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Heater unit and vehicular seat

Abstract

Conventional heater units have a problem in that both ventilation characteristics and mechanical strength cannot be satisfied at the same time. A heater unit includes a base material and a cord-shaped heater, the cord-shaped heater being disposed on and fixed to the base material, in which the base material is made by combining a structural yarn that is disposed in an approximately planar shape and a nonwoven fabric with each other, and the cord-shaped heater is fixed in direct contact with the structural yarn.

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References Cited

U.S. PATENT DOCUMENTS

Patent No.	Issued Date	Patentee Name	U.S. Cl.	CPC
3627988	12/1970	Romaniec	252/502	F24D 13/02
8544942	12/2012	Lazanja	219/217	A47C 7/748
8702164	12/2013	Lazanja	219/217	H05B 3/36
9657963	12/2016	Lazanja	N/A	H05B 3/36
9963056	12/2017	Ishiyama	N/A	B60N 2/5685
2003/0111454	12/2002	Ishiyama et al.	N/A	N/A
2003/0213797	12/2002	Yoneyama et al.	N/A	N/A
2008/0223844	12/2007	Cronn	36/2.6	H05B 3/342
2011/0226751	12/2010	Lazanja	219/217	A47C 7/748
2012/0091112	12/2011	Wei	219/202	B60N 2/5685
2013/0106147	12/2012	Lazanja	297/180.12	H05B 3/36
2014/0187140	12/2013	Lazanja	219/528	F24H 3/0411
2016/0236598	12/2015	Hoshi	N/A	N/A
2018/0279416	12/2017	Sajic	N/A	H05B 1/0272
2021/0321491	12/2020	Hagihara	N/A	B32B 7/12
2024/0059198	12/2023	Fujii	N/A	H05B 3/56

FOREIGN PATENT DOCUMENTS

Patent No.	Application Date	Country	CPC
H0668964	12/1993	JP	N/A
H08507404	12/1995	JP	N/A
2005285602	12/2004	JP	N/A
3991750	12/2006	JP	N/A
4202071	12/2007	JP	N/A
4999455	12/2011	JP	N/A
2015074375	12/2014	JP	N/A
2017157279	12/2016	JP	N/A
6636825	12/2019	JP	N/A
9409684	12/1993	WO	N/A

OTHER PUBLICATIONS

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Background/Summary

CROSS REFERENCE TO RELATED APPLICATIONS

(1) The present application is a U.S. National Phase of International Application No. PCT/JP2022/000271 entitled “HEATER UNIT AND VEHICULAR SEAT,” and filed on Jan. 6, 2022. International Application No. PCT/JP2022/000271 claims priority to Japanese Patent Application No. 2021-002905 filed on Jan. 12, 2021, and to Japanese Patent Application No. 2021-002906 filed on Jan. 12, 2021, and to Japanese Patent Application No. 2021-012569 filed on Jan. 29, 2021, and to Japanese Patent Application No. 2021-012570 filed on Jan. 29, 2021. The entire contents of each of the above-listed applications are hereby incorporated by reference for all purposes.

TECHNICAL FIELD

(2) The present invention relates to a heater unit that is suitably usable in an electric blanket, an electrically heated carpet, a car seat heater, and the like and, in particular, to a heater unit with superior ventilation characteristics and mechanical strength.

BACKGROUND

(3) Conventionally, as a heater unit to be mounted to a vehicular seat to serve as a car seat heater, for example, there is a heater unit configured such that a cord-shaped heater in which a thermal fusion bonding portion is provided on a base material is wired in a serpentine manner and the base material and the thermal fusion bonding portion are bonded and fixed by thermal fusion bonding due to heating and pressurization (for example, refer to Patent Literature 1). In addition, in recent years, vehicular seats with a built-in air-conditioning apparatus are being put to practical use as means to further improve comfortableness of an interior environment of a vehicle. Specifically, a vehicular seat is known in which, by imparting ventilation characteristics to a heater unit and a seat cover to send air to a cover side through a ventilation flue formed inside the seat, air is blown out from a surface of the vehicular seat (for example, refer to Patent Literature 2).

(4) As a heater unit to be applied to a vehicular seat with the built-in air-conditioning apparatus described above, a heater unit with particularly superior ventilation characteristics is required. Therefore, known methods of improving ventilation characteristics include using, as a base material of the heater unit, a base material in which a plurality of through-holes are formed, a base material made of a material with superior ventilation characteristics such as a spunbonded nonwoven fabric or a spunlaced nonwoven fabric, and a base material having a mesh structure (refer to Patent Literature 3 to 7).

CITATION LIST

Patent Literature

(5) Patent Literature 1: Japanese Patent No. 4202071: Kurabe Industrial Co., Ltd. Patent Literature 2: Japanese Patent No. 4999455: Kurabe Industrial Co., Ltd. Patent Literature 3: Japanese Patent No. 3991750: Matsushita Electric Industrial Co., Ltd. Patent Literature 4: Japanese Unexamined Patent Application Publication No. 2005-285602: Matsushita Electric Industrial Co., Ltd. Patent Literature 5: Published Japanese Translation of PCT International Publication for Patent

SUMMARY

Technical Problem

(6) However, with the base materials of the heater units described in Patent Literatures 3 to 6 described above, there is a significant drop in mechanical strength in return for ventilation characteristics. In particular, while heater units to be applied to a vehicular seat are repetitively subject to loads due to a driver or the like sitting on and alighting from the vehicular seat, there has not been a vehicular seat with characteristics sufficient enough to prevent deformation or fracture even with respect to such loads. In addition, with a base material in which a plurality of through-holes are formed, since there is only a slight improvement in ventilation characteristics, a further improvement in ventilation characteristics is required.

