

ABSTRACT

A vehicle door structure that can suppress deformation of a door sash made of resin is provided. A vehicle door structure (100) includes a vehicle door (102), a door sash (110) made of resin with an elongated shape that guides a door glass (114) that can be raised and lowered inside the vehicle door and accommodates the door glass when the door glass is lowered, and an elastic glass run (112) that is assembled to an inside of the door sash and is in contact with an edge of the door glass. The door sash includes an inner wall (116) and an outer wall (118) that are in contact with the glass run respectively from a vehicle inner side and a vehicle outer side, a coupling wall (120) that couples the inner wall and the outer wall and surrounds the glass run together with the inner wall and the outer wall, an outward-projecting wall (140) that projects outward from the inner wall, the outer wall and the coupling wall and surrounds the walls, and a fixed portion (142) that extends from the outward-projecting wall toward a vehicle inner side and is fixed to an inner door panel (146) constituting the vehicle door.

WHAT IS CLAIMED IS:

1. A vehicle door structure, comprising:
 - a vehicle door;
 - a door sash made of resin with an elongated shape that guides a door glass that can be raised and lowered inside the vehicle door and accommodates the door glass when the door glass is lowered; and
 - an elastic glass run that is assembled to an inside of the door sash and is in contact with an edge of the door glass,
 - wherein the door sash includes:
 - an inner wall and an outer wall that are in contact with the glass run respectively from a vehicle inner side and a vehicle outer side;
 - a coupling wall that couples the inner wall and the outer wall and surrounds the glass run together with the inner wall and the outer wall;
 - an outward-projecting wall that projects outward from the inner wall, the outer wall and the coupling wall and surrounds the walls; and
 - a fixed portion that extends from the outward-projecting wall toward a vehicle inner side and is fixed to an inner door panel constituting the vehicle door.
2. The vehicle door structure according to claim 1, wherein the door sash further includes a flange that is provided on the outward-projecting wall and that projects in a longitudinal direction of the door sash, and
 - the flange abuts against at least one of the inner wall, the outer wall and the coupling wall.
3. The vehicle door structure according to claim 1 or 2, wherein the inner wall and the outer wall include claw portions that engage the glass run, and
 - the outward-projecting wall is provided in the

region of the claw portions.

4. The vehicle door structure according to any one of claims 1 to 3, further comprising a door locking mechanism that is disposed inside the vehicle door and locks the vehicle door with a key cylinder,

wherein the outward-projecting wall covers the door locking mechanism when viewed from a vehicle upper side.

5. The vehicle door structure according to any one of claims 2 to 4, further comprising a door opening/closing mechanism that opens/closes the vehicle door using a door handle attached to an outer door panel constituting the vehicle door,

wherein the door opening/closing mechanism includes a rotary shaft that extends in a vehicle front-to-rear direction and a weight that rotates around the rotary shaft, moving on a first trajectory toward a vehicle inner side when the vehicle door is opened, and

the flange is located on a second trajectory that is shifted to a vehicle inner side with respect to the first trajectory, and abuts against the weight when the weight moves on the second trajectory.

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Dated this 21 day of July, 2014

