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Temperature sensor and wire harness

Abstract

A temperature sensor applied to a wire harness includes a temperature-sensitive element, a main body part that holds the temperature-sensitive element, a clamp part, and a connector. The main body part includes a holding part that holds the temperature-sensitive element on the tip side in an insertion direction and is positioned inside the clamp part by being inserted into the clamp part along that direction. The clamp part includes a pair of window parts that allow the temperature-sensitive element to be exposed to outside of the clamp part. Furthermore, the holding part includes a pair of protection wall parts positioned by sandwiching a window part in a state of being inserted into the clamp part. An end part of the wall part on a tip side in the insertion direction is positioned by protruding more than an end part of the temperature-sensitive element on the tip side does.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATION(S)

(1) The present application claims priority to and incorporates by reference the entire contents of Japanese Patent Application No. 2022-069862 filed in Japan on Apr. 21, 2022.

BACKGROUND OF THE INVENTION

1. Field of the Invention

(2) The present invention relates to a temperature sensor and a wire harness.

2. Description of the Related Art

(3) For example, Japanese Patent Application Laid-open No. 2010-281787A discloses a temperature sensor with simplified fixing function, which is configured with a mounting clamp inserted and fixed through a through-hole of a mounting target, and a thermistor element embedded

near a tip inside the mounting clamp. The temperature sensor with simplified fixing function is formed compact and can be easily attached to a mounting target by integrally molding the thermistor element, terminals, and lead wires or the like connected to the terminals embedded in the clamp.

(4) Such a temperature sensor with simplified fixing function described above may have each part separately molded considering versatility such as mountability and maintainability after mounting. In such a case, a temperature-sensitive element such as a thermistor element needs to be mounted to the clamp, and it is desired to have a configuration capable of properly protecting the temperature-sensitive element until the temperature-sensitive element is mounted to the clamp.

SUMMARY OF THE INVENTION

(5) The present invention is designed in view of the aforementioned circumstances, and an object thereof is to provide a temperature sensor and a wire harness capable of properly protecting a temperature-sensitive element.

(6) In order to achieve the above mentioned object, a temperature sensor according to one aspect of the present invention includes a temperature-sensitive element that detects a temperature of a measurement target; a main body part that holds the temperature-sensitive element; a clamp part that is capable of being attached to and detached from a fixing target area along a first direction and capable of fixing the main body part to the fixing target area in a state of being mounted to the fixing target area; and a connector that is provided at an end part of a wiring material exhibiting conductivity and allows, in a state of being fitted to the main body part, the temperature-sensitive element and the wiring material to be electrically connected, wherein the main body part includes: a holding part that extends along an insertion direction aligned with the first direction, the holding part holding the temperature-sensitive element on a tip side in the insertion direction and being positioned inside the clamp part by being inserted inside the clamp part along the insertion direction; and a connector part to which the connector is capable of being fitted in a state of being fixed to the fixing target area via the clamp part, the clamp part includes, in a state of being mounted to the fixing target area, a pair of window parts for exposing the temperature-sensitive element held by the holding part to outside of the clamp part, the pair of window parts being provided at end parts positioned inside the fixing target area and being formed along a direction intersecting with the first direction, the holding part includes a pair of protection wall parts positioned by sandwiching the window parts in a state of being inserted inside the clamp part, and an end part of the protection wall part on a tip side in the insertion direction is positioned by protruding more to the tip side than an end part of the temperature-sensitive element on the tip side does.

(7) In order to achieve the above mentioned object, a wire harness according to another aspect of the present invention includes a wiring material exhibiting conductivity; and a temperature sensor that includes: a temperature-sensitive element that detects a temperature of a measurement target; a main body part that holds the temperature-sensitive element; a clamp part that is capable of being attached to and detached from a fixing target area along a first direction and capable of fixing the main body part to the fixing target area in a state of being mounted to the fixing target area; and a connector that is provided at an end part of a wiring material exhibiting conductivity and allows, in a state of being fitted to the main body part, the temperature-sensitive element and the wiring material to be electrically connected, wherein the main body part includes: a holding part that extends along an insertion direction aligned with the first direction, the holding part holding the temperature-sensitive element on a tip side in the insertion direction and being positioned inside the clamp part by being inserted inside the clamp part along the insertion direction; and a connector part to which the connector is capable of being fitted in a state of being fixed to the fixing target area via the clamp part, the clamp part includes, in a state of being mounted to the fixing target area, a pair of window parts for exposing the temperature-sensitive element held by the holding part to outside of the clamp part, the pair of window parts being provided at end parts positioned

inside the fixing target area and being formed along a direction intersecting with the first direction, the holding part includes a pair of protection wall parts positioned by sandwiching the window parts in a state of being inserted inside the clamp part, and an end part of the protection wall part on a tip side in the insertion direction is positioned by protruding more to the tip side than an end part of the temperature-sensitive element on the tip side does.

