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FRONT STRUCTURE OF VEHICLE

Abstract

A front structure constitutes a front portion of a vehicle body and has a main body including a pair of side portions, an upper portion, and a pair of stay portions. The side portions are provided at an interval in a width direction, and extend in an upper-lower direction. The upper portion extends in the width direction, and couples end portions on an upper side of the side portions. The stay portions extend from respective end portions on a lower side of the side portions in respective directions intersecting both the width direction and the upper-lower direction, and are connected to the upper portion. An end edge on the lower side of the stay portions constitutes a part of an outer peripheral edge of the front structure. The side portions, the upper portion, and the stay portions have an uneven portion extending along directions in which these portions extend.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is based on and claims priority under 35 USC 119 from Japanese Patent Application No. 2024-018681 filed on Feb. 9, 2024, the entire content of which is incorporated herein by reference.

TECHNICAL FIELD

[0002] The present disclosure relates to a front structure of a vehicle.

BACKGROUND ART

[0003] WO2012/153601A1 describes a front structure of a vehicle body that is arranged on a front surface side of a radiator to support the radiator, that is, a so-called radiator support. The front structure of a vehicle body includes an upper extending in a vehicle width direction and a lower extending in the vehicle width direction below the upper. A pair of sides extending in an upper-lower direction of the vehicle body are each coupled to an end of the upper and an end of the lower in the vehicle width direction.

[0004] The upper is provided with, for example, a locking structure portion of a hood that opens and closes an engine room of a vehicle.

[0005] The radiator is attached to the pair of sides.

[0006] The front structure of a vehicle body further includes a center stay that extends in the upper-lower direction and couples the upper and the lower, and a pair of side stays that extend in directions intersecting both the vehicle width direction and the upper-lower direction and couple the upper and the sides.

[0007] The front structure of a vehicle body is integrally molded from a fiber reinforced resin. Accordingly, a strength desired for the radiator support is ensured.

[0008] According to such a front structure of a vehicle body, a strength of the front structure of a vehicle body, particularly the upper, in the upper-lower direction is increased by the center stay and the pair of side stays. Accordingly, it is possible to provide the front structure of a vehicle body with a strength that can withstand a strong load acting in the upper-lower direction when the hood is closed, for example.

[0009] However, such a front structure has a problem that a structure is complicated due to the provision of the center stay and the side stays. Therefore, it is desired to increase the strength of the front structure with a simple configuration.

SUMMARY OF INVENTION

[0010] An aspect of the present disclosure will be described.

[0011] (1) The aspect of the present disclosure provides a front structure of a vehicle, which is made of a fiber reinforced resin and integrally molded by injection molding, [0012] the front structure constituting a part of a front portion of a vehicle body of the vehicle, and having a main body portion that includes: [0013] when a width direction and an upper-lower direction of the vehicle are referred to as a vehicle width direction and an upper-lower direction, and an upper side and a lower side in the upper-lower direction are simply referred to as an upper side and a lower side, [0014] a pair of side portions that are provided at an interval in the vehicle width direction, and extend in the upper-lower direction; [0015] an upper portion that extends in the vehicle width direction, and couples end portions on the upper side of the pair of side portions; and [0016] a pair of stay portions that extend from respective end portions on the lower side of the pair of side portions in respective directions intersecting both the vehicle width direction and the upper-lower direction, and are connected to the upper portion, [0017] in which an end edge on the lower side of the pair of stay portions constitutes a part of an outer peripheral edge of the front structure, and [0018] at least one of the side portions, the upper portion, or the stay portions has an uneven