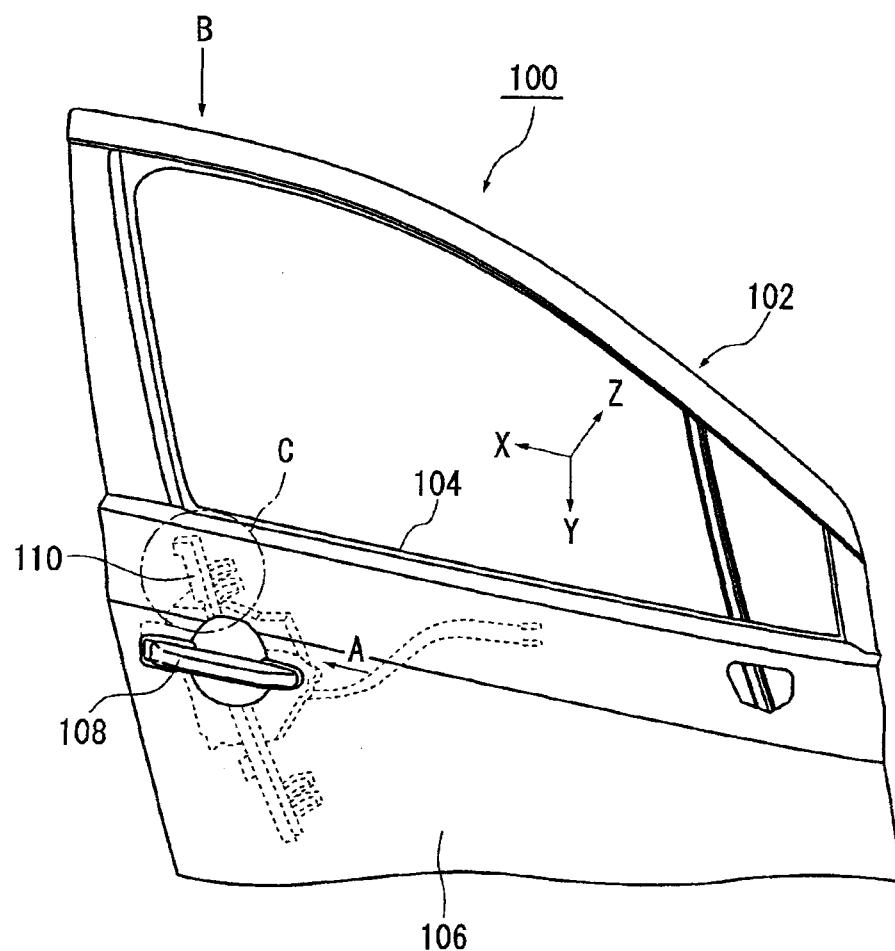

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FIG. 1

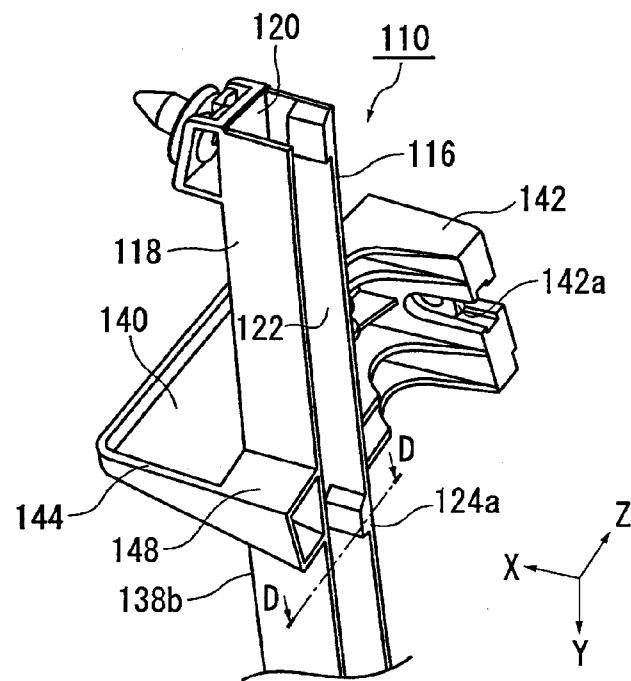
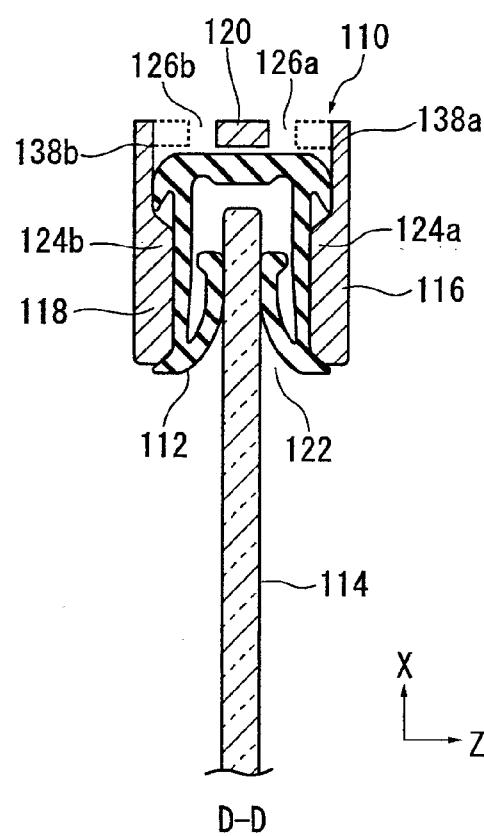


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FIG. 2A**FIG. 2B**

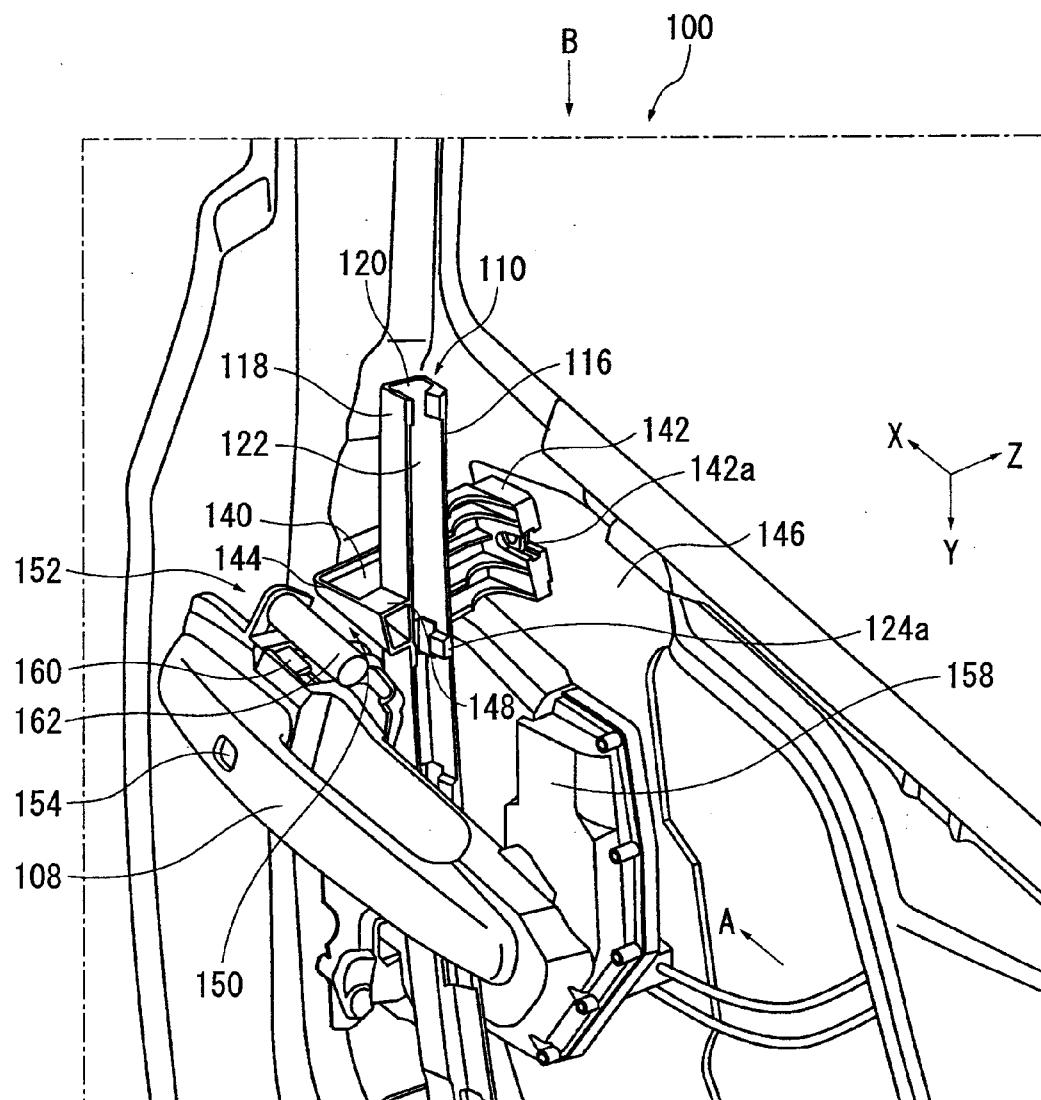
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FIG. 3