(7) The heater unit described in Patent Literature 7 described above solves the problems of the heater units described in Patent Literatures 3 to 6. However, a further improvement in ventilation characteristics is required and there is a demand to reduce density (basis weight) of a nonwoven fabric. As a result, mechanical strength and stiffness as a base material decline and fracture and deformation are more likely to occur. Deformation of the base material makes work difficult when, for example, arranging the heater unit in a vehicular seat and may even result in the heater unit being arranged in places not originally intended by design. Therefore, there is a need to further improve mechanical strength or stiffness as a heater unit.

(8) The present invention has been made in order to solve such problems in related art and an object thereof is to provide a heater unit with superior ventilation characteristics and mechanical strength.

Solution to Problem

(9) In order to achieve the object described above, a heater unit according to the present invention includes a base material and a cord-shaped heater, the cord-shaped heater being disposed on and fixed to the base material, in which the base material is made by combining a structural yarn that is disposed in an approximately planar shape and a nonwoven fabric with each other, and the cord-shaped heater is fixed in direct contact with the structural yarn.

(10) In addition, conceivably, a thermal fusion bonding portion is formed on an outermost layer of the cord-shaped heater, and the thermal fusion bonding portion is fixed to the nonwoven fabric and the structural yarn by thermal fusion bonding.

(11) In addition, conceivably, the structural yarn is woven, or knitted, or parallel alignments of the structural yarn in different directions are stacked and an opening portion larger than an apparent diameter of the structural yarn is provided.

(12) In addition, conceivably, the base material is made of a structural yarn and a pair of a nonwoven fabric, and the structural yarn is sandwiched by the pair of the nonwoven fabric.

(13) In addition, a vehicular seat according to the present invention has a seat cover and a seat pad, and the heater unit described above is arranged between the seat cover and the seat pad.

(14) In addition, a heater unit according to the present invention includes a base material and a cord-shaped heater, the cord-shaped heater being disposed on and fixed to the base material, in which the base material is made by combining a plurality of structural yarns that are disposed in an approximately planar shape and a nonwoven fabric with each other, the plurality of structural yarns are made up of at least a first structural yarn group that is linearly disposed with respect to a predetermined direction and a second structural yarn group that is linearly disposed with respect to a direction different from the direction of the first structural yarn group, the cord-shaped heater is disposed on the base material in a serpentine shape created by a combination of linear portions and curved portions, and the linear portions of the cord-shaped heater are arranged so as to assume an angle that differs from the angles of the first structural yarn group and the second structural yarn

group.

(15) In addition, conceivably, the structural yarn is woven or parallel alignments of the structural yarn in different directions are stacked and an opening portion larger than an apparent diameter of the structural yarn is provided.

(16) In addition, conceivably, the base material is made of a structural yarn and a pair of a nonwoven fabric, and the structural yarn is sandwiched by the pair of the nonwoven fabric.

(17) In addition, conceivably, a thermal fusion bonding portion is formed on an outermost layer of the cord-shaped heater, and the thermal fusion bonding portion is fixed to the nonwoven fabric and the structural yarn by thermal fusion bonding.

(18) In addition, a vehicular seat according to the present invention has a seat cover and a seat pad, and the heater unit described above is arranged between the seat cover and the seat pad.

Advantageous Effect of Invention

(19) Generally, while reducing an amount of fiber per a unit area of a base material is effective in improving ventilation characteristics, the reduction in the amount of fiber also significantly lowers mechanical strength and stiffness of the base material. With the heater unit according to the present invention, tensile strength is produced due to a structural yarn disposed in an approximately planar shape. Therefore, the base material with improved ventilation characteristics can have superior mechanical strength.

(20) Furthermore, due to the thermal fusion bonding portion and the structural yarn being directly fixed, separation of the cord-shaped heater due to fiber loss from the nonwoven fabric can be prevented. In addition, since the cord-shaped heater and the structural yarn are to be tightly integrated, an effect of making the heater unit less likely to deform can be produced.

(21) Furthermore, setting a direction of the structural yarn and a direction of the linear portions of the cord-shaped heater at different angles also enables the cord-shaped heater to contribute towards retaining the shape of the base material.