portion extending along a direction in which the portion extends.
[0019] When the front structure is integrally molded by the injection molding, a fountain flow phenomenon, in which the molten resin bubbles up and flows toward the molding surface sides of a mold, occurs at a front end portion in a flow direction of a molten resin flowing in a cavity of the mold. Therefore, fibers in the molten resin move along a surface of the above-described front end portion and flow toward the molding surface sides of the mold. Accordingly, in skin layers on the molding surface sides that are formed by cooling and solidifying the molten resin filled in the cavity earlier than a central portion (a core layer) of the molten resin filled in the cavity, orientations of the fibers are easily aligned in the flow direction. Since a strength of the fiber reinforced resin is increased in the direction in which the orientations of the fibers are aligned, a strength of the front structure is increased by the above-described skin layers.
[0020] Here, according to the above-described configuration, a surface area of the main body portion of the front structure is increased by the uneven portion. Accordingly, an area of the skin layers is increased. As a result, the strength of the front structure can be further increased.
[0021] Further, according to the above-described configuration, the end edge on the lower side of the pair of stay portions constitutes a part of the outer peripheral edge of the front structure. In other words, the front structure does not include the lower portion, described in WO2012/153601A1, which couples the end portions on the lower side of the pair of side portions and extends in the vehicle width direction. Even in this case, if the uneven portion is formed on the main body portion, the strength of the front structure is increased by the above-described operations, and therefore, the front structure has a sufficient strength to serve as a component constituting a part of the front portion of the vehicle body.
[0022] Therefore, the strength can be increased with a simple configuration.
[0023] (2) In the front structure of the aspect, the uneven portion is provided continuously over all of the pair of side portions, the upper portion, and the pair of stay portions.
[0024] According to the above-described configuration, the area of the skin layers can be increased over the entire main body portion. Therefore, the strength of the front structure can be further increased.
[0025] (3) In the front structure of the aspect, when a front-rear direction of the vehicle is referred to as a front-rear direction, and a front side and a rear side in the front-rear direction are simply referred to as a front side and a rear side, [0026] the main body portion includes: [0027] a pair of side wall portions that extend in the front-rear direction, and are arranged at an interval from each other; and [0028] a bottom wall portion that couples end portions on the rear side of the pair of side wall portions, [0029] the uneven portion is a ridge portion provided on the bottom wall portion and protruding toward the front side, and [0030] a groove portion is provided on a rear surface of the bottom wall portion, the groove portion extending along the ridge portion and opening to the rear side.
[0031] According to the above-described configuration, a size of the front structure in the front-rear direction can be reduced as compared with a case in which the uneven portion is a ridge portion that protrudes towards the rear side from the bottom wall portion of the main body portion.
[0032] (4) In the front structure of the aspect, a restricting portion is provided on the rear surface of the bottom wall portion, the restricting portion extending in a direction intersecting a direction in which the groove portion extends and facing a bottom surface of the groove portion.
[0033] According to the above-described configuration, a part of an elongated member such as a wire harness, a washer hose, or a hood lock wire routed in the front portion of the vehicle can be accommodated in the groove portion. Further, since the elongated member is surrounded in the groove portion made of a resin, a protective material such as a corrugated metal that protects the elongated member can be eliminated.
[0034] According to the above-described configuration, the restricting portion, which faces the bottom surface of the groove portion, is provided on the rear surface of the bottom wall portion.

Therefore, the elongated member accommodated in the groove portion is restricted from moving toward the rear side from the groove portion. Therefore, the elongated member can be prevented from falling off from the groove portion.

[0035] (5) In the front structure of the aspect, a gate mark is formed on the main body portion, the gate mark being a mark of a gate used when the front structure is injection-molded, and [0036] the gate mark is formed on a portion different from the uneven portion.

[0037] When the front structure is integrally molded by the injection molding, since the flow direction of the molten resin flowing in the cavity is not fixed to one direction near the gate, the orientations of the fibers in the skin layers are difficult to be aligned in the same direction. Therefore, when the gate mark is formed on the uneven portion, it is difficult to increase the strength by the uneven portion.

[0038] In this regard, according to the above-described configuration, the gate mark is formed on a portion of the main body portion different from the uneven portion. Therefore, a strength of the main body portion can be suitably increased by the uneven portion.

[0039] (6) In the front structure of the aspect, the main body portion has a shape being symmetrical with respect to a virtual plane that passes through a central portion of the upper portion in the vehicle width direction and is orthogonal to the vehicle width direction, and [0040] the gate mark is located at the central portion.

[0041] According to such a configuration, when the front structure is integrally molded by the injection molding, the cavity is filled with the molten resin from the gate located at the central portion. Here, the main body portion of the front structure has a shape that is symmetrical with respect to the virtual plane. Therefore, the molten resin in the cavity easily flows along a certain flow direction, such as flowing outward in the vehicle width direction from the central portion in the cavity for molding the upper portion and then flowing into the cavity for molding the side portion and the stay portion. Accordingly, in the skin layers, the orientations of the fibers are easily aligned in the above-described flow direction. Therefore, the strength of the front structure can be further increased.