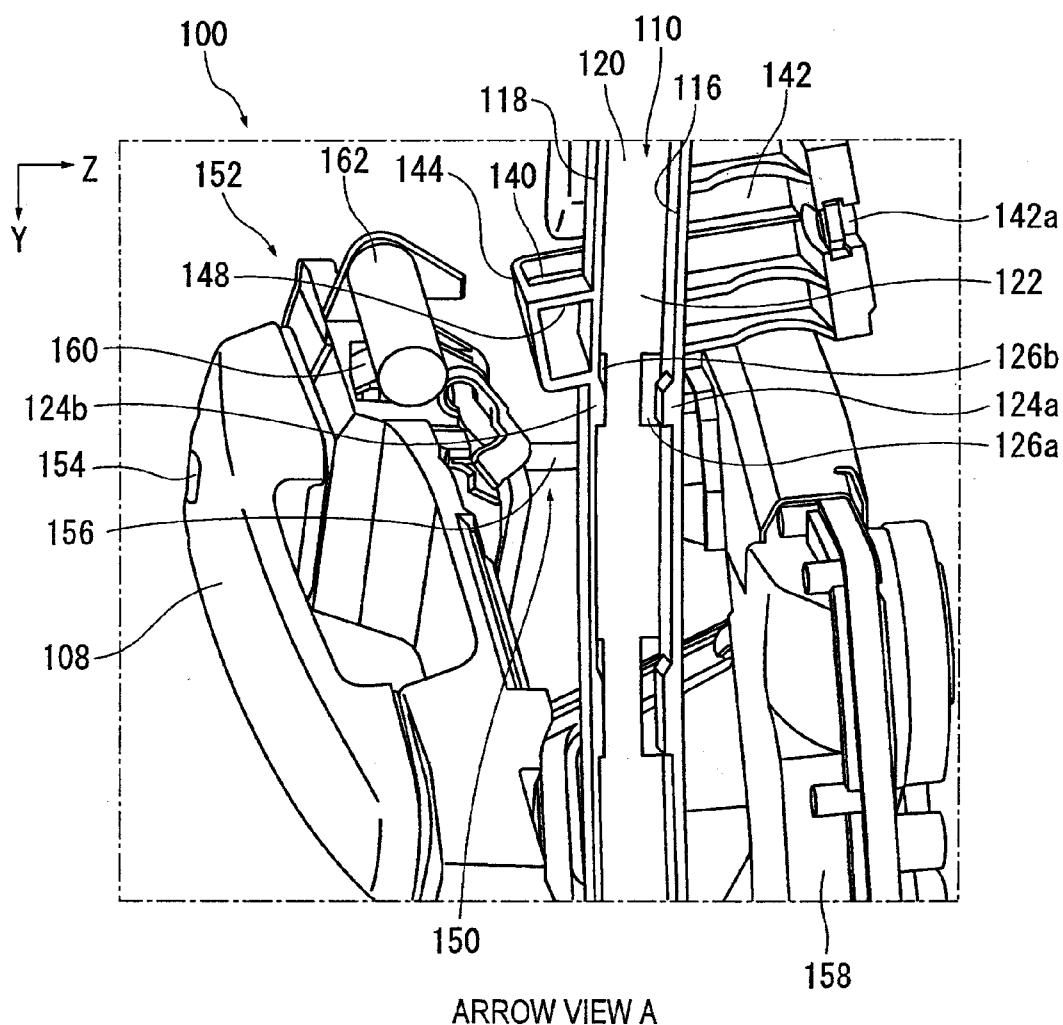
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FIG. 4