(8) The above and other objects, features, advantages and technical and industrial significance of this invention will be better understood by reading the following detailed description of presently preferred embodiments of the invention, when considered in connection with the accompanying drawings.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) FIG. 1 is a perspective view illustrating a schematic configuration of a wire harness including a temperature sensor according to an embodiment;

(2) FIG. 2 is an exploded perspective view illustrating a schematic configuration of the wire harness including the temperature sensor according to the embodiment;

(3) FIG. 3 is an exploded front view illustrating a schematic configuration of the wire harness including the temperature sensor according to the embodiment;

(4) FIG. 4 is a front view illustrating a schematic configuration of the wire harness including the temperature sensor according to a first embodiment;

(5) FIG. 5 is a side view illustrating a schematic configuration of the wire harness including the temperature sensor according to the first embodiment; and

(6) FIG. 6 is a sectional side view taken along a fitting direction of the wire harness including the temperature sensor according to the first embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

(7) Hereinafter, an embodiment according to the present invention will be described in detail with reference to the accompanying drawings. Note, however, that the present invention is not limited by the embodiment. Furthermore, structural components in the following embodiment include those that can be easily replaced by those skilled in the art, or those that are substantially the same. First Embodiment

(8) A wire harness WH illustrated in FIG. 1 and FIG. 2 is a bundle of a plurality of wiring materials W used for power supply and signal communication formed into an assembly component so as to connect the wiring materials W to each device via a connector and the like for connecting each of the devices loaded on a vehicle, for example.

(9) The wire harness WH includes: a wiring material WT with terminal, which includes the wiring material W exhibiting conductivity and a terminal T provided at an end part of the wiring material W; and a temperature sensor 1 connected to the wiring material WT with terminal. In addition, the wire harness WH may further include various structural components such as a corrugated tube, a grommet, an electrical junction box, a connector, and the like.

(10) The wiring material W is, for example, an insulated electric wire with the core wire, which is a bundle of a plurality of conductive metal element wires, covered with an insulation coating part. The wiring material W may also be a bundle of a plurality of insulated electric wires. Note that the wiring material W may be an insulated metal rod, which is a conductive metal rod covered with an insulation coating part.

(11) The terminal T (see FIG. 6) is, for example, a crimp terminal that is configured with a conductive metallic material and crimped to the terminal of the wiring material W. For example, the terminal T is formed into a prescribed shape by performing pressing such as bending and cutting on a metal plate that is a base material. The terminal T provided at an end part of the wiring

material W is housed and held in a connector **300** to be described later.

(12) The temperature sensor **1** includes a main body part **100**, a clamp part **200**, and the connector **300**. The temperature sensor **1** can electrically connect a temperature-sensitive element E and the wiring material W by fitting the connector **300** that holds the terminal T of the wiring material WT with terminal to the main body part **100** that holds the temperature-sensitive element E that detects the temperature of a measurement target. The temperature sensor **1** is, for example, applied to an air duct used for a battery pack or the like. For example, battery packs loaded on electric vehicles and hybrid vehicles generate heat through electrochemical reactions, and the higher the temperature, the lower the power generation efficiency. Therefore, the air duct needs to blow cooling air as necessary to cool the battery pack, and the temperature sensor **1** is used as a member that is fixed to a fixing target area A provided on the intake side of the air duct for detecting the air temperature inside the air duct to control the airflow.

(13) Furthermore, the temperature sensor **1** according to the present embodiment has the main body part **100** and the clamp part **200** molded separately and, for example, has a structure for protecting the temperature-sensitive element E when the main body part **100** is attached to the clamp part **200** along an insertion direction that is aligned with a fixing direction (corresponding to a first direction) to the fixing target area A. As such a structure, the temperature sensor **1** implements a configuration capable of properly protecting the temperature-sensitive element E until the temperature-sensitive element E is mounted to the clamp part **200**, by applying a pair of wall parts **110a** (corresponding to protection wall parts) to the main body part **100**. Hereinafter, configurations of each of the main body part **100**, the clamp part **200**, and the connector **300** configuring the temperature sensor **1** will be described in detail by referring to FIG. **1** to FIG. **6**.

(14) Note that XY direction in FIG. **1** to FIG. **6** typically corresponds an extending direction and the like of the fixing target area A, X direction corresponds to a depth direction of the fixing target area A, and Y direction corresponds to a width direction and the like of the fixing target area A. Furthermore, Z direction corresponds to a height direction (thickness direction) and the like of the fixing target area A. Unless otherwise noted, each of the directions used in the following description is described as the direction in a state where the temperature sensor **1** is being mounted to the fixing target area A via the clamp part **200**, and the X direction is referred to as the depth direction X, the Y direction as the width direction Y, and the Z direction as the height direction Z.