Description

BRIEF DESCRIPTION OF DRAWINGS

(1) FIG. 1 is a diagram showing an embodiment of the present invention being a plan view showing a configuration of a heater unit;

(2) FIG. 2 is a diagram showing an embodiment of the present invention being a partial cutaway perspective view showing a configuration of a base material;

(3) FIG. 3 is a diagram showing an embodiment of the present invention being a partial cutaway side view showing a configuration of a cord-shaped heater;

(4) FIG. 4 is a diagram showing an embodiment of the present invention being a diagram showing a configuration of a hot press-type heater production apparatus;

(5) FIG. 5 is a diagram showing an embodiment of the present invention being a partial perspective view showing how the cord-shaped heater is arranged in a predetermined pattern and shape;

(6) FIG. 6 is a diagram showing an embodiment of the present invention being an enlarged plan view showing a part of the heater unit by making the base material transparent;

(7) FIG. 7 is a diagram showing an embodiment of the present invention being an enlarged sectional view of a part of the heater unit;

(8) FIG. 8 is a diagram showing an embodiment of the present invention being a perspective view partially showing a part cutaway of how the heater unit is embedded in a vehicular seat;

(9) FIG. 9 is a diagram showing another embodiment of the present invention being a partial cutaway side view showing a configuration of a cord-shaped heater;

(10) FIG. 10 is a diagram showing another embodiment of the present invention being a partial cutaway side view showing a configuration of a cord-shaped heater;

- (11) FIG. 11 is a diagram showing another embodiment of the present invention being a partial cutaway side view showing a configuration of a cord-shaped heater;
- (12) FIG. 12 is a diagram showing another embodiment of the present invention being a partial cutaway side view showing a configuration of a cord-shaped heater;
- (13) FIG. 13 is a diagram showing another embodiment of the present invention being a partial cutaway perspective view showing a configuration of a base material according to another mode;
- (14) FIG. 14 is a photograph showing an embodiment of the present invention being an enlarged photograph showing characterizing parts of a heater unit; and
- (15) FIG. 15 is a photograph showing an embodiment of the present invention being an enlarged photograph of a sectional view of characterizing parts of a heater unit.

DETAILED DESCRIPTION

- (16) Hereinafter, embodiments of the present invention will be described with reference to the drawings. The embodiments represent examples which assume that the present invention is to be applied to a vehicular seat heater.
- (17) First, a configuration of a cord-shaped heater **10** according to the present first embodiment will be described. The cord-shaped heater **10** according to the present embodiment is configured as shown in FIG. 3. First, there is a heater core **3** made of an aromatic polyamide fiber bundle with an outer diameter of approximately 0.2 mm, and six paralleled conductor strands **5a** made of a copper alloy wire (TH-SNCC-3) with a strand diameter of 0.08 mm and containing tin plating hard tin are spirally wound around an outer circumference of the heater core **3** at a pitch of approximately 0.7 mm. Tetrafluoroethylene-hexafluoropropylene copolymer (FEP) as an insulator layer **7** is extruded at a thickness of approximately 0.15 mm to coat an outer circumference of the conductor strands **5a** wound around the heater core **3** to construct a heating wire **1**. A polyester resin containing a flame retardant is extruded as a thermal fusion bonding portion **9** at a thickness of 0.2 mm to coat an outer circumference of the heating wire **1**. The cord-shaped heater **10** is configured in this manner and has a finished outer diameter of 1.1 mm. While the heater core **3** described above is effective when flexibility and tensile strength are taken into consideration, a plurality of paralleled or twisted heating element wires may conceivably be used in place of the heater core **3**. Preferably, the cord-shaped heater **10** has sufficient flame retardancy to pass the Horizontal Flame Test of UL 1581, Fourth Edition, dated 2008 by itself since such flame retardancy enables flame retardancy of the heater unit to be improved.
- (18) Next, a configuration of a base material **11** to which the cord-shaped heater **10** configured as described above is bonded and fixed will be described. As shown in FIG. 2, in the base material **11** according to the present embodiment, a structural yarn **11a** is sandwiched between a pair of nonwoven fabric **11b** and pasted by an adhesive. For example, the nonwoven fabric **11b** is a nonwoven fabric made of flame-retardant polyester fiber with a basis weight of 27 g/m^{sup.2} and an apparent thickness of about 1 mm. In this case, the structural yarn **11a** is a polyester multifilament with an apparent diameter of 0.5 mm. In addition, in the base material **11**, the structural yarn **11a** is plain-woven at a grid spacing of 10 mm, a size of the opening portion **11c** being 9.5 mm, and a shielding ratio being 12.9%. Furthermore, the structural yarn **11a** is made up of a first structural yarn group **11x** that is linearly disposed in a left-right direction in FIG. 2 and a second structural yarn group **11y** that is linearly arranged in a front-rear direction in FIG. 2. The nonwoven fabric is obtained by spinning a material that constitutes fibers by melt extrusion and stacking the material to form a web, and is made of filaments (long fibers). The structural yarn **11a** is sandwiched between a pair of such nonwoven fabric **11b**, and the structural yarn **11a** and the nonwoven fabric **11b** are fixed by an adhesive. Intersections where different structural yarns **11a** intersect with each other are also fixed by an adhesive. The base material **11** configured as described above has a basis weight of 100 g/m^{sup.2} as a whole.
- (19) Next, a configuration in which the cord-shaped heater **10** described above is arranged on the base material **11** in a serpentine shape to be bonded and fixed will be described. In the present

embodiment, a serpentine spacing is set to 20 mm. FIG. 4 is a diagram showing a configuration of a hot press-type heater production apparatus **13** for bonding and fixing the cord-shaped heater **10** onto the base material **11**. First, there is a hot press jig **15** and a plurality of locking mechanisms **17** are provided on the hot press jig **15**. As shown in FIG. 5, the locking mechanisms **17** are provided with a pin **19** and the pin **19** is inserted from below into a hole **21** drilled into the hot press jig **15**. A locking member **23** is mounted to an upper part of the pin **19** so as to be movable in an axial direction and is constantly biased upward by a coil spring **25**. In addition, as indicated by a virtual line in FIG. 5, the cord-shaped heater **10** is to be arranged in a serpentine shape by being hooked on the locking members **23** of the plurality of locking mechanisms **17**.