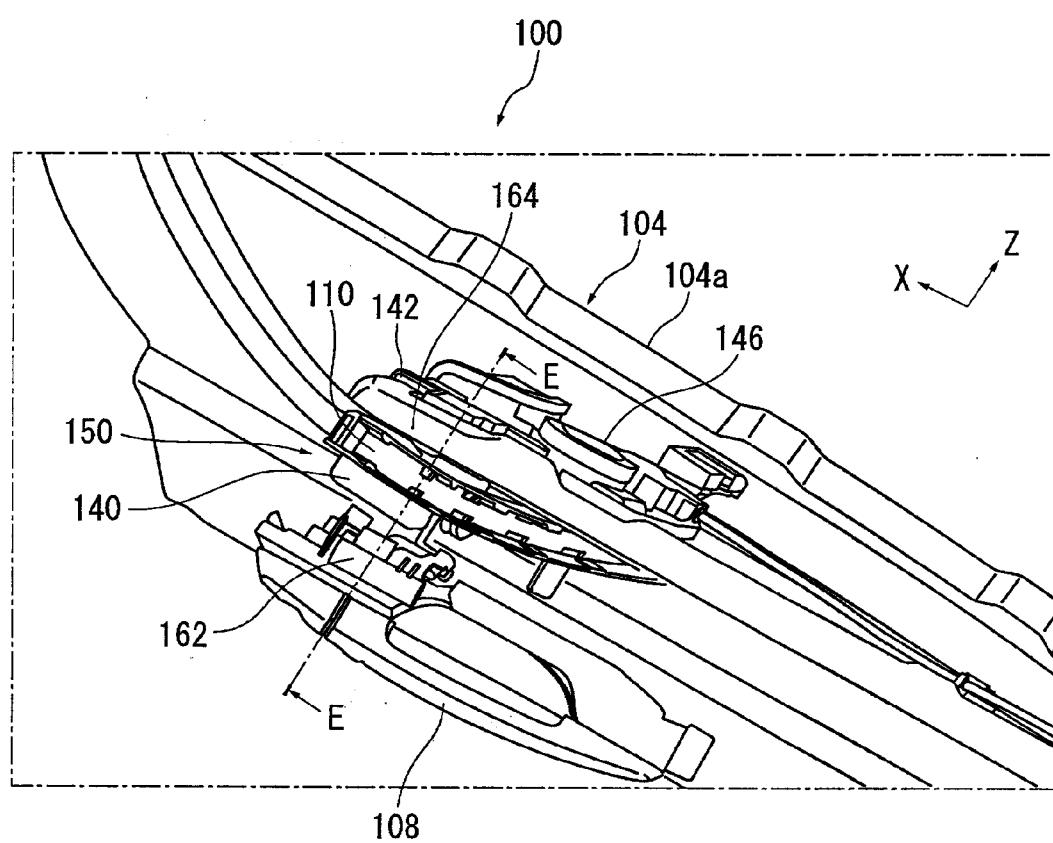
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FIG. 5



ARROW VIEW B

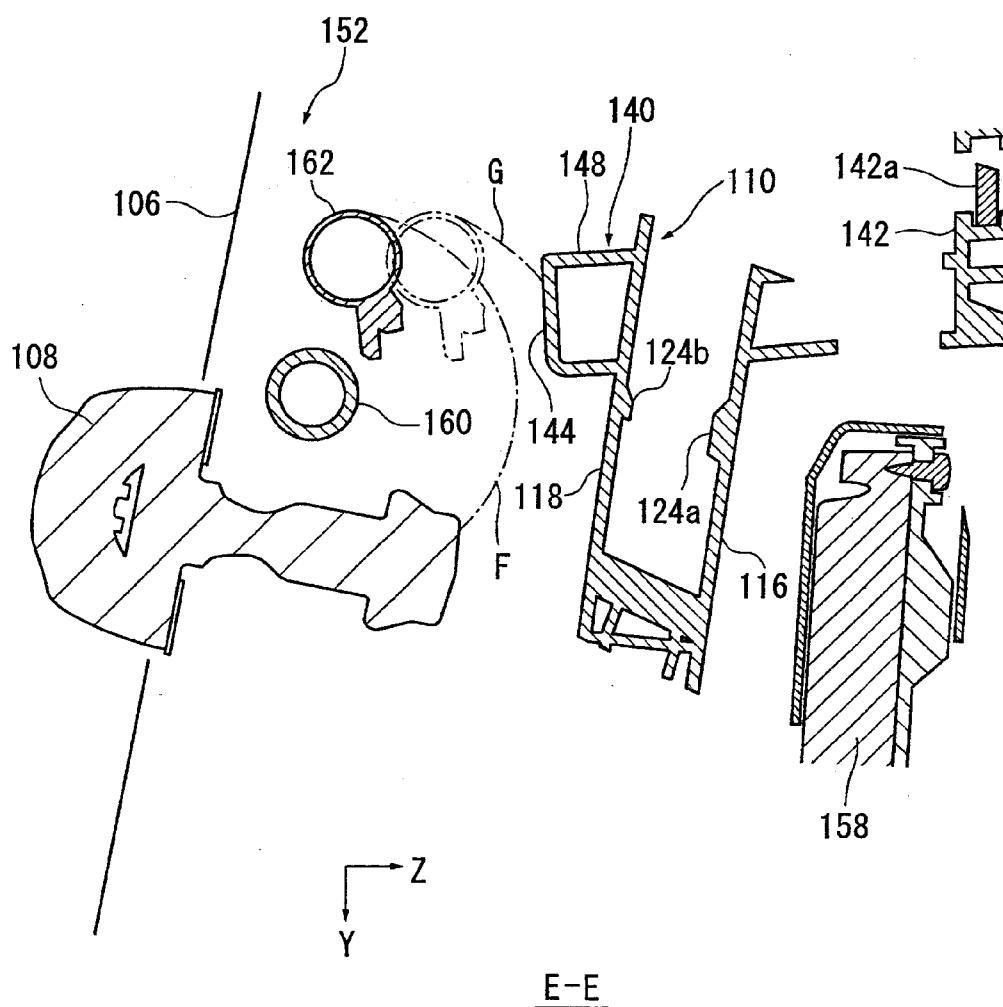
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FIG. 6



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DOOR STRUCTURE FOR VEHICLE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is based upon and claims the benefit of priority from the prior Japanese Patent Application No. 2013-152868, filed on July 23, 2013, the entire contents of which are incorporated herein by reference.