(15) Furthermore, the tip side in the depth direction X corresponds to the side where the connector **300** is positioned relative to the main body part **100**, for example, and the base end side in the depth direction X corresponds to the side where the clamp part **200** is positioned relative to the main body part **100**, for example. In addition, the upper side in the height direction Z corresponds to the side where the connector **300** is positioned relative to the fixing target area A (outer side of the duct that is the fixing target area A), for example, and the lower side in the height direction Z corresponds to the side where the clamp part **200** is positioned relative to the fixing target area A (inner side of the duct), for example.

(16) In the following description, a first direction is the direction in which the clamp part **200** is inserted into an insertion hole Ah of the fixing target area A when fixing the temperature sensor **1** to the fixing target area A, and it corresponds to the direction from the upper side toward the lower side in the height direction Z. Furthermore, the insertion direction aligned with the first direction described above is the direction in which the main body part **100** is inserted into an insertion hole **200h** of the clamp part **200** and, like the first direction, it corresponds to the direction from the upper side toward the lower side in the height direction Z. Furthermore, the direction in which the connector **300** is fitted to the main body part **100** in a state where the main body part **100** is being fixed to the fixing target area A is described as a direction that is aligned with the depth direction X, that is, a direction orthogonal to the height direction Z. Thus, for convenience of explanation, the direction in which the clamp part **200** is inserted into the insertion hole Ah of the fixing target area A and the direction in which the main body part **100** is inserted into the insertion hole **200h** of the

clamp part **200** are referred to as insertion direction **Z1**, and the direction in which the connector **300** is fitted to the main body part **100** is referred to as fitting direction **X1** (see FIG. 5 and FIG. 6).

(17) As illustrated in FIG. 2 and FIG. 6, the main body part **100** is configured including a holding part **110** and a connector part **120**, and each of those parts is integrally formed with an insulating resin material.

(18) The holding part **110** is a part that extends along the insertion direction **Z1** and capable of holding the temperature-sensitive element **E** on the tip side in the insertion direction **Z1**. The holding part **110** is inserted into the clamp part **200** along the insertion direction **Z1** to be positioned inside the clamp part **200**, and it is positioned on the inner side of the fixing target area **A** in a state of being fixed to the fixing target area **A** via the clamp part **200**.

(19) Furthermore, as illustrated in FIG. 2, FIG. 3, and FIG. 6, the holding part **110** is configured including a pair of wall parts **110a** and a wall part **110b**.

(20) The pair of wall parts **110a** are sidewall parts that extend along the depth direction **X** and the height direction **Z** with the width direction **Y** being the thickness direction. The wall parts **110a** are positioned opposing to each other with a space provided therebetween along the width direction **Y**, and are positioned by sandwiching a window part **210K** provided to the clamp part **200** in a state of being inserted into the clamp part **200**. Note that the configuration of the window part **210K** will be described later.

(21) On the other hand, the wall part **110b** is a sidewall part that extends along the width direction **Y** and the height direction **Z** with the depth direction **X** being the thickness direction. The wall part **110b** has both end parts in the width direction **Y** connected to the ends of each of the wall parts **110a** on the base end side in the depth direction **X**, and it is positioned in the window part **210K** provided to the clamp part **200** in a state of being inserted into the clamp part **200**.

(22) Note that each of the wall parts **110a** is set such that the length in the height direction **Z** is longer than the temperature-sensitive element **E** in a state where the holding part **110** is holding the temperature-sensitive element **E**, and it is formed such that a position **K1** (see FIG. 3 and FIG. 6) of an end part **110az** on the lower side in the height direction **Z** (that is, the tip side of the insertion direction **Z1**) is lower than the position of an end part **Ez** of the temperature-sensitive element **E** on the lower side in the height direction **Z** and positioned by protruding toward the lower side in the height direction **Z**. Furthermore, the wall part **110b** is set such that the length in the height direction **Z** is shorter than the temperature-sensitive element **E** in a state where the holding part **110** is holding the temperature-sensitive element **E**, and it is formed such that the position of the end part on the lower side in the height direction **Z** is higher than the position of the temperature-sensitive element **E**.

(23) Therefore, the holding part **110** has a U-shaped cross-section orthogonal to the height direction **Z**, and the temperature-sensitive element **E** can be housed in an internal space **110S** with the tip side in the depth direction **X** being opened. The holding part **110** can also hold the temperature-sensitive element **E** in an exposed state along the depth direction **X**.