[0042] (7) In the front structure of the aspect, the uneven portion is provided on the upper portion and the pair of stay portions, [0043] the main body portion has a weld portion formed by molten resins colliding with each other when the front structure is integrally molded by the injection molding, and [0044] the weld portion is formed only on the side portion.

[0045] Since the upper portion and the pair of stay portions each have a component extending in the vehicle width direction, a load in the vehicle width direction is likely to act on the upper portion and the pair of stay portions when the vehicle body is twisted during turning or the like of the vehicle. Therefore, the upper portion and the stay portions are each required to have a strength capable of withstanding the above-described load.

[0046] Meanwhile, when the front structure is integrally molded by the injection molding, the weld portions are formed on the front structure by the molten resins branched in the cavity colliding with each other. In the weld portions, orientation directions of the fibers are changed by changing the flow direction due to the collision. Therefore, the fibers are oriented in a direction intersecting the flow direction of the molten resin flowing in the cavity. Accordingly, a strength of each of the weld portions is likely to be lower than that of other portions.

[0047] In this regard, according to the above-described configuration, the weld portions are formed only on the respective side portions. Therefore, the strength of each of the upper portion and the pair of stay portions is not reduced by the weld portions. Further, since the uneven portion is formed on the upper portion and the pair of stay portions, the strength of each of the upper portion and the pair of stay portions is increased by the uneven portion.

[0048] Therefore, the strength of the front structure can be further increased.

[0049] According to the aspects of the present disclosure, the strength can be increased with a simple configuration.

Description

BRIEF DESCRIPTION OF DRAWINGS

[0050] Exemplary embodiment(s) of the present invention will be described in detail based on the following figures, wherein:

[0051] FIG. **1** is a perspective view illustrating a front portion of a vehicle equipped with a front structure according to an embodiment;

[0052] FIG. **2** is a rear view illustrating the front structure in FIG. **1**;

[0053] FIG. **3** is a cross-sectional view taken along a line **3-3** in FIG. **2**;

[0054] FIG. **4** is a schematic view illustrating orientations of fibers in skin layers and a core layer; and

[0055] FIG. **5** is a schematic view illustrating orientations of fibers in a skin layer including a weld portion.

DESCRIPTION OF EMBODIMENTS

[0056] Hereinafter, an embodiment of a front structure of a vehicle will be described with reference to FIGS. **1** to **5**. In the present embodiment, the present invention is embodied as a front structure **22** of an automobile **10**.

[0057] Hereinafter, a front-rear direction of the automobile **10** is referred to as a front-rear direction X, and a front side and a rear side in the front-rear direction X are simply referred to as a front side and a rear side. Further, a vehicle width direction of the automobile **10** is described as a vehicle width direction W. In addition, an upper-lower direction of the automobile **10** at the time when the automobile **10** is located on a horizontal plane is referred to as an upper-lower direction Z, and an upper side and a lower side in the upper-lower direction Z are simply referred to as an upper side and a lower side.

Front Structure **22**

[0058] As illustrated in FIG. **1**, a front portion **11** of the automobile **10** is provided with an exterior member **13** integrally constituting an outer shell of a portion of the front portion **11** below a pair of headlights **12**.

[0059] A front structure **22**, which is attached to front ends of a pair of front side members (not illustrated) of a vehicle body **20** and constitutes a part of a front portion **21** of the vehicle body **20**, is provided on a rear side of the exterior member **13**.

[0060] The front structure **22** is made of a fiber reinforced resin and is integrally molded by injection molding. As the fiber reinforced resin, for example, a glass fiber reinforced resin obtained by mixing a glass fiber in a polyethylene resin can be used.

(Main Body Portion **23**)

[0061] As illustrated in FIG. **2**, the front structure **22** includes a main body portion **23** including a pair of side portions **24**A and **24**B, an upper portion **25**, and a pair of stay portions **26**A and **26**B.

[0062] The pair of side portions **24**A and **24**B are portions that are provided at an interval in the vehicle width direction W and extend in the upper-lower direction Z.