Field of the Invention

[0002] The present invention relates to a vehicle door structure including a door sash that is disposed inside a vehicle door.

DESCRIPTION OF THE RELATED ART

[0003] A vehicle door structure includes a door sash and a glass run that is assembled to the inside of the door sash. The door sash is, for example, an elongated member that guides a door glass moving up and down inside the vehicle door and accommodates the door glass when the door glass is lowered. The glass run is a member that has elasticity and is in contact with an edge of the door glass.

[0004] The door sash includes an inner wall and an outer wall that are in contact with the glass run respectively from the vehicle inner side and the vehicle outer side, and a coupling wall. The coupling wall couples the inner wall and the outer wall and surrounds the glass run together with the inner wall and the outer wall.

[0005] Japanese Patent Laid-open Publication No. JP 2002-2270A describes a metal door sash in which a glass run is assembled to the inner circumference of an inner wall, outer wall and coupling wall that have been formed by

bending metal by pressing. It should be noted that the door sash includes an opening through which the glass run is assembled. The opening is formed by opening the side opposite to the coupling wall, and is not surrounded by the walls.

[0006] In recent years, door sashes made of resin have become widespread with a demand for reduction in weight of a vehicle. Door sashes made of resin have lower rigidity than sheet metal door sashes and, in addition, are susceptible to thermal deformation accompanying thermal expansion or deterioration over time due to creep or the like. It should be noted that a creep phenomenon means a phenomenon that deformation of materials increases with time under a constant load.

[0007] The door sash has an elongated shape in order to accommodate the door glass and, in addition, it may have a moderately curved shape. The door sash made of resin with such a shape is deformed such that the outer circumferential side of the curved shape is widened and the inner circumferential side to which the glass run is assembled is contracted. Thereby, the door sash is likely to be deformed such that the opening, which is not surrounded by the walls, is widened.

[0008] If the door sash is deformed, there is a risk that, for example, the door glass cannot be accommodated normally, rainwater infiltrates inside the vehicle door as a result of misregistration of the door glass, or peripheral layout components and the door sash interfere with each other.

[0009] The present invention was made in view of such problems, and it is an object thereof to provide a vehicle door structure that can suppress deformation of a door sash

made of resin.

SUMMARY OF THE INVENTION

[0010] In order to solve the foregoing problems, a vehicle door structure according to the present invention having a typical structure is a vehicle door structure, including: a vehicle door; a door sash made of resin with an elongated shape that guides a door glass that can be raised and lowered inside the vehicle door and accommodates the door glass when the door glass is lowered; and an elastic glass run that is assembled to an inside of the door sash and is in contact with an edge of the door glass, wherein the door sash includes: an inner wall and an outer wall that are in contact with the glass run respectively from a vehicle inner side and a vehicle outer side; a coupling wall that couples the inner wall and the outer wall and surrounds the glass run together with the inner wall and the outer wall; an outward-projecting wall that projects outward from the inner wall, the outer wall and the coupling wall and surrounds the walls; and a fixed portion that extends from the outward-projecting wall toward a vehicle inner side and is fixed to an inner door panel constituting the vehicle door.

[0011] In the above-described configuration, the outward-projecting wall surrounds the walls of the door sash, and the fixed portion that extends from the outward-projecting wall is fixed to the inner door panel. Therefore, since the outer circumferences of the walls of the door sash are supported by the outward-projecting wall, its rigidity can be enhanced, suppressing deformation. Also, the door sash is reinforced with the inner door panel by fixing the fixed portion to the inner door panel, which has high rigidity.

[0012] Furthermore, in the above-described configuration, since the fixed portion extends from the outward-projecting wall, it is possible to shorten a distance between a fixed point of the inner door panel and the outward-projecting wall. Therefore, the door sash tends not to be deformed, and it is possible to suppress the misregistration of the door sash with respect to the position of the fixed point and to improve the accuracy of position. It should be noted that misregistrations of the door sash include shaping errors of the door sash, which is a resin component, deformation errors accompanying thermal expansion, and the like.

[0013] It is preferable that the door sash further includes a flange that is provided on the outward-projecting wall and that projects in a longitudinal direction of the door sash, and the flange abuts against at least one of the inner wall, the outer wall and the coupling wall. In this manner, the flange provided on the outward-projecting wall abuts against the wall of the door sash, and therefore, the outward-projecting wall tends not to be deformed. Accordingly, in the above-described configuration, it is possible to prevent twisting around an axis in which a longitudinal direction of the door sash is used as the axis.

[0014] It is preferable that the inner wall and the outer wall include claw portions that engage the glass run, and the outward-projecting wall is provided in the region of the claw portions. Here, when the claw portions are molded, the door sash made of resin needs to be provided with a removing hole for removing a mold in the region of the claw portions. Therefore, the door sash has a low rigidity in the region of the claw portions. In the above-described configuration, the

outward-projecting wall is provided in the region of the claw portions, and therefore, it is possible to prevent the rigidity of the door sash from being reduced.