(24) The connector part **120** is a part that, in a state of being fixed to the fixing target area **A** via the clamp part **200**, is positioned on the outer side of the fixed target area **A**, and extends from the holding part **110** along the fitting direction **X1** that intersects with (is orthogonal to) the insertion direction **Z1** to allow the connector **300** to be fitted along the fitting direction **X1**. As illustrated in FIG. 2, FIG. 5, and FIG. 6, the connector part **120** is configured including a pair of wall parts **120a**, a pair of wall parts **120b**, and a wall part **120c**, and each of the parts is formed integrally. Each of the wall parts **120a** is a sidewall part that extends along the fitting direction **X1** and the height direction **Z** with the width direction **Y** being the thickness direction, and the wall parts **120a** are positioned by opposing to each other with a space provided therebetween along the width direction **Y**. Furthermore, each of the wall parts **120b** is a top wall part or a bottom wall part that extends along the fitting direction **X1** and the width direction **Y** with the height direction **Z** being the thickness direction, and the wall parts **120b** are positioned by opposing to each other with a space

provided therebetween along the height direction Z. Furthermore, the wall part **120c** is an end wall part that extends along the width direction Y and the height direction Z with the fitting direction **X1** being the thickness direction, and both end parts in the width direction Y are connected to the end parts of the wall parts **120a** positioned on the base end side in the fitting direction **X1**, respectively, while both end parts thereof in the height direction Z are connected to the end parts of the wall parts **120b** positioned on the base end side in the fitting direction **X1**, respectively. Therefore, the connector part **120** is formed in a rectangular box shape, and capable of housing the connector **300** in an internal space **120S** by inserting the connector **300** through an opening part **120K** positioned on the tip side in the fitting direction **X1**.

(25) Furthermore, as illustrated in FIG. 1, FIG. 2, FIG. 4, and FIG. 6, the main body part **100** is configured including a locking part **130** formed in the connector part **120**.

(26) The locking part **130** is a part that locks the connector part **120** at a prescribed position (**L2** indicated in FIG. 6) in a state where the main body part **100** is being fitted to the connector **300**. As illustrated in FIG. 2, the locking part **130** is a frame part that is provided in a top wall outer face **120b1** of the wall part **120b** positioned on the upper side in the height direction Z, and it is formed by a slit extending from the base end side toward the tip side in the fitting direction **X1**.

(27) Furthermore, as illustrated in FIG. 2, FIG. 3, and FIG. 6, the main body part **100** holds a terminal **ET** extending from the temperature-sensitive element **E**. The terminal **ET** is, for example, an L-shaped terminal configured with a conductive metallic material, and it is connected to the terminal **T** of the connector **300** when the connector **300** is fitted to the main body part **100**. The main body part **100** holds the terminal **ET** with one end of the terminal **ET** being exposed to the internal space **110S** and the other end of the terminal **ET** being exposed to the internal space **120S**, and it is insert-molded with the terminal **ET**, for example. At this time, a lead terminal **Ea** extending from the temperature-sensitive element **E** is connected to a part of the terminal **ET** exposed in the internal space **110S** by welding or the like, while the terminal **T** of the connector **300** is connected to a part of the terminal **ET** exposed in the internal space **120S**. The temperature sensor **1** can electrically connect the temperature-sensitive element **E** and the wiring material **W** by physically and electrically connecting the terminal **ET** on the temperature-sensitive element **E** side and the terminal **T** on the wiring material **W** side in the internal space **120S**. Note that the shape of the terminal **ET** is not specifically limited and can be changed as necessary in accordance with the shape of the main body part **100**.

(28) Furthermore, as illustrated in FIG. 1, FIG. 2, FIG. 5, and FIG. 6, the main body part **100** is configured including a pressure plane part **121** formed in the connector part **120**. The pressure plane part **121** is a part that can press the outer face of the connector part **120** along the insertion direction **Z1** when fixing the clamp part **200** to the fixing target area **A**. The pressure plane part **121** is positioned by partially overlapping with the clamp part **200** when viewed from the insertion direction **Z1**, and it is formed in the top wall outer face **120b1** of the wall part (top wall part) **120b** positioned on the front side of the insertion direction **Z1** (upper side of the height direction Z). The wall part **120b** extends along the **XY** direction, and the base end side thereof overlaps with the clamp part **200** in the fitting direction **X1**. Therefore, when the wall part **120b** is pressed, the main body part **100** can efficiently transmit the force to each of the parts of the clamp part **200**.

(29) As illustrated in FIG. 1 to FIG. 6, the clamp part **200** is configured including a shaft part **210**, a positioning part **220** (see FIG. 6), and a pair of fixing parts **230**, and each of those parts is integrally formed with an insulating resin material.