[0063] The upper portion **25** is a portion that extends in the vehicle width direction W and couples end portions on the upper side of the pair of side portions **24**A and **24**B.

[0064] The stay portion **26**A is a portion that extends from an end portion on the lower side of the side portion **24**A in a direction intersecting both the vehicle width direction W and the upper-lower direction Z and is connected to the upper portion **25**.

[0065] The stay portion **26**B is a portion that extends from an end portion on the lower side of the side portion **24**B in a direction intersecting both the vehicle width direction W and the upper-lower direction Z and is connected to the upper portion **25**.

[0066] The pair of stay portions **26**A and **26**B, as a whole, constitute an arch portion **26** that extends in a curved shape such that a central portion in the vehicle width direction W protrudes

toward the upper side.
[0067] An end edge **26***a* on the upper side of the arch portion **26** is connected to an end edge **25***a* on the lower side of the upper portion **25** at a central portion of the upper portion **25** in the vehicle width direction W.
[0068] An end edge **26***b* on the lower side of the arch portion **26** constitutes a part of an outer peripheral edge **22***a* of the front structure **22**.
[0069] The main body portion **23** has a shape that is symmetrical with respect to a virtual plane V that passes through the central portion of the upper portion **25** in the vehicle width direction W and is orthogonal to the vehicle width direction W.
(Side Wall Portion **31** and Bottom Wall Portion **32**)
[0070] As illustrated in FIGS. **2** and **3**, the main body portion **23** includes a pair of side wall portions **31** and a bottom wall portion **32**.
[0071] The pair of side wall portions **31** extend in the front-rear direction X and are arranged at an interval from each other in a direction orthogonal to both the front-rear direction X and an extending direction in which the portions **24**A, **24**B, **25**, and **26** of the main body portion **23** extend (see FIG. **2**).
[0072] The bottom wall portion **32** couples end portions on the rear side of the pair of side wall portions **31** (see FIG. **3**).
[0073] A ridge portion **33**, which protrudes toward the front side, is formed on the bottom wall portion **32**. A groove portion **34**, which opens to the rear side, is formed on a rear surface **32***b* of the bottom wall portion **32**. The groove portion **34** is a portion that is formed inextricably with the ridge portion **33**.
[0074] As illustrated in FIG. **2**, the ridge portion **33** extends along the extending direction in which the portions **24**A, **24**B, **25**, and **26** of the main body portion **23** extend. The ridge portion **33** is formed continuously over all of the portions **24**A, **24**B, **25**, and **26** of the main body portion **23**, that is, over the entire main body portion **23**.
[0075] The groove portion **34** is configured such that a part of an elongated member routed in the front portion **11** of the automobile **10** can be accommodated therein. FIG. **3** illustrates, by a two-dot chain line, a wire harness **14** as an example of the elongated member. Examples of the elongated member include a washer hose and a hood lock wire in addition to the wire harness.
[0076] As illustrated in FIGS. **2** and **3**, restricting portions **35** are provided on the rear surface **32***b* of the bottom wall portion **32**. In the present embodiment, the pair of restricting portions **35** are provided on the upper portion **25** at an interval in the vehicle width direction W (see FIG. **2**).
[0077] As illustrated in FIG. **3**, the restricting portions **35** each include a base end portion **35***a* protruding towards the rear side from the rear surface **32***b*, and a facing wall portion **35***b* extending from the base end portion **35***a* in a direction (in the present embodiment, the upper-lower direction Z) intersecting an extending direction in which the groove portion **34** extends. The facing wall portion **35***b* faces a bottom surface **34***a* of the groove portion **34** in the front-rear direction X.
(Gate Mark **41** and Weld Portion **42**)
[0078] As illustrated in FIG. **2**, the main body portion **23** has a gate mark **41** that is a mark of a gate used when the front structure **22** is injection-molded, and weld portions **42** that is formed by molten resins colliding with each other.
[0079] The gate mark **41** is located at a central portion in the vehicle width direction W of the bottom wall portion **32** of the upper portion **25**. The gate mark **41** is formed on a portion different from the ridge portion **33**.
[0080] In the present embodiment, each of the weld portions **42** is formed only on a respective one of the pair of side portions **24**A and **24**B. Each of the weld portions **42** is formed on one location of each of the side portions **24**A and **24**B. The weld portions **42** extend in a direction (in the present embodiment, the vehicle width direction W) intersecting the direction in which the groove portion **34** extends.