[0015] It is preferable that the vehicle door structure further includes a door locking mechanism that is disposed inside the vehicle door and locks the vehicle door with a key cylinder, wherein the outward-projecting wall covers the door locking mechanism when viewed from a vehicle upper side.

[0016] In this manner, the outward-projecting wall covers the door locking mechanism when viewed from the vehicle upper side, and therefore, the door locking mechanism is not visible from the vehicle upper side. Accordingly, even when a criminal peeks into the vehicle door from the vehicle upper side and tries to enter a tool to unlock the door locking mechanism, he/she cannot access the door locking mechanism. Therefore, in the above-described configuration, it is possible to enhance crime prevention. Furthermore, since the outward-projecting wall extends from the walls of the door sash so as to cover the door locking mechanism, the rigidity is enhanced and deformation tends not to occur.

[0017] It is preferable that the vehicle door structure further includes a door opening/closing mechanism that opens/closes the vehicle door using a door handle attached to an outer door panel constituting the vehicle door, wherein the door opening/closing mechanism includes a rotary shaft that extends in a vehicle front-to-rear direction and a weight that rotates around the rotary shaft, moving on a first trajectory toward a vehicle inner side when the vehicle door is opened, and the flange is located on a second trajectory that is shifted to a vehicle inner side with

respect to the first trajectory, and abuts against the weight when the weight moves on the second trajectory.

[0018] Normally, that is, when an occupant grasps the door handle and opens the vehicle door, the weight moves on the first trajectory around the rotary shaft. On the other hand, when impact is applied in a side collision, the weight enters the vehicle inner side and moves on the second trajectory that is displaced to the vehicle inner side of the first trajectory. When the weight moves on the second trajectory, the vehicle door is inadvertently opened.

[0019] In the above-described configuration, the flange of the door sash is located on the second trajectory, and therefore, even if the weight enters the vehicle inner side in a side collision, the weight abuts against the flange. Therefore, the flange restricts the movement of the weight in a side collision, and it is possible to prevent the vehicle door from being inadvertently opened.

[0020] With the present invention, it is possible to provide a vehicle door structure that can suppress deformation of a door sash made of resin.

Brief Explanation of the Drawings

[0021]

FIG. 1 is a drawing of a vehicle door structure according to one embodiment.

FIGS. 2A and 2B are enlarged views illustrating the main part of the vehicle door structure in FIG. 1.

FIG. 3 is an enlarged view illustrating the inside of the vehicle door structure in FIG. 1.

FIG. 4 is a view taken in a direction of an arrow A

of the vehicle door structure in FIG. 3.

FIG. 5 is a view taken in a direction of an arrow B of the vehicle door structure in FIG. 3.

FIG. 6 is a drawing illustrating an end surface taken along line E-E of the vehicle door structure in FIG. 5.

DETAILED DESCRIPTION OF THE INVENTION

[0022] Hereinafter, a preferred embodiment of the present invention will be described in detail with reference to the accompanying drawings. The dimensions, materials, and other specific numerical values described in this embodiment are merely examples for facilitating the understanding of the present invention, and are not to be construed as limiting the invention unless otherwise stated. It should be noted that elements constituting substantially identical functions and configurations are denoted by identical reference numerals in the present specification and the drawings, and hence redundant description has been omitted. Also, illustration of elements that are not directly relevant to the present invention has been omitted.

[0023] FIG. 1 is a drawing of a vehicle door structure 100 of this embodiment. The drawing shows a state where a vehicle door 102 is viewed from the outside of a vehicle. It should be noted that only the contours of members disposed inside the vehicle door 102 are indicated by broken lines.

[0024] Hereinafter, arrows X, Y and Z shown in the drawings indicate the vehicle rear side, vehicle lower side and vehicle inner side, respectively. It should be noted that arrow A indicates a direction in which the vehicle rear side is viewed from the vehicle front side and arrow B indicates a direction in which the vehicle lower side is viewed from the vehicle upper side. Moreover, although the

vehicle door structure 100 will be described based on the vehicle door 102 disposed on the vehicle right side hereinafter, a vehicle door structure including a vehicle door disposed on the vehicle left side has similar functionality and so on.

[0025] As shown in FIG. 1, the vehicle door structure 100 includes the vehicle door 102 and an outer door panel 106 constituting a window frame 104 of the vehicle door 102. A door handle 108 that is grasped by an occupant when opening/closing the vehicle door 102 is attached to the vehicle outer side of the outer door panel 106. A door sash 110 is disposed as shown in FIG. 1 on the vehicle inner side of the outer door panel 106, that is, inside the vehicle door 102. The door sash 110 is an elongated member made of resin that extends in a vehicle vertical direction and is moderately curved as shown in the drawing.

[0026] FIGS. 2A and 2B show enlarged views illustrating the main part of the vehicle door structure 100 in FIG. 1. FIG. 2A is an enlarged view of the region C surrounded by a dot-dash line in FIG. 1. FIG. 2B is a cross-sectional view taken along line D-D in FIG. 2A. As shown in the cross-section taken along line D-D in FIG. 2B, a glass run 112 is assembled to the inside of the door sash 110. The glass run 112 is a member that has elasticity and is in contact with an edge of a door glass 114 that is disposed in a window frame 104 so that it can be raised and lowered. It should be noted that the glass run 112 and the door glass 114 are not shown in FIG. 2A.