(20) Returning to FIG. 4, a press hot plate **27** is arranged so as to be ascendible and descendible above the plurality of locking mechanisms **17**. In other words, the cord-shaped heater **10** is arranged in a serpentine shape by being hooked on the locking members **23** of the plurality of locking mechanisms **17**, and the base material **11** is placed on top of the cord-shaped heater **10**. The press hot plate **27** is lowered in this state to subject the cord-shaped heater **10** and the base material **11** to heating and pressurization at 230° C. for 5 seconds. Accordingly, the thermal fusion bonding portion **9** on the side of the cord-shaped heater **10** and thermally fusible fibers on the side of the base material **11** are to be thermally fused and, as a result, the cord-shaped heater **10** and the base material **11** are to be bonded and fixed to each other. During heating and pressurization due to the descent of the press hot plate **27**, the locking members **23** of the plurality of locking mechanisms **17** are to move downward against a biasing force of the coil spring **25**.

(21) As shown in FIG. 6, the serpentine shape of the cord-shaped heater **10** is constructed by combining linear portions **10a** and curved portions **10b** with each other. In doing so, the linear portions **10a** of the cord-shaped heater **10** are preferably arranged to be at an angle that differs from the angles of the first structural yarn group **11x** and the second structural yarn group fly as in the present embodiment. As the mechanical strength of the base material **11**, while the base material **11** is strong in a direction in which the structural yarn **11a** is arranged, with respect to tension at an angle that differs from the direction in which the structural yarn **11a** is arranged, the base material **11** becomes more deformable as the angle changes. In particular, when the first structural yarn group **11x** and the second structural yarn group fly are orthogonal to each other as in the present embodiment, deformability is highest with respect to tension at an angle that deviates from the first structural yarn group **11x** by 45 degrees. By arranging the linear portions **10a** of the cord-shaped heater **10** at an angle that differs from the angles of the first structural yarn group **11x** and the second structural yarn group **11y**, deformation is less likely to occur even with respect to tension at various angles. Note that the nonwoven fabric **11b** of the base material **11** is shown as though transparent in FIG. 6.

(22) An adhesion layer may be formed or a double-sided adhesive tape may be applied on a surface of the base material **11** on a side where the cord-shaped heater **10** is not arranged. This is done in order to fix the heater unit **31** to a seat when mounting the heater unit **31** to the seat.

(23) By performing the operations described above, the heater unit **31** of a vehicular seat heater similar to that shown in FIG. 1 can be obtained. Note that a cord is connected to both ends of the cord-shaped heater **10** and a temperature control apparatus **39** in the heater unit **31**, and the cord-shaped heater **10**, the temperature control apparatus **39**, and a connector **35** are connected by the cord. In addition, a connection with an electric system of a vehicle (not illustrated) is to be established via the connector **35**.

(24) Furthermore, the heater unit **31** configured as described above is embedded and arranged in a vehicular seat **41** in a state shown in FIG. 8. In other words, as described earlier, the heater unit **31** is to be bonded to a seat cover **43** or a seat pad **45** of the vehicular seat **41**.

(25) In the heater unit obtained as in the embodiment described above, due to the thermal fusion bonding portion **9** of the cord-shaped heater **10** penetrating into the nonwoven fabric **11b** of the base material **11** and surrounding the fibers that make up the nonwoven fabric **11b**, the cord-shaped

heater **10** and the base material **11** are to be tightly bonded to each other. In particular, if the base material **11** includes thermally fusible fibers, the thermally fusible fibers have a sheath-core structure, and the sheath portion has a low melting point, the sheath portion and the thermal fusion bonding portion **9** of the cord-shaped heater are to be thermally fused and integrated with each other in a state where the core portion is surrounded. Accordingly, the cord-shaped heater **10** and the base material **11** are to be even more tightly bonded to each other.

(26) As in the enlarged sectional view shown in FIG. 7, preferably, the thermal fusion bonding portion **9** of the cord-shaped heater **10** penetrates beyond the nonwoven fabric **11b** of the base material **11** until the thermal fusion bonding portion **9** comes into direct contact with the structural yarn **11a** and the thermal fusion bonding portion **9** and the structural yarn **11a** are fixed by thermal fusion bonding. Since improving ventilation characteristics of the base material **11** reduces density (basis weight) of the nonwoven fabric **11b** of the base material **11**, separation of the cord-shaped heater **10** due to fiber loss from the nonwoven fabric **11b** is more likely to occur. Due to the thermal fusion bonding portion **9** and the structural yarn **11a** being directly fixed, such separation can be prevented. In addition, since the cord-shaped heater **10** and the structural yarn **11a** are to be tightly integrated, an effect of making the heater unit less likely to deform can also be produced. FIG. 14 and FIG. 15 show enlarged photographs of characterizing parts of the heater unit. FIG. 14 is a photograph of the heater unit taken from a surface of the base material which is opposite to the surface to which the cord-shaped heater is fixed. FIG. 15 is a photograph of a cross section of the heater unit created by cutting the heater unit along an orientation of the cord-shaped heater. Both FIG. 14 and FIG. 15 show that the thermal fusion bonding portion of the cord-shaped heater is surrounding the structural yarn and that the thermal fusion bonding portion and the structural yarn are fixed by thermal fusion bonding.