(30) The shaft part **210** is configured including a housing part **211** and a hat part **212**. The housing part **211** is a wall part that extends along the height direction Z and is formed in a cylindrical shape. The housing part **211** is in a size (diameter) that can be inserted into the insertion hole **Ah** of the fixing target area **A**, and its length along the height direction Z is formed to be longer than the thickness of the fixing target area **A**. On the other hand, the hat part **212** is a wall part extending from the housing part **211** radially, and it is formed at an end part of the housing part **211** on the

upper side in the height direction Z. The hat part **212** is disposed at a position to cover the insertion hole Ah, in a state where the temperature sensor **1** is being fixed to the fixing target area A.

(31) The positioning part **220** is a part that is supported by the housing part **211** in a cantilever-like shape and has a positioning claw part **221** formed at its tip part, thereby allowing the holding part **110** to be locked at a prescribed position L1 (see FIG. 6) when mounting the holding part **110** to the shaft part **210**. The positioning part **220** is formed protruding from the inner face of the housing part **211** to the depth direction X, and extends from the lower side toward the upper side in the height direction Z. Furthermore, each of the positioning claw parts **221** is formed protruding inwardly in the depth direction X, and locks the wall part of the holding part **110**, such as the wall part **110b** or the like.

(32) Note that the shaft part **210** can house the temperature-sensitive element E held by the holding part **110** together with the holding part **110**, when the holding part **110** is locked by the positioning part **220**.

(33) Furthermore, the shaft part **210** is configured including a pair of window parts **210K** formed along the depth direction X at the end part on the lower side in the height direction Z. Each of the window parts **210K** is a part that allows the temperature-sensitive element E to be in contact with outside air (air flowing outside the shaft part **210**) by exposing the temperature-sensitive element E held by the holding part **110** to outside (outside of the clamp part **200**) in a state where the holding part **110** is being mounted to the shaft part **210** and locked at the prescribed position L1 by the positioning part **220**. Air flowing through the fixing target area A comes into contact with the temperature-sensitive element E as it passes through the shaft part **210** along the depth direction X through the pair of window parts **210K**. Therefore, the temperature-sensitive element E can efficiently detect the temperature of the air as a measurement target. While the shape of the window part **210K** illustrated in FIG. 1 to FIG. 4 and the like is an arch shape, the shape thereof is not specifically limited as long as it is a structure that allows the temperature-sensitive element E to more easily come into contact with air, and it can be changed as necessary in accordance with the specifications of each part of the temperature-sensitive element E and the like.

(34) The pair of fixing parts **230** are parts that are supported by the housing part **211** in a cantilever-like shape and have fixing claws **231** formed at the tip parts, respectively, capable of fixing the main body part **100** to the fixing target area A when the clamp part **200** is inserted into the insertion hole Ah. As illustrated in FIG. 6, the pair of fixing parts **230** are formed protruding from the outer face of the housing part **211** to the depth direction X. Furthermore, the fixing parts **230** are formed at positions opposing to each other with the housing part **211** interposed therebetween with respect to the depth direction X, and extend from the lower side to the upper side in the height direction Z. Moreover, each of the fixing claws **231** is formed protruding outwardly in the depth direction X, and locked to the edge of the insertion hole Ah when the clamp part **200** is inserted into the insertion hole Ah. The pair of fixing parts **230** have flexibility and are formed such that each of the fixing parts **230** is capable of being inserted into the insertion hole Ah while being bent, and each of the fixing claws **231** is locked at the edge of the insertion hole Ah, whereby the clamp part **200** can fix the temperature sensor **1** to the fixing target area A because.

(35) As illustrated in FIG. 1, FIG. 2, and FIG. 6, the connector **300** is configured including a plurality of terminal housing parts **310**, a locked part **320** that is locked to the main body part **100**, and a locking release operation part **330**, and each of those parts is integrally formed with an insulating resin material.

(36) The terminal housing part **310** is a part that can house the terminal T of the wiring material W when the wiring material WT with terminal is mounted. As illustrated in FIG. 1, FIG. 2, and FIG. 4, two terminal housing parts **310** are provided, and each of the terminal housing parts **310** is positioned with a space provided therebetween along the width direction Y in a state where the connector **300** is being fitted to the connector part **120**.

(37) As illustrated in FIG. 1, FIG. 2, and FIG. 4, the connector **300** is configured including a

housing formed with a plurality of wall parts (sidewall parts) **300a** and a plurality of wall parts (a top wall part and a bottom wall part) **300b**, and a plurality of terminal housing parts **310** are formed in the housing. Each of the terminal housing parts **310** is formed (sectioned) by the wall parts **300a** and the wall parts **300b** configuring the housing. More specifically, each of the wall parts **300a** is a wall part that extends along the height direction Z and the fitting direction X1 that is aligned with the depth direction X with the width direction Y being the thickness direction, and is positioned by opposing to each other with a space provided therebetween along the width direction Y.

