by E in FIG. **10**) is positioned lower than a belt line BL of the vehicle, that is, a boundary line between the door glass **42** and the door. As described above, this is to support an upper portion of the belt line BL to which the glass frame is not applied with the center pillar internal upper **12** having high stiffness.

(41) As shown in FIG. **5**, the center pillar reinforcement internal **17** and the center pillar reinforcement external **16** are sequentially coupled to the outside of the center pillar internal upper **12** to which the center pillar internal upper **12** and the center pillar internal lower **13** are coupled.

(42) In the center pillar reinforcement internal **17**, an upper end portion of the center pillar reinforcement internal **17** is positioned higher than an upper end portion of the center pillar internal lower **13**, and the upper end portion of the center pillar reinforcement internal **17** is positioned lower than a lower end portion of the belt support **18** fastened to the center pillar internal upper **12** in the height direction of the vehicle. In other words, FIG. **9** shows that the upper end portion of the center pillar reinforcement internal **17** is lower than the lower end portion of the belt support **18**.

(43) Meanwhile, the center pillar reinforcement external **16** is formed to have substantially the same height as that of the center pillar internal **11**. In other words, because a structure having an improved stiffness by the center pillar internal upper **12** is applied to the upper portion of the center pillar internal **11**, the center pillar reinforcement internal **17** is applied to only portions except for an upper portion of the center pillar **10**, that is, middle and lower portions thereof.

(44) An upper end portion of the center pillar reinforcement external **16** is coupled to the roof side rail external **21**, and the roof side rail external **21** is coupled to the outside of the roof side rail internal **22** to form the roof side rail **20**.

(45) A structure in which the center pillar **10** is fastened to the roof side of the vehicle will be referred to as follows.

(46) A connection member **15** and a reinforcement plate **14** may be applied to a portion where the center pillar **10** is fastened to the roof side of the vehicle.

(47) First, describing the connection member **15**, as shown in FIG. **7**, FIG. **8**, FIG. **9**, FIG. **10**, and FIG. **11**, the center pillar internal upper **12** is applied to a portion where the center pillar internal upper **12** is coupled to the roof side rail internal **22** and coupled to an internal surface of the roof side rail internal **22**.

(48) The connection member **15** is formed from an upper end portion of the center pillar internal upper **12** toward a roof panel of the vehicle, and formed to have a cross section in which an unevenness is repeated in the longitudinal direction T of the vehicle. Because the connection member **15** is formed from the upper end portion of the center pillar internal upper **12** toward the roof panel of the vehicle, the connection member **15** may be fastened to each of the roof side rail internal **22** and the roof panel. As the cross section has the shape in which the unevenness is repeated, a sufficient stiffness may be embodied at the coupled portion. The connection member **15** is additionally coupled to the internal side of the vehicle at a portion where the center pillar internal upper **12** is coupled to the roof side rail internal **22**, so that it is possible to increase the stiffness of the portion where the center pillar internal upper **12** is connected to the roof side rail internal **22**.

(49) The reinforcement plate **14** is coupled to the external surfaces of the center pillar internal upper **12** and the roof side rail internal **22**. The reinforcement plate **14** is formed downward by a predetermined length from an upper end portion of the roof side rail internal **22**, and both end portions of the reinforcement plate **14** are coupled to the coupling portion **12***b* formed on the circumference of the center pillar internal upper **12** (see FIGS. **8**, **9**, and **11**). The reinforcement plate **14** is additionally coupled to the external side of the vehicle at the portion where the center pillar internal upper **12** is coupled to the roof side rail internal **22**, so that it is possible to increase the stiffness of the portion where the center pillar internal upper **12** is coupled to the roof side rail

internal **22**. In the reinforcement plate **14**, as shown in FIG. **8**, a circumference of the reinforcement plate **14** is coupled to the coupling portion **12***b* of the center pillar internal upper **12** by a bolting M. FIG. **8** shows that only the reinforcement plate **14** and the center pillar internal upper **12** are coupled, but the reinforcement plate **14**, the center pillar internal upper **12**, and the center pillar reinforcement external **16** are coupled by the bolting M in an overlapping state.

(50) As shown in FIG. **11**, the connection member **15**, the roof side rail internal **22**, and the reinforcement plate **14** are sequentially disposed and coupled to one another in the width direction L of the vehicle at an upper portion (portion indicated by J) of the roof side rail internal **22**.