(27) Note that the present invention is not limited to the embodiment described above. Various conventionally known cord-shaped heaters can be used as the cord-shaped heater **10**. Examples of the configuration of the heating wire **1** include twisting or paralleling the conductor strand **5a** in plurality, winding the conductor strands **5a** around the heater core **3**, and applying the insulator layer **7** on an outer circumference of the heater core **3** (refer to FIG. 3), twisting a plurality of the conductor strands **5a** coated by an insulating film **5b** (refer to FIG. 9), and paralleling a plurality of the conductor strands **5a** coated by the insulating film **5b** (refer to FIG. 10) as in the embodiment described above, twisting or paralleling the conductor strand **5a** coated by the insulating film **5b** in plurality and winding the conductor strands **5a** around the heater core **3** (refer to FIG. 11), and intermittently forming the thermal fusion bonding portion **9** (refer to FIG. 12) as in the embodiment described above. In addition, a temperature sensing wire, a short-circuit detection wire, or the like may be bound together. Specific aspects among such other aspects will be described below. First, in a configuration such as that shown in FIG. 11, seven conductor strands **5a** made of a tin-copper alloy wire with a strand diameter of 0.08 mm are paralleled and spirally wound at a pitch of 1 mm around an outer circumference of the heater core **3** made of an aromatic polyamide fiber bundle with an outer diameter of approximately 0.2 mm to construct the heating wire **1**. Note that the conductor strands **5a** are coated by the insulating film **5b** made of polyurethane at a thickness of approximately 0.005 mm. A polyethylene resin containing a flame retardant is extruded as the thermal fusion bonding portion **9** at a thickness of 0.25 mm to coat an outer circumference of the heating wire **1**. The cord-shaped heater **10** is configured in this manner and has a finished outer diameter of 0.9 mm.

(28) Examples of the heater core **3** include fibers configured such that a core material thereof is a monofilament, a multifilament, a spun yarn of an inorganic fiber such as a glass fiber or an organic fiber such as polyester fibers such as polyethylene terephthalate, an aliphatic polyamide fiber, an aromatic polyamide fiber, or a wholly aromatic polyester fiber, or a fiber material thereof, or an organic polymeric material constituting a fiber material, and an circumference of the core material is coated with a thermoplastic organic polymeric material. In addition, making the heater

core 3 heat-shrinkable and thermally fusible results in a core wire becoming fused and broken due to anomalous heating when the conductor strands 5a break, and contraction of the core wire causes the wound conductor strands 5a to follow the motion of the heater core 3 and results in the end portions of the broken conductor strands 5a becoming separated from each other. Therefore, situations where respective end portions of broken conductor strands come into contact with or become separated from each other or remain in contact over a small contact area such as point contact no longer occur and anomalous heat generation can be prevented. In addition, when a configuration in which the conductor strands 5a are insulated by the insulating film 5b is adopted, the heater core 3 need not necessarily be made of an insulation material. For example, a stainless steel wire or a titanium alloy wire can also be used. However, the heater core 3 is favorably made of an insulation material in consideration of a situation where the conductor strands 5a break.

(29) Conventionally known conductor strands can be used as the conductor strands 5a and, for example, a copper wire, a copper alloy wire, a nickel wire, an iron wire, an aluminum wire, a nickel-chromium alloy wire, a copper-nickel alloy wire, an iron-chromium alloy wire, and a silver-containing copper alloy wire that contains a copper solid solution and a copper-silver eutectic in a fibrous state. In addition, conductor strands with various sectional shapes can be used and, in addition to those with a circular cross section which are normally used, so-called rectangular wires may also be used. However, when winding the conductor strands 5a around the heater core 3, a conductor strand with a small amount of springback when winding the heating wire 1 among those described above is favorable. For example, with a silver-containing copper alloy wire that contains a copper solid solution and a copper-silver eutectic in a fibrous state or the like, while high tensile strength characteristics and superior tensile strength and bending strength are achieved, there is a high likelihood of springback when winding the heating wire. Therefore, such a wire is unfavorable since floating of the conductor strands 5a or a fracture of the conductor strands 5a due to excessive winding tension is likely to occur when the wire is being wound around the heater core 3 and habitual twisting is likely to occur after processing. In particular, when adopting a mode in which the conductor strands 5a are coated with the insulating film 5b, a restoring force due to the insulating film 5b is to be additionally applied. Therefore, it is important to select a wire with a low restoration rate as the conductor strands 5a to compensate for the restoring force due to the insulating film 5b.