Furthermore, each of the wall parts **300b** is a wall part that extends along the fitting direction X1 and the width direction Y with the height direction Z being the thickness direction, and is positioned opposing to each other with a space provided therebetween along the height direction Z. With such configurations, each of the terminal housing parts **310** is formed in a rectangular cylindrical shape, and the terminal T can be inserted and housed therein through an insertion port **310K** (see FIG. 5) positioned on the tip side (base end side of the connector **300**) in the fitting direction X1. Furthermore, each of the terminal housing parts **310** can lock the terminal T by a lance **310a** and a retainer **310b** disposed inside thereof (see FIG. 6).

(38) The lance **310a** is a member that is disposed on the base end side of each of the terminal housing parts **310** in the fitting direction X1. When the terminal T is inserted through the insertion port **310K**, the lance **310a** elastically deforms in a direction that intersects with the fitting direction X1 (inward side in the height direction Z) to be fitted to the terminal T, thereby making it possible to hold the terminal T at a prescribed position (housing completed position) inside each of the terminal housing parts **310**. On the other hand, the retainer **310b** is a member that is disposed on the tip side of each of the terminal housing parts **310** in the fitting direction X1, and it can properly lock the terminal to the terminal housing part **310** by suppressing positional misalignment of the terminal T to be housed in each of the terminal housing parts **310**.

(39) The locked part **320** is a part that is locked to the locking part **130** of the main body part **100** at the prescribed position L2 (see FIG. 6), in a state where the connector **300** is being fitted to the main body part **100**. As illustrated in FIG. 2, the connector **300** is configured including a flexible part that is formed by a pair of support parts **300c** erected from a top wall outer face **300b1** of the wall part **300b** positioned on the upper side of the height direction Z and a deformation part **300d** that extends along the extending direction of the wall part **300b** and has both end parts connected to each of the support parts **300c**. The locked part **320** is formed in the deformation part **300d** of the flexible part, and extends from the tip side toward the base end side in the fitting direction X1. Furthermore, a locked claw **321** is formed at the tip of the locked part **320**, that is, on the base end side of the fitting direction X1, and the locked claw **321** is formed protruding outwardly in the height direction Z.

(40) The locking release operation part **330** is a part capable of releasing a locking relation between the locked part **320** and the locking part **130**. The locking release operation part **330** is configured with the flexible part described above including the pair of support parts **300c** and the deformation part **300d**, which is formed on the tip side (insertion port **310K** side) of the deformation part **300d** in the fitting direction X1. Therefore, the locking release operation part **330** elastically deforms the pair of support parts **300c** inwardly in the height direction Z together with the deformation part **300d** when a deformation part outer face **300d1** of the deformation part **300d** positioned on the front side of the insertion direction Z1 along the extending direction XY of the fixing target area A is pressed along the insertion direction Z1, in a state where the connector **300** is being fitted to the main body part **100**.

(41) Next, an operation of the wire harness WH will be described.

(42) First, an operator prepares the main body part **100**, the clamp part **200**, and the connector **300** of the temperature sensor **1**. Although each of the parts of the temperature sensor **1** is transported to an installation site in an unassembled state, the holding part **110** of the main body part **100** can prevent external forces from being applied to the temperature-sensitive element E by the pair of

wall parts **110a** positioned by sandwiching the temperature-sensitive element E. Therefore, the main body part **100** can properly protect the temperature-sensitive element E.

(43) Then, the operator mounts the main body part **100** to the clamp part **200**. At this time, the holding part **110** of the main body part **100** is inserted into the housing part **211** from the insertion hole **200h** of the clamp part **200** along the insertion direction **Z1**. The end part Ez on the tip side of the holding part **110** in the insertion direction **Z1** is positioned by protruding more to the tip side in the insertion direction **Z1** than the end part **110az** of the temperature-sensitive element E on the tip side in the insertion direction **Z1** does. Therefore, when the main body part **100** is inserted inside the clamp part **200**, it is possible to prevent the temperature-sensitive element E positioned on the inner side (upper side in the height direction **Z**) than the end part Ez of the holding part **110** from contacting each of the parts of the clamp part **200** and possible to prevent external forces from being applied to the temperature-sensitive element E. Furthermore, the holding part **110** is locked at the prescribed position **L1** by the positioning part **220**. Therefore, the temperature-sensitive element E held by the holding part **110** is housed in the housing part **211** of the clamp part **200** and fixed at a position exposed through each of the window parts **210K** formed in the housing part **211**.

(44) The operator then prepares the wiring materials WT with terminal, and houses each of the terminals T of the wiring materials WT with terminal in each of the terminal housing parts **310** formed in the connector **300**. At this time, each of the terminals T is inserted through the insertion port **310K** of each of the terminal housing parts **310**, and fixed by the lance **310a** and the retainer **310b** disposed inside each of the terminal housing parts **310**.