(Skin Layer **51** and Core Layer **52**)

[0081] As illustrated in FIG. **4**, the pair of side wall portions **31** and the bottom wall portion **32** each include a pair of skin layers **51** and a core layer **52** arranged between the pair of skin layers **51**. FIG. **4** illustrates the skin layers **51** and the core layer **52** in the bottom wall portion **32**.

[0082] The skin layers **51** are portions on molding surface sides that are formed by cooling and solidifying the molten resin in a cavity earlier than a central portion (the core layer **52**) of the molten resin in the cavity when the front structure **22** is integrally molded by injection molding.

[0083] In the pair of skin layers **51**, orientations of fibers **53** are aligned with a flow

[0084] direction R of the molten resin flowing in the cavity (in the present embodiment, the extending direction of the portions **24**A, **24**B, **25**, and **26** of the main body portion **23**) as compared with that in the core layer **52**.

[0085] As illustrated in FIG. **5**, in the skin layer **51** in the weld portion **42**, orientations of the fibers **53** are aligned in a direction (in the present embodiment, the vehicle width direction W) intersecting the above-described flow direction R.

Operations of Present Embodiment

[0086] Next, the operations of the present embodiment will be described.

[0087] When the front structure **22** is integrally molded by the injection molding, a fountain flow phenomenon, in which the molten resin bubbles up and flows toward the molding surface sides of a mold, occurs at a front end portion in the flow direction R of the molten resin flowing in the cavity of the mold. Therefore, the fibers **53** in the molten resin move along a surface of the above-described front end portion and flow toward the molding surface sides of the mold. Accordingly, as illustrated in FIG. **4**, in the skin layers **51** on the molding surface sides that are formed by cooling and solidifying the molten resin filled in the cavity earlier than the central portion (the core layer **52**) of the molten resin filled in the cavity, the orientations of the fibers **53** are easily aligned in the flow direction R (the extending direction of the portions **24**A, **24**B, **25**, and **26**). Since a strength of the fiber reinforced resin is increased in the direction in which the orientations of the fibers **53** are aligned, a strength of the front structure **22** is increased by the above-described skin layers **51**.

[0088] Here, according to the above-described configuration, a surface area of the main body portion **23** of the front structure **22** is increased by the ridge portion **33**. Accordingly, an area of the skin layers **51** is increased. As a result, the strength of the front structure **22** can be further increased.

[0089] Further, according to the above-described configuration, the end edge **26***b* on the lower side of the arch portion **26** constitutes a part of the outer peripheral edge **22***a* of the front structure **22**. In other words, the front structure **22** does not include a lower portion described in WO2012/153601A1 that couples the end portions on the lower side of the pair of side portions **24**A and **24**B and extends in the vehicle width direction W. Even in this case, if the ridge portion **33** is formed on the main body portion **23**, the strength of the front structure **22** is increased by the above-described operations, and therefore, the front structure **22** has a sufficient strength to serve as a component constituting a part of the front portion **21** of the vehicle body **20**.

Effects of Present Embodiment

[0090] Next, the effects of the present embodiment will be described.

[0091] (1) The front structure **22** includes a main body portion **23** including the pair of side portions **24**A and **24**B that are provided at the interval in the vehicle width direction W and extend in the upper-lower direction Z, the upper portion **25** that extends in the vehicle width direction W and couples end portions on the upper side of the pair of side portions **24**A and **24**B, and the pair of stay portions **26**A and **26**B that extend from the respective end portions on the lower side of the pair of side portions **24**A and **24**B in the respective directions intersecting both the vehicle width direction W and the upper-lower direction Z and are connected to the upper portion **25**. The end edge **26***b* on the lower side of the pair of stay portions **26**A and **26**B constitutes a part of the outer peripheral edge **22***a* of the front structure **22**. The pair of side portions **24**A and **24**B, the upper