(30) Conventionally known resin materials and the like can be used as the insulating film 5b to coat the conductor strands 5a, and examples of such resin materials include polyurethane resin, polyamide resin, polyimide resin, polyamide-imide resin, polyester-imide resin, nylon resin, polyester-nylon resin, polyethylene resin, polyester resin, vinyl chloride resin, fluorine resin, and silicone resin. A plurality of layers of these materials may be formed. Using a material with thermal fusibility among these materials is preferable since the conductor strands 5a can be thermally fused to each other and workability can be improved since the heating wire 1 does not become loosened when processing terminals such as for connection with a connecting terminal. In addition, when performing soldering as the processing of terminals, since workability increases significantly if the insulating film 5b is removed by heat during soldering, the material of the insulating film 5b preferably has good thermal decomposability.

(31) When paralleling or twisting the conductor strands 5a described above and winding the conductor strands 5a around the heater core 3, paralleling is more preferable than twisting. This is because paralleling results in a smaller diameter of a cord-shaped heater 10 and also realizes a smooth surface. In addition to paralleling or twisting, the conductor strands 5a can conceivably be braided on the heater core 3.

(32) When forming the insulator layer 7, the insulator layer 7 may be formed by extrusion or the like or the insulator layer 7 molded in a tube shape in advance may be overlaid and a method of formation is not particularly limited. A material constituting the insulator layer 7 may also be appropriately designed according to a usage mode or a usage environment of the cord-shaped

heater and there is a wide variety of examples of the material constituting the insulator layer 7 including a polyethylene-based resin, a polyester-based resin, a polyurethane-based resin, a polyamide-based resin, vinyl chloride resin, a fluorine-based resin, synthetic rubber, fluoro-rubber, an ethylene-based thermoplastic elastomer, and an urethane-based thermoplastic elastomer. In addition, a protective coat may be further formed on the outer circumference of the insulator layer 7.

(33) When forming the thermal fusion bonding portion 9 on the outer circumference of the heating wire 1, in addition to forming the thermal fusion bonding portion on an entire outer circumference of the heating wire, various aspects of the thermal fusion bonding portion are conceivable such as forming the thermal fusion bonding portion in a linear shape or a spiral linear shape along a length direction of the cord-shaped heater, forming the thermal fusion bonding portion in a dotted pattern, or intermittently forming the thermal fusion bonding portion as shown in FIG. 12. In doing so, making the thermal fusion bonding portion discontinuous in the length direction of the cord-shaped heater is preferable since, even when a part of the thermal fusion bonding portion ignites, the ignited part does not spread. In addition, if a volume of the thermal fusion bonding portion is sufficiently small, even when the thermal fusion bonding portion is made of a combustible material, a flame is extinguished in no time due to a lack of burning material and, furthermore, dripping (burning drops) no longer occurs. Therefore, the volume of the thermal fusion bonding portion is preferably a minimum volume necessary for retaining adhesion with the base material. However, in such aspects, the insulator layer 7 or the insulating film 5b is preferably made of a flame-retardant material.

(34) As a material that constitutes the thermal fusion bonding portion 9, a flame-retardant polymer composition is preferably used. A flame-retardant polymer composition described herein refers to polymer compositions with an oxygen index of 21 or higher according to the Determination of Burning Behaviour as set forth in JIS-K7201 (1999). Polymer compositions with an oxygen index of 26 or higher are particularly preferable. Examples of specific materials include thermoplastic polymeric materials such as an olefin-based resin, a polyester-based resin, a polyamide-based resin, vinyl chloride resin, polyurethane resin, modified Noryl resin (polyphenylene oxide resin), aliphatic polyamide resin, polystyrene resin, a polyolefin-based thermoplastic elastomer, a polyester-based thermoplastic elastomer, a polyurethane-based thermoplastic elastomer, a polyamide-based thermoplastic elastomer, and materials obtained by appropriately blending a flame retardant into such thermoplastic polymeric materials. In addition, examples of olefin-based resins include high-density polyethylene, low-density polyethylene, ultra-low-density polyethylene, linear low-density polyethylene, polypropylene, polybutene, an ethylene- α -olefin copolymer, and an ethylene-unsaturated ester copolymer. Examples of an ethylene-unsaturated ester copolymer include an ethylene-vinyl acetate copolymer, an ethylene-methyl (meth)acrylate copolymer, an ethylene-ethyl (meth)acrylate copolymer, and an ethylene-butyl (meth)acrylate copolymer which can be used independently or a mixture of two or more of these copolymers may be used. In this case, “(meth)acrylate” represents both acrylate and methacrylate. While polyester-based thermoplastic elastomers include a polyester-polyester type and a polyester-polyether type, the polyester-polyether type has higher adhesion and is therefore preferable. Aliphatic polyamide resins are called nylons which include n-nylon that is synthesized by a polycondensation reaction of an ω -amino acid and n,m-nylon that is synthesized by a copolycondensation reaction of a diamine and a dicarboxylic acid. Examples of n-nylon include nylon 6, nylon 11, and nylon 12, and examples of n,m-nylon include nylon 66, nylon 610, nylon 61, nylon 6T, nylon 9T, and nylon MST. As a polyamide-based thermoplastic elastomer, a block copolymer using polyamide as a hard segment and polyether as a soft segment is known. Various examples of polyamide to be used as the hard segment is conceivable including aromatic polyamides such as para-aramid and meta-aramid in addition to the aliphatic poly amides described earlier. Various examples of polyether to be used as the soft segment is conceivable including polyalkylene ether glycols such as polyethylene glycol,