(45) The operator then fits the connector **300** to the main body part **100** by fitting the tip of the connector **300** connected to the end part of the wiring material WT with terminal into the internal space **120S** from the opening part **120K** of the connector part **120**. At this time, the locked part **320** of the connector **300** is locked at the prescribed position **L2** by the locking part **130** of the main body part **100**. Furthermore, while maintaining the locked state between the connector **300** and the main body part **100**, the terminal T on the connector **300** side and the terminal ET on the main body part **100** side are physically and electrically connected, and the wiring material W and the temperature-sensitive element E are electrically connected.

(46) Then, in a state where the housing part **211** of the clamp part **200** is being inserted into the insertion hole Ah, the operator fixes the temperature sensor **1** to which the wiring material WT with terminal is mounted, that is, the wire harness WH, to the fixing target area A by pressing the pressure plane part **121** along the insertion direction **Z1**. At this time, the pressure plane part **121** is positioned on the front side of the insertion direction **Z1**. Therefore, the operator can press the pressure plane part **121** with a single finger F1, for example, to fix the wire harness WH to the fixing target area A by a simple operation method. Furthermore, the pressure plane part **121** is formed at a position partially overlapping with the clamp part **200** when viewed from the height direction **Z**. Thus, the operator can press a position close to an axial center Za of the clamp part **200**, and the main body part **100** can efficiently transmit the external force applied to the pressure plane part **121** to the clamp part **200**. Therefore, the operator can fix the wire harness WH to the fixing target area A with less force.

(47) Furthermore, in a state where the wire harness WH is being fixed to the fixing target area A, the connector part **120** of the main body part **100** and the connector **300** are disposed along the fitting direction **X1** that intersects with (orthogonal to) the insertion direction **Z1**, with the connector part **120** and the connector **300** being disposed adjacent to the fixing target area A, as illustrated in FIG. 5. Therefore, with the wire harness WH, it is possible to route the wiring material W extending from the connector **300** along the fixing target area A and to suppress the amount of protrusion (length in the height direction **Z**) from the fixing target area A.

(48) The operator then removes the connector **300** from the main body part **100** fixed to the fixing target area A by pressing the locking release operation part **330** of the connector **300** as necessary, during maintenance work or replacement work of the temperature-sensitive element E. At this time,

the locking release operation part **330** is provided on the insertion port **310K** side. Therefore, as illustrated in FIG. **4**, the operator can release the locking relation between the locked part **320** and the locking part **130** by, for example, pressing the locking release operation part **330** with the finger **F1** and elastically deforming the locked part **320** inwardly in the height direction **Z**. Furthermore, the operator can remove the connector **300** from the main body part **100** by pinching the end part of the connector **300** on the insertion port **310K** side with two fingers **F2** and **F3** from the width direction **Y** side in a state where the locking relation between the locked part **320** and the locking part **130** is released.

(49) The wire harness **WH** to which the temperature sensor **1** described above is applied includes: the temperature-sensitive element **E** that detects the temperature of a measurement target; the main body part **100** that holds the temperature-sensitive element **E**; the clamp part **200** that is capable of being attached to and detached from the fixing target area **A** along the insertion direction **Z1** (a first direction) and capable of fixing the main body part **100** to the fixing target part **A** in a state of being mounted to the fixing target area **A**; and the connector **300** that is provided at an end part of the wiring material **W** exhibiting conductivity, and the temperature-sensitive element **E** and the wiring material **W** are electrically connected in a state of being fitted to the main body part **100**.

Furthermore, the main body part **100** includes the holding part **110** extending along the insertion direction **Z1** (insertion direction along the first direction), which holds the temperature-sensitive element **E** on the tip side in the insertion direction **Z1** and is positioned inside the clamp part **200** by being inserted inside the clamp part **200** along the insertion direction **Z1**; and the connector part **120** capable of allowing the connector **300** to be fitted thereto in a state of being fixed to the fixing target area **A** via the clamp part **200**. The clamp part **200** includes, in a state of being mounted to the fixing target area **A**, the pair of window parts **210K** for exposing the temperature-sensitive element **E** held by the holding part **110** to outside of the clamp part **200**, which are provided at end parts positioned inside the fixing target area **A** and formed along a direction intersecting with the insertion direction **Z1**. Furthermore, the holding part **110** includes the pair of wall parts **110a** (protection wall parts) positioned by sandwiching the window part **210K** in a state of being inserted inside the clamp part **200**, and the end part **110az** of the wall part **110a** on the tip side in the insertion direction **Z1** is positioned by protruding more toward the tip side than the end part **Ez** of the temperature-sensitive element **E** on the tip side does.