portion **25**, and the pair of stay portions **26**A and **26**B have the ridge portion **33** serving as an uneven portion extending along the extending directions of these portions.
[0092] According to such a configuration, the above-described operations are implemented.
[0093] Therefore, the strength of the front structure **22** can be increased with a simple configuration.
[0094] (2) The ridge portion **33** serving as the uneven portion is formed continuously over all of the pair of side portions **24**A and **24**B, the upper portion **25**, and the pair of stay portions **26**A and **26**B.
[0095] According to such a configuration, the area of the skin layers **51** can be increased over the entire main body portion **23**. Therefore, the strength of the front structure **22** can be further increased.
[0096] (3) The main body portion **23** includes the pair of side wall portions **31** that extend in the front-rear direction X and are arranged at the interval from each other, and the bottom wall portion **32** that couples the end portions on the rear side of the pair of side wall portions **31**. The ridge portion **33** serving as the uneven portion is formed on the bottom wall portion **32** and protrudes toward the front side. The groove portion **34**, which extends along the ridge portion **33** and opens to the rear side, is formed on the rear surface **32***b* of the bottom wall portion **32**.
[0097] According to such a configuration, a size of the front structure **22** in the front-rear direction X can be reduced as compared with a case in which the ridge portion **33** is a ridge portion that protrudes towards the rear side from the bottom wall portion **32** of the main body portion **23**.
[0098] (4) The restricting portion **35**, which extends in the direction (in the present embodiment, the upper-lower direction Z) intersecting the direction in which the groove portion **34** extends and faces the bottom surface **34***a* of the groove portion **34** in the front-rear direction X, is provided on the rear surface **32***b* of the bottom wall portion **32**.
[0099] According to such a configuration, a part of the wire harness **14** routed in the front portion **11** of the automobile **10** can be accommodated in the groove portion **34**. Since the wire harness **14** is surrounded in a groove portion made of a resin, a protective material such as a corrugated metal that is normally provided to protect the wire harness **14** can be eliminated.
[0100] According to the above-described configuration, the restricting portion **35**, which faces the bottom surface **34***a* of the groove portion **34**, is provided on the rear surface **32***b* of the bottom wall portion **32**. Therefore, the wire harness **14** accommodated in the groove portion **34** is restricted from moving toward the rear side from the groove portion **34**. Therefore, the wire harness **14** can be prevented from falling off from the groove portion **34**.
[0101] (5) A gate mark **41**, which is the mark of the gate used when the front structure **22** is
[0102] injection-molded, is formed on the main body portion **23**. The gate mark **41** is formed on a portion different from the ridge portion **33**.
[0103] When the front structure **22** is integrally molded by the injection molding, since the flow direction R of the molten resin flowing in the cavity is not fixed to one direction near the gate, the orientations of the fibers **53** in the skin layers **51** are difficult to be aligned in the same direction. Therefore, when the gate mark **41** is formed on the ridge portion **33**, it is difficult to increase the strength by the ridge portion **33**.
[0104] In this regard, according to the above-described configuration, the gate mark **41** is formed on a portion of the main body portion **23** different from the ridge portion **33**. Therefore, a strength of the main body portion **23** can be suitably increased by the ridge portion **33**.
[0105] (6) The main body portion **23** has the shape being symmetrical with respect to the virtual plane V that passes through the central portion of the upper portion **25** in the vehicle width direction W and is orthogonal to the vehicle width direction W. The gate mark **41** is located at the above-described central portion.
[0106] According to such a configuration, when the front structure **22** is integrally molded by the injection molding, the cavity is filled with the molten resin from the gate located at the above-described central portion. Here, the main body portion **23** of the front structure **22** has the shape

that is symmetrical with respect to the virtual plane V. Therefore, the molten resin in the cavity easily flows along the certain flow direction R, such as flowing outward in the vehicle width direction W from the central portion in the cavity for molding the upper portion **25** and then flowing into the cavity for molding the side portion **24**A (**24**B) and the stay portion **26**A (**26**B). Accordingly, in the skin layers **51**, the orientations of the fibers **53** are easily aligned in the above-described flow direction R. Therefore, the strength of the front structure **22** can be further increased.

[0107] (7) The ridge portion **33** is formed on the upper portion **25** and the pair of stay portions **26**A and **26**B. The main body portion **23** has the weld portion **42** formed by molten resins colliding with each other when the front structure **22** is integrally molded by the injection molding. The weld portion **42** is formed only on the pair of side portions **24**A and **24**B.