[0027] As shown in FIGS. 2A and 2B, the door sash 110 includes an inner wall 116, an outer wall 118 and a coupling wall 120. As shown in FIG. 2B, the inner wall 116 is in contact with the glass run 112 from the vehicle

inner side. The outer wall 118 is in contact with the glass run 112 from the vehicle outer side. The coupling wall 120 couples the inner wall 116 and the outer wall 118, and surrounds the glass run 112 together with the inner wall 116 and the outer wall 118.

[0028] Also, the door sash 110 includes an opening 122 in the side opposite to the coupling wall 120 (here, vehicle front side) in order to assemble the glass run 112 therethrough. As shown in FIG. 2B, the door sash 110 includes claw portions 124a and 124b that are formed on the inner wall 116 and the outer wall 118, respectively. By engaging the claw portions 124a and 124b of the door sash 110, the glass run 112 is prevented from being dislodged from the door sash 110 or being displaced with respect to the door sash 110.

[0029] As shown in FIG. 2B, the coupling wall 120 of the door sash 110 is provided with hole portions 126a and 126b. These hole portions 126a and 126b are mold removing holes for mold removal when the claw portions 124a and 124b are formed by metal molding.

[0030] It should be noted that the door sash 110 is molded of resin by pouring molten resin into a gap formed by butting two molds (not shown), for example, and then solidifying this molten resin. After the door sash 110 is molded, the mold that is located on the side of the coupling wall 120 can be removed through the hole portions 126a and 126b in a predetermined direction.

[0031] In this manner, when the claw portions 124a and 124b are molded, the door sash 110 needs to be provided with the hole portions 126a and 126b serving as a mold removing hole for removing a mold 130 in the region of the claw portions 124a and 124b. Therefore,

the door sash 110 has low rigidity in the region of the claw portions 124a and 124b.

[0032] Moreover, since the door sash 110 is made of resin as described above, it has lower rigidity than a sheet metal door sash and, in addition, is susceptible to thermal deformation accompanying thermal expansion or deterioration over time due to creep or the like. Furthermore, the door sash 110 has a moderately curved elongated shape and has also the opening 122 that is not surrounded by the walls. Therefore, the door sash 110 is deformed such that the outer circumferential side of the curved shape is widened and the inner circumferential side to which the glass run 112 is assembled is contracted. Thereby, the door sash 110 is likely to be deformed such that the opening 122 is widened. It should be noted that the opening 122 may be deformed due to the deformation of corner portions 138a and 138b (see FIG. 2B) in which the walls of the door sash 110 intersect, and these corner portions 138a and 138b need to be also reinforced.

[0033] To address this issue, as shown in FIG. 2A, the door sash 110 is provided with an outward-projecting wall 140 in the region of the claw portions 124a and 124b to prevent the rigidity of the door sash 110 from being reduced. The outward-projecting wall 140 projects outward from the inner wall 116, the outer wall 118 and the coupling wall 120 of the door sash 110 so as to intersect substantially orthogonally with the longitudinal direction of the door sash 110, and surrounds the walls. Therefore, the outward-projecting wall 140 also surrounds the corner portions 138a and 138b of the walls that cause a deformation in which the opening 122 is widened.

[0034] Also, the door sash 110 further includes a fixed portion 142 and a flange 144. The fixed portion 142 is a portion that extends from the outward-projecting wall 140 toward the vehicle inner side and is fixed to an inner door panel 146 (see FIG. 3) constituting the vehicle door 102, and includes a fixed point 142a.

[0035] The flange 144 is provided on the elected wall 140, projects in the longitudinal direction of the door sash 110, and abuts against, for example, the outer wall 118 of the walls of the door sash 110. It should be noted that as shown in FIG. 2A, the flange 144 that abuts against the outer wall 118 forms a part of a box portion 148 with a box shape projecting toward the vehicle outer side.

[0036] FIG. 3 is an enlarged view illustrating the inside of the vehicle door structure 100 in FIG. 1. In the drawing, the outer door panel 106 described above is not shown, but the inner door panel 146 that is fixed to the fixed portion 142 of the door sash 110 at the fixed point 142a is shown. FIG. 4 is a view of the vehicle door structure 100 in FIG. 3, taken in the direction of arrow A.

[0037] The vehicle door structure 100 further includes a door locking mechanism 150 and a door opening/closing mechanism 152. The door locking mechanism 150 is a mechanism that locks the vehicle door 102 with a key cylinder 154 assembled in the door handle 108. The door locking mechanism 150 includes a key rod 156 with a rod shape as shown in FIG. 4. The key rod 156 is coupled to a lock lever (not shown) of a door latch 158, for example. The key rod 156 moves the lock lever by moving in a predetermined direction in conjunction with an action of inserting a key (not shown) into the key cylinder 154 and turning it. Thereby, the door latch 158

locks the vehicle door 102 with a predetermined mechanism.

[0038] The door opening/closing mechanism 152 is a mechanism that opens/closes the vehicle door 102 using the door handle 108. The door opening/closing mechanism 152 includes a rotary shaft 160 that, for example, is located on the vehicle outer side of the door sash 110 and extends in the vehicle front-to-rear direction and a weight 162 that rotates around the rotary shaft 160. In the door opening/closing mechanism 152, when an occupant grasps the door handle 108, the weight 162 rotates in conjunction with that, and the door latch 158 allows the vehicle door 102 to be open with a predetermined mechanism.