(50) With such a configuration, the temperature sensor **1** can prevent external forces from being applied to the temperature-sensitive element **E** during transportation and assembling operations by the pair of wall parts **110a** that are provided in the holding part **110** of the main body part **100** and positioned by sandwiching the temperature-sensitive element **E**. Furthermore, the temperature sensor **1** has the end part **110az** of the wall part **110a** positioned by protruding more toward the tip side in the insertion direction **Z1** than the end part **Ez** of the temperature-sensitive element **E** does, thereby making it possible to prevent the end part **Ez** of the temperature-sensitive element **E** from contacting each part of the clamp part **200** and to prevent the external forces from being applied to the temperature-sensitive element **E** when the main body part **100** is inserted inside the clamp part **200** along the insertion direction **Z1**. Therefore, the temperature sensor **1** and the wire harness **WH** can properly protect the temperature-sensitive element **E**.

(51) Note that the temperature sensor **1** and the wire harness **WH** according to the embodiment of the present invention described above are not limited to the embodiment described above, and various changes are possible within the scope of the appended claims.

(52) For example, while the direction in which the connector is fitted to the main body part is described as the direction along the depth direction **X** that is orthogonal to the height direction **Z**, it is not limited thereto. The direction in which the connector is fitted to the main body part may be in a direction that intersects with the depth direction **X** when viewed from the width direction **Y** or may be a direction along the height direction **Z**.

(53) Furthermore, while the fixing target area **A** is described as a structure of an air duct on the

intake side, it is not limited thereto. The fixing target area A may also be a structure other than an air duct of a vehicle.

(54) The temperature sensor and the wire harness according to the present embodiment may be configured by combining the structural components of the embodiment described above and modification examples as appropriate.

(55) The temperature sensor and the wire harness according to the present embodiment can properly protect the temperature-sensitive element.

(56) Although the invention has been described with respect to specific embodiments for a complete and clear disclosure, the appended claims are not to be thus limited but are to be construed as embodying all modifications and alternative constructions that may occur to one skilled in the art that fairly fall within the basic teaching herein set forth.

Claims

1. A temperature sensor comprising: a temperature-sensitive element that detects a temperature of a measurement target; a main body part that holds the temperature-sensitive element; a clamp part that is capable of being attached to and detached from a fixing target area along a first direction and capable of fixing the main body part to the fixing target area in a state of being mounted to the fixing target area; and a connector that is provided at an end part of a wiring material exhibiting conductivity and allows, in a state of being fitted to the main body part, the temperature-sensitive element and the wiring material to be electrically connected, wherein the main body part includes: a holding part that extends along an insertion direction aligned with the first direction, the holding part holding the temperature-sensitive element on a tip side in the insertion direction and being positioned inside the clamp part by being inserted inside the clamp part along the insertion direction; and a connector part to which the connector is capable of being fitted in a state of being fixed to the fixing target area via the clamp part, the clamp part includes, in a state of being mounted to the fixing target area, a pair of window parts for exposing the temperature-sensitive element held by the holding part to outside of the clamp part, the pair of window parts being provided at end parts positioned inside the fixing target area and being formed along a direction intersecting with the first direction, the holding part includes a pair of protection wall parts positioned by sandwiching the window parts in a state of being inserted inside the clamp part, and an end part of the protection wall part on a tip side in the insertion direction is positioned by protruding more to the tip side than an end part of the temperature-sensitive element on the tip side does.

2. A wire harness comprising: a wiring material exhibiting conductivity; and a temperature sensor that includes: a temperature-sensitive element that detects a temperature of a measurement target; a main body part that holds the temperature-sensitive element; a clamp part that is capable of being attached to and detached from a fixing target area along a first direction and capable of fixing the main body part to the fixing target area in a state of being mounted to the fixing target area; and a connector that is provided at an end part of a wiring material exhibiting conductivity and allows, in a state of being fitted to the main body part, the temperature-sensitive element and the wiring material to be electrically connected, wherein the main body part includes: a holding part that extends along an insertion direction aligned with the first direction, the holding part holding the temperature-sensitive element on a tip side in the insertion direction and being positioned inside the clamp part by being inserted inside the clamp part along the insertion direction; and a connector part to which the connector is capable of being fitted in a state of being fixed to the fixing target area via the clamp part, the clamp part includes, in a state of being mounted to the fixing target area, a pair of window parts for exposing the temperature-sensitive element held by the holding part to outside of the clamp part, the pair of window parts being provided at end parts positioned inside the fixing target area and being formed along a direction intersecting with the first direction,

the holding part includes a pair of protection wall parts positioned by sandwiching the window parts in a state of being inserted inside the clamp part, and an end part of the protection wall part on a tip side in the insertion direction is positioned by protruding more to the tip side than an end part of the temperature-sensitive element on the tip side does.