(51) Meanwhile, the connection member **15**, the roof side rail internal **22**, the center pillar internal upper **12**, and the reinforcement plate **14** are sequentially disposed and coupled to one another at a lower portion (portion indicated by K) of the roof side rail internal **22**. The upper end portion of the center pillar internal upper **12** and the upper portion of the center pillar internal upper **12** are coupled to the roof side rail internal **22** at the lower portion of the roof side rail internal **22**. At the instant time, the connection member **15** is positioned inside the roof side rail internal **22**, and the reinforcement plate **14** is positioned outside the center pillar internal upper **12** to be integrally coupled to each other.

(52) Here, the above components are coupled to each other by bolts, welding, or adhesives.

(53) Furthermore, the belt support **18** fastened to the center pillar **10** also improves the stiffness of the center pillar **10** (see FIG. **12**). The belt support **18** is formed in the height direction H of the vehicle to have each of the upper and lower end portions fastened to the belt support fastening portion **12***c* of the center pillar internal upper **12**. A bracket **18***a* for fastening the seat belt is formed on the belt support **18**. Because the belt support **18** is also a structure formed in the height direction of the vehicle, it is possible to improve the stiffness of the center pillar **10** by fastening the belt support **18** to the center pillar internal upper **12**. The belt support **18** may be fastened to the center pillar internal upper **12** using a fastening member such as a fastening bolt **19** at a plurality of points from the upper end portion to the lower end portion of the belt support **18** (portion indicated by F in FIG. **14**). FIG. **12** shows an example in which the belt support **18** is fastened to the center pillar internal upper **12** by the fastening bolt **19** at the upper and lower end portions (portions indicated by G) thereof. Furthermore, the upper end portion of the belt support **18** is also fastened to the reinforcement plate **14**, so that the stiffness of the corresponding portion is reinforced.

(54) FIG. **13** and FIG. **14** each show a modified embodiment of the reinforcement plate **14**.

(55) FIG. **13** shows an example in which the lower end portion of the reinforcement plate **14** extends downward. In other words, the lower end portion of the reinforcement plate **14** extends up to the lower end portion of the belt support **18**. Accordingly, the belt support **18**, the center pillar internal upper **12**, the center pillar reinforcement external **16**, and the reinforcement plate **14** are fastened by the fastening bolt **19** at the lower end portion of the belt support **18**.

(56) Furthermore, as shown in FIG. **14**, the reinforcement plate **14** may also extend in the longitudinal direction T of the vehicle. The portion extending downwardly from the reinforcement plate **14** also extends in the longitudinal direction T of the vehicle, and the extending portion of the reinforcement plate **14** is coupled to the internal surface of the center pillar internal upper **12**. The portion extending from the reinforcement plate **14** may be coupled to the center pillar internal upper **12** by welding W.

(57) For convenience in explanation and accurate definition in the appended claims, the terms “upper”, “lower”, “inner”, “outer”, “up”, “down”, “upwards”, “downwards”, “front”, “rear”, “back”, “inside”, “outside”, “inwardly”, “outwardly”, “interior”, “exterior”, “internal”, “external”, “forwards”, and “backwards” are used to describe features of the exemplary embodiments with reference to the positions of such features as displayed in the figures. It will be further understood that the term “connect” or its derivatives refer both to direct and indirect connection.

(58) Furthermore, the term of “fixedly connected” signifies that fixedly connected members always rotate at a same speed. Furthermore, the term of “selectively connectable” signifies “selectively

connectable members rotate separately when the selectively connectable members are not engaged to each other, rotate at a same speed when the selectively connectable members are engaged to each other, and are stationary when at least one of the selectively connectable members is a stationary member and remaining selectively connectable members are engaged to the stationary member".

(59) The foregoing descriptions of specific exemplary embodiments of the present disclosure have been presented for purposes of illustration and description. They are not intended to be exhaustive or to limit the present disclosure to the precise forms disclosed, and obviously many modifications and variations are possible in light of the above teachings. The exemplary embodiments were chosen and described in order to explain certain principles of the invention and their practical application, to enable others skilled in the art to make and utilize various exemplary embodiments of the present disclosure, as well as various alternatives and modifications thereof. It is intended that the scope of the present disclosure be defined by the Claims appended hereto and their equivalents.