poly(1,2- and 1,3-)propylene ether glycols, polytetramethylene ether glycol, and polyhexamethylene ether glycol, block or random copolymers of ethylene oxide and propylene oxide, block or random copolymers of ethylene oxide and tetrahydrofuran, and polyethers containing dihydric phenol such as bisphenol A and hydroquinone. Among the above, a polyamide-based thermoplastic elastomer with particularly superior adhesion at high temperatures and which provides good compatibility in terms of a melting point and adhesion when using a nonwoven fabric made of polyester fibers as the base material is preferable, a block copolymer of an aliphatic polyamide and a polyalkylene ether glycol is more preferable, and a block copolymer of nylon 11 or nylon 12 and a polytetramethylene ether glycol is particularly favorable. While a material may be optionally selected from these materials, the selected material preferably melts at a temperature equal to or lower than a kickoff temperature or a temperature equal to or lower than a melting point of the material that constitutes the insulating film **5b** or the insulator layer **7** described above. In addition, an example of a material with superior adhesion with the base material is a polyester-based thermoplastic elastomer. Furthermore, in order to realize easy bonding with the base material and to secure adhesion strength after the bonding, a melt flow rate of the material constituting the thermal fusion bonding portion **9** is preferably 5.0 cm.sup.3/10 minutes or higher. The melt flow rate is measured at a temperature of 200° C. and under a load of 2.16 kg according to Method A as described in JIS K 7210: 1999. Examples of the flame retardant include a metal hydrate such as magnesium hydroxide and aluminum hydroxide, antimony oxide, melamine compounds, phosphorus-based compounds, chlorine-based flame retardants, and bromine-based flame retardants. Surface treatment may be appropriately applied to these flame retardants using known methods. In particular, surface treatment which lowers viscosity during melting of the polymer composition that constitutes the thermal fusion bonding portion **9** is preferable. In addition, the method of forming the thermal fusion bonding portion **9** is not particularly limited and, for example, the thermal fusion bonding portion **9** may be formed by known extrusion or by application. Note that, in the present invention, adhesion strength between the cord-shaped heater and the base material is particularly important. When the adhesion strength is insufficient, since the base material and the cord-shaped heater become separated through repetitive use and, as a result, unintended bending is applied to the cord-shaped heater, there is a possibility of breaking of the conductor strands.

(35) In addition, when using a cord-shaped heater similar to that shown in FIG. **3**, a good conductor of electricity such as a metal foil can be wound around an outer circumference of the conductor strands **5a** in a portion in a length direction. Furthermore, when using a cord-shaped heater similar to that shown in FIG. **3**, a good conductor of electricity such as a metal foil can be wound around an outer circumference of the heater core **3** (an inner surface of the conductor strands **5a**) in a portion in the length direction. As a result, since electricity is conducted through the good conductor of electricity but hardly through the conductor strands **5a** in the portion where the good conductor of electricity is wound, heat generation no longer occurs in this portion. Therefore, a good conductor of electricity is conceivably wound as described above in a portion where heat generation need not occur. Furthermore, winding a good conductor of electricity as described above around an end portion of the cord-shaped heater makes the portion a lead wire portion. Therefore, since a heat generation portion and the lead wire portion are to be formed in a continuous manner, waterproofing is to be realized without having to perform a special treatment for connection or waterproofing. As a result, such a configuration is suitably used in applications where a waterproofing property is required such as a humid environment, an environment exposed to splashing water, or an environment where de-icing is performed.

(36) In addition to providing one cord-shaped heater **10**, two or more cord-shaped heaters **10** may be arranged. In such a case, one cord-shaped heater and the other cord-shaped heater may be arranged on a same surface of the base material or on different surfaces of the base material. Furthermore, a cord-shaped sensor may conceivably be arranged together with the cord-shaped

heater. As the cord-shaped sensor, a cord-shaped sensor obtained by replacing heating strands with detecting strands in a cord-shaped heater such as that described above is conceivable. Conceivable examples of the cord-shaped sensor include a temperature sensor which measures a change in a resistance value due to a temperature of the detecting strands, a temperature sensor which detects conduction through the detecting strands due to melting of an insulation material that melts at a predetermined temperature, a grip sensor or a seating sensor which measures a change in capacitance of the detecting strands, and a pressure sensor or a load sensor which detects or measures tension or a displacement of the detecting strands. The cord-shaped sensor may similarly be arranged on a same surface of the base material as the cord-shaped heater or on a different surface of the base material from the cord-shaped heater.

(37) As the base material **11**, a base material that combines the structural yarn **11a** arranged in an approximately planar shape and the nonwoven fabric **11b** is used. As the structural yarn **11a**, structural yarns of various modes such as a multifilament, a monofilament, and a spun yarn can be used. Among these modes, a multifilament is preferable due to superior flexibility and strength. While an apparent diameter of the structural yarn may be appropriately set in accordance with a usage environment of the heater unit **31** or the like, the apparent diameter preferably ranges from 0.25 mm to 1 mm from the perspectives of flexibility, mechanical strength, and ventilation characteristics. Note that the apparent diameter of the structural yarn is a value which is obtained by an actual measurement and which includes gaps between fibers that make up the structural yarn, and the apparent diameter can be approximately calculated according to the following equation.
$$D=0.0357 \times \{T/(\rho \times \phi)\}^{0.5}$$