[0039] Hereinafter, the positional relation of the door sash 110 with respect to the door locking mechanism 150 and the door opening/closing mechanism 152 will be described with reference to FIGS. 5 and 6. FIG. 5 is a view, taken in the direction of arrow B, of the vehicle door structure 100 in FIG. 3. It should be noted that the drawing shows an upper edge 104a of the window frame 104 that extends in the vehicle front-to-rear direction and an inner reinforcement 164. The inner reinforcement 164 is a member that is disposed on the vehicle outer side of the inner door panel 146 and reinforces the inner door panel 146, covering, from the upper side, the vicinity of the fixed portion 142 extending from the outward-projecting wall 140.

[0040] As shown in FIG. 5, the outward-projecting wall 140 covers the door locking mechanism 150 when viewed from the vehicle upper side. Therefore, for example, the above-described key rod 156 is not visible from the vehicle upper side. Accordingly, even when a

criminal peeks into the vehicle door 102 from the vehicle upper side and tries to enter a tool to unlock the door locking mechanism 150, he/she cannot access the door locking mechanism 150, making it possible to enhance crime prevention.

[0041] FIG. 6 is a drawing illustrating an end surface taken along line E-E of the vehicle door structure 100 in FIG. 5. Normally, that is, when an occupant grasps the door handle 108 and opens the vehicle door 102, the above-described weight 162 of the door opening/closing mechanism 152 rotates around the rotary shaft 160, moving on a first trajectory F shown by a dot-dash line in the drawing.

[0042] On the other hand, when an impact is applied in a side collision, the weight 162 can be assumed to enter the vehicle inner side and to move on a second trajectory G that is shifted to the vehicle inner side with respect to the first trajectory F. When the weight 162 moves to the vehicle lower side on the second trajectory G, the vehicle door 102 may be inadvertently opened.

[0043] To address this issue, in the door sash 110, the box portion 148 including the above-described flange 144 is placed on the second trajectory G of the weight 162. Therefore, the weight 162 abuts against the box portion 148 in a side collision in which the weight 162 enters the vehicle inner side and moves on the second trajectory G. Accordingly, in the door sash 110, the box portion 148 restricts the movement of the weight 162 in a side collision and it is possible to prevent the vehicle door 102 from being inadvertently opened.

[0044] In the vehicle door structure 100 of this

embodiment, the outward-projecting wall 140 surrounds the inner wall 116, the outer wall 118 and the coupling wall 120 of the door sash 110, and the fixed portion 142 extending from the outward-projecting wall 140 is fixed to the inner door panel 146. Thereby, in the door sash 110, the outer circumferences of the walls are supported by the outward-projecting wall 140, and therefore, the rigidity can be enhanced and deformation can be suppressed.

[0045] Since the outward-projecting wall 140 also surrounds the corner portions 138a and 138b of the walls that cause a deformation in which the opening 122 is widened, the corner portions 138a and 138b can be reinforced, and deformation of the opening 122 can be reliably suppressed. Also, the door sash 110 is reinforced with the inner door panel 146 by fixing the fixed portion 142 to the inner door panel 146, which has high rigidity.

[0046] Furthermore, in the vehicle door structure 100, the fixed portion 142 extends from the outward-projecting wall 140 toward the vehicle inner side, and therefore, it is possible to shorten a distance between a fixed point 142a of the inner door panel 146 and the outward-projecting wall 140. It should be noted that misregistrations of the door sash 110 include shaping errors of the door sash 110, which is a resin component, deformation errors accompanying thermal expansion, and the like. Accordingly, since the above-described distance is shortened, the door sash 110 tends not to be deformed, and it is possible to suppress the misregistration with respect to the position of the fixed point 142a and to improve the accuracy of position.

[0047] Moreover, in the door sash 110, the flange

144 provided on the outward-projecting wall 140 abuts against the walls of the door sash 110, and therefore, the outward-projecting wall 140 tends not to be deformed. Accordingly, in the vehicle door structure 100, it is possible to prevent twisting around an axis in which a longitudinal direction of the door sash 110 is used as the axis.

[0048] In addition, since the outward-projecting wall 140 extends from the outer wall 118 of the door sash 110 toward the vehicle outer side, covering the door locking mechanism 150, its width is increased, which enhances the rigidity, and the outward-projecting wall 140 tends not to be deformed.

[0049] In the above-described embodiment, the outward-projecting wall 140 projects outward from the inner wall 116, the outer wall 118 and the coupling wall 120 of the door sash 110, intersecting orthogonally with the longitudinal direction of the door sash 110, but there is no limitation to this. The outward-projecting wall 140 may be formed on the walls of the door sash 110 so as to be obliquely inclined with respect to the longitudinal direction of the door sash 110, for example, as long as the deformation of the door sash 110 is suppressed.

[0050] Moreover, in the above-described embodiment, the outward-projecting wall 140 that projects outward from the walls of the door sash 110 is provided with the box portion 148 that abuts against the weight 162, but there is no limitation to this. That is, as long as the outward-projecting wall 140 abuts against the weight 162 that enters the vehicle inner side in a side collision and has enough rigidity to restrict the movement of the weight 162, it is also possible to form only the flange 144 thereon without the box portion 148.

[0051] While a preferred embodiment of the present invention has been described above with reference to the accompanying drawings, it should be appreciated that the present invention is not limited to the embodiment shown above. It will be apparent for a person skilled in the art that various modifications and variations may be made within the scope of the invention as defined in the appended claims, and those modifications and variations should be understood to be included within the technical scope of the present invention.

[0052] The present invention can be utilized in a vehicle door structure including a door sash that is disposed inside a vehicle door.