Claims

1. A center pillar for a vehicle with improved stiffness, the center pillar comprising: a center pillar internal including: a center pillar internal upper including an upper portion coupled to a roof side rail internal; and a center pillar internal lower including an upper portion coupled to a lower portion of the center pillar internal upper, and a lower portion coupled to a side sill, wherein a center pillar reinforcement internal is coupled to an external surface of the center pillar internal, wherein a center pillar reinforcement external is coupled to an external surface of the center pillar reinforcement internal, wherein the center pillar internal upper is further provided with a connection member and a reinforcement plate at a portion coupled to the roof side rail internal, wherein the connection member is coupled to an internal surface of the roof side rail internal, and wherein the reinforcement plate is coupled to external surfaces of the center pillar internal upper and the roof side rail internal.

2. The center pillar of claim 1, wherein the lower portion of the center pillar internal upper and the upper portion of the center pillar internal lower are disposed to overlap by a predetermined length and coupled to each other.

3. The center pillar of claim 1, wherein the center pillar internal upper includes a material having a tensile strength greater than a tensile strength of the center pillar internal lower.

4. The center pillar of claim 1, wherein the center pillar internal upper further includes: a coupling portion formed along a periphery of the center pillar internal upper; stiffness portions formed convexly toward a vehicle interior inside the coupling portion in a height direction of the vehicle, and formed to be spaced from each other in a longitudinal direction of the vehicle; a connection portion formed to connect the coupling portion and the stiffness portions; and a belt support fastening portion formed between the stiffness portions spaced from each other in the height direction of the vehicle.

5. The center pillar of claim 4, wherein a width of the connection portion is formed to be reduced toward an upper end portion and a lower end portion of the connection portion.

6. The center pillar of claim 4, wherein the center pillar internal lower further includes: a coupling portion formed along a periphery of the center pillar internal lower; and stiffness portions formed convexly toward the vehicle interior inside the coupling portion in the height direction of the vehicle, and formed to be spaced from each other in the longitudinal direction of the vehicle.

7. The center pillar of claim 6, wherein the stiffness portions of the center pillar internal lower and the stiffness portions of the center pillar internal upper are connected to each other.

8. The center pillar of claim 4, further including: a belt support formed in the height direction of the vehicle, and including each of upper and lower end portions thereof fastened to the belt support fastening portion.

9. The center pillar of claim 1, wherein the connection member is formed from an upper end portion of the center pillar internal upper toward a roof panel of the vehicle, and formed to have a cross section in which an unevenness is repeated in a longitudinal direction of the vehicle.
10. The center pillar of claim 1, wherein the reinforcement plate is formed downwardly from an upper end portion of the roof side rail internal by a predetermined length, and wherein first and second end portions of the reinforcement plate are coupled to a coupling portion formed on a periphery of the center pillar internal upper.
11. The center pillar of claim 10, wherein in the reinforcement plate, an upper portion of the reinforcement plate is coupled to the connection member and the roof side rail internal.
12. The center pillar of claim 10, wherein an upper end portion of the center pillar internal upper is coupled to the connection member, the roof side rail internal, and the reinforcement plate.
13. The center pillar of claim 12, wherein in the center pillar internal upper, the upper portion of the center pillar internal upper is coupled to the roof side rail internal and the reinforcement plate at a portion spaced apart downwardly from the upper end portion of the center pillar internal upper.
14. The center pillar of claim 1, wherein the reinforcement plate is fastened to the center pillar internal upper and an upper end portion of a belt support fastened to the center pillar internal upper in a height direction of the vehicle.
15. The center pillar of claim 1, wherein the reinforcement plate is fastened to a lower end portion of a belt support fastened to the center pillar internal upper in a height direction of the vehicle.
16. The center pillar of claim 1, wherein the reinforcement plate extends in front and rear directions of the vehicle and is coupled to an internal surface of the center pillar internal upper.
17. The center pillar of claim 1, wherein a cross-sectional area of the center pillar internal upper is formed to be narrower upwards.
18. The center pillar of claim 1, wherein a portion where the lower portion of the center pillar internal upper and the upper portion of the center pillar internal lower are coupled is positioned lower than a belt line of the vehicle.
19. The center pillar of claim 1, wherein in the center pillar reinforcement internal, an upper end portion of the center pillar reinforcement internal is positioned higher than an upper end portion of the center pillar internal lower, and positioned lower than a lower end portion of a belt support fastened to the center pillar internal upper in a height direction of the vehicle.