[0108] Since the upper portion **25** and the pair of stay portions **26**A and **26**B each have a component extending in the vehicle width direction W, a load in the vehicle width direction W is likely to act on the upper portion **25** and the pair of stay portions **26**A and **26**B when the vehicle body **20** is twisted during turning or the like of the automobile **10**. Therefore, the upper portion **25** and the stay portions **26**A and **26**B are each required to have a strength capable of withstanding the above-described load.

[0109] Meanwhile, when the front structure **22** is integrally molded by the injection molding, the weld portion **42** is formed on the front structure **22** by the molten resins branched in the cavity colliding with each other. In the weld portion **42**, orientation directions of the fibers **53** are changed by changing the flow direction R (in the present embodiment, the upper-lower direction Z, which is the direction in which the side portions **24***a* and **24**B extend) due to the collision. Therefore, as illustrated in FIG. **5**, the fibers **53** are oriented in the direction (in the present embodiment, the vehicle width direction W) intersecting the flow direction R of the molten resin flowing in the cavity. Accordingly, a strength of the weld portion **42** is likely to be lower than that of other portions.

[0110] In this regard, according to the above-described configuration, the weld portions **42** is formed only on the pair of side portions **24**A and **24**B. Therefore, the strength of the upper portion **25** and the pair of stay portions **26**A and **26**B is not reduced by the weld portion **42**. Further, since the ridge portion **33** is formed on the upper portion **25** and the pair of stay portions **26**A and **26**B, the strength of the upper portion **25** and the pair of stay portions **26**A and **26**B is increased by the ridge portion **33**.

[0111] Therefore, the strength of the front structure **22** can be further increased.

Modifications

[0112] The present embodiment can be modified and implemented as follows. The present embodiment and the following modifications can be combined with each other and implemented without technical contradiction.

[0113] The front structure **22** is not limited to the one in which the gate mark **41** is formed at a position exemplified in the present embodiment, and the arrangement and the number of the gate marks **41** may be appropriately changed as long as the weld portion **42** is formed only on the pair of side portions **24**A and **24**B. For example, in the front structure **22**, the plurality of gate marks **41** may be arranged at intervals from each other along the direction in which the portions of the main body portion **23** extend.

[0114] The front structure **22** is not limited to the one in which the weld portions **42** is formed only on the pair of side portions **24**A and **24**B as exemplified in the present embodiment, and the weld portion **42** may be formed on the upper portion **25** or the arch portion **26**. According to such a configuration, when the front structure **22** is integrally molded by the injection molding, a degree of freedom in forming the gate is improved.

[0115] In the front structure **22**, the gate mark **41** may be located on the ridge portion **33**.

[0116] The present embodiment exemplifies the one in which the pair of stay portions **26**A and

26B, as a whole, constitute the arch portion **26**, but the pair of stay portions **26**A and **26**B may be provided independently of each other. More specifically, the stay portion **26**A and the stay portion **26**B are not limited to being connected to the upper portion **25** at the central portion of the upper portion **25** in the vehicle width direction W, and may be connected to the upper portion **25** at positions separated from each other in the vehicle width direction W. In this case, it is sufficient that the ridge portions **33** formed on the pair of stay portions **26**A and **26**B are connected to the ridge portion **33** formed on the upper portion **25**.

[0117] The main body portion **23** is not limited to having the shape that is symmetrical with respect to the virtual plane V, and may have a shape that is asymmetrical with respect to the virtual plane V as long as the main body portion **23** includes the pair of side portions **24**A and **24**B, the upper portion **25**, and the pair of stay portions **26**A and **26**B.

[0118] The arrangement and the number of the restricting portions **35** are not limited to those exemplified in the present embodiment, and may be appropriately changed according to types, the number, positions, and the like of the elongated members routed in the groove portion **34**. For example, the restricting portion **35** may be provided on each of the pair of side portions **24**A and **24**B or each of the pair of stay portions **26**A and **26**B. The number of the restricting portions **35** may be one, or may be three or more. Further, the restricting portion **35** may be omitted.

[0119] The front structure **22** is not limited to the one in which the ridge portion **33** is formed only on the bottom wall portion **32** as exemplified in the present embodiment, and for example, the ridge portion **33** may be formed on at least one of the pair of side wall portions **31**.

[0120] The ridge portion **33** may not extend continuously over the entire main body portion **23**. That is, in the front structure **22**, a plurality of ridge portions **33** may be arranged at intervals along the direction in which the portions **24**A, **24**B, **25**, **26**A, and **26**B of the main body portion **23** extend.

[0121] The ridge portion **33** is not limited to being formed on all portions of the pair of side portions **24**A and **24**B, the upper portion **25**, and the pair of stay portions **26**A and **26**B as exemplified in the present embodiment. That is, in the front structure **22**, it is sufficient that the ridge portion **33** is formed on at least one of the side portion **24**A, the side portion **24**B, the upper portion **25**, the stay portion **26**A, and the stay portion **26**B.

[0122] The uneven portion according to the present invention is not limited to the ridge portion **33** exemplified in the present embodiment. For example, the uneven portion may be a ridge portion that protrudes towards the rear side from the rear surface **32***b* of the bottom wall portion **32**. In this case, a groove portion, which extends along the above-described ridge portion and opens to the front side, is formed on a front surface **32***a* of the bottom wall portion **32**.

[0123] The front structure **22** may support the headlights **12** and the exterior member **13**, or may be disposed in the front side of a radiator to support the radiator.

[0124] The upper portion **25** of the front structure **22** may be provided with a hood lock.

[0125] The front structure according to the present invention is not limited to the front structure **22** of the automobile **10**, and the present invention can be applied to any front structure that constitutes a part of a front portion of a vehicle body in a vehicle.

Claims

1. A front structure of a vehicle, which is made of a fiber reinforced resin and integrally molded by injection molding, the front structure constituting a part of a front portion of a vehicle body of the vehicle, and comprising a main body portion that includes: when a width direction and an upper-lower direction of the vehicle are referred to as a vehicle width direction and an upper-lower direction, and an upper side and a lower side in the upper-lower direction are simply referred to as an upper side and a lower side, a pair of side portions that are provided at an interval in the vehicle width direction, and extend in the upper-lower direction; an upper portion that extends in the

vehicle width direction, and couples end portions on the upper side of the pair of side portions; and a pair of stay portions that extend from respective end portions on the lower side of the pair of side portions in respective directions intersecting both the vehicle width direction and the upper-lower direction, and are connected to the upper portion, wherein an end edge on the lower side of the pair of stay portions constitutes a part of an outer peripheral edge of the front structure, and at least one of the side portions, the upper portion, or the stay portions has an uneven portion extending along a direction in which the portion extends.

2. The front structure according to claim 1, wherein the uneven portion is provided continuously over all of the pair of side portions, the upper portion, and the pair of stay portions.

3. The front structure according to claims 1, wherein when a front-rear direction of the vehicle is referred to as a front-rear direction, and a front side and a rear side in the front-rear direction are simply referred to as a front side and a rear side, the main body portion includes: a pair of side wall portions that extend in the front-rear direction, and are arranged at an interval from each other; and a bottom wall portion that couples end portions on the rear side of the pair of side wall portions, the uneven portion is a ridge portion provided on the bottom wall portion and protruding toward the front side, and a groove portion is provided on a rear surface of the bottom wall portion, the groove portion extending along the ridge portion and opening to the rear side.

4. The front structure according to claim 3, wherein a restricting portion is provided on the rear surface of the bottom wall portion, the restricting portion extending in a direction intersecting a direction in which the groove portion extends and facing a bottom surface of the groove portion.

5. The front structure according to claim 1, wherein a gate mark is formed on the main body portion, the gate mark being a mark of a gate used when the front structure is injection-molded, and the gate mark is formed on a portion different from the uneven portion.

6. The front structure according to claim 5, wherein the main body portion has a shape being symmetrical with respect to a virtual plane that passes through a central portion of the upper portion in the vehicle width direction and is orthogonal to the vehicle width direction, and the gate mark is located at the central portion.

7. The front structure according to claim 6, wherein the uneven portion is provided on the upper portion and the pair of stay portions, the main body portion has a weld portion formed by molten resins colliding with each other when the front structure is integrally molded by the injection molding, and the weld portion is formed only on the side portion.