D: apparent diameter of structural yarn (mm) T: thickness of structural yarn (tex) ρ : density of fibers constituting structural yarn (g/cm³) ϕ : fill factor of structural yarn (ratio of apparent density of structural yarn to density of fibers)

(38) Various types of materials can be used as the material that constitutes the structural yarn **11a** and examples thereof include inorganic fibers such as a glass fiber, an alumina fiber, a silica fiber, an alumina-silica fiber, and a carbon fiber, polyester fibers such as a polyethylene terephthalate fiber, a polyethylene naphthalate fiber, and a polybutylene terephthalate fiber, synthetic fibers such as a polyvinyl alcohol fiber, a polyvinyl chloride fiber, a polyvinylidene chloride fiber, a polyethylene fiber, a polypropylene fiber, a polyacrylonitrile fiber, a polystyrene fiber, a polyurethane fiber, a polyphenylene sulfide fiber, an aramid fiber, a nylon fiber, a polyether sulfone fiber, a polyether ketone fiber, and an ethylene tetrafluoride fiber, and natural fibers such as cotton, hemp, flax, silk, and sheep's wool. In addition, fibers with a sheath-core structure in which a sheath made of a low-melting point material is formed on an outer circumference of a core made of a high-melting point material may be used. These materials may be appropriately selected in consideration of usage conditions or the like. Obviously, the structural yarn **11a** may be made of fibers of a single type or fibers of a plurality of types may be combined to form the structural yarn **11a**.

(39) Conceivable examples of a mode in which the structural yarn **11a** is disposed in an approximately planar shape include disposing the structural yarn **11a** in a serpentine shape, paralleling a plurality of the structural yarns **11a** while separating the structural yarns **11a** at predetermined intervals, paralleling a plurality of the structural yarns **11a** while separating the structural yarns **11a** at predetermined intervals and then stacking the paralleled structural yarns **11a** in a plurality of layers such that respective parallel alignment directions differ from each other, weaving the structural yarns **11a** (for example, plain weave, twill weave, and sateen weave), and knitting the structural yarns **11a** (for example, plain stitch, rib stitch, purl stitch, interlock stitch, moss stitch, jacquard stitch, raschel stitch, and tricot stitch). In particular, weaving the structural yarn **11a** so that the opening portion **11c** thereof is larger than the apparent diameter of the structural yarn **11a** or knitting the structural yarn **11a** so that the opening portion **11c** thereof is larger than the apparent diameter of the structural yarn **11a** enables sufficient ventilation characteristics to be provided by the opening portion **11c**. Furthermore, due to a structure created

by weaving or knitting, displacement of the structural yarn **11a** can be prevented even when subjected to an external force. As the size of the opening portion **11c**, for example, the opening portion **11c** is preferably around 10 to 30 times the apparent diameter of the structural yarn **11a**. Note that the size of the opening portion **11c** is obtained in a portion where the diameter of the opening portion **11c** is maximized and, for example, when the opening portion **11c** is a quadrature, a length of a diagonal is adopted as the size of the opening portion **11c**. In addition, from another perspective, the shielding ratio of the structural yarn **11a** preferably ranges from 8.8 to 23.2%. The shielding ratio refers to a percentage of an area occupied by the structural yarn **11a** in a unit area and, when the apparent diameter of the structural yarn **11a** is constant, the larger the size of the opening portion **11c**, the lower the shielding ratio, but when the size of the opening portion **11c** is constant, the larger the apparent diameter of the structural yarn **11a**, the higher the shielding ratio.

(40) While an angle formed between the first structural yarn group **11x** and the second structural yarn group **11y** is 90 degrees in the embodiment described above, it is obvious that the angle may be other than 90 degrees. However, since sufficient mechanical strength with respect to a predetermined direction may not be secured when the angle is too small, the angle is preferably 45 degrees or more. In addition, besides the first structural yarn group **11x** and the second structural yarn group **11y**, a third structural yarn group, a fourth structural yarn group, and the like at different angles may be further used. For example, as shown in FIG. 13, the base material **11** is also conceivable in which the first structural yarn group **11x**, the second structural yarn group **11y**, and a third structural yarn group **11z** which are disposed at 60-degree intervals. In the case of an aspect such as that shown in FIG. 13, while the linear portions **10a** of the cord-shaped heater **10** may be disposed at an angle which differs from all of the angles of the first structural yarn group **11x**, the second structural yarn group **11y**, and the third structural yarn group **11z**, an advantageous effect of the present invention can be sufficiently produced as long as the linear portions **10a** of the cord-shaped heater **10** are disposed at an angle which differs from two of the angles of the first structural yarn group **11x**, the second structural yarn group **11y**, and the third structural yarn group **11z**.

(41) As the nonwoven fabric **11b**, a nonwoven fabric formed by various methods such as a wetlaid method, a thermal bond method, a chemical bond method, a needle punch method, and a spun lace method is conceivable. Various types of materials can be used as the fibers that constitute the nonwoven fabric **11b** and examples thereof include inorganic fibers such as a glass fiber, an alumina fiber, a silica fiber, an alumina-silica fiber, and a carbon fiber, polyester fibers such as a polyethylene terephthalate fiber, a polyethylene naphthalate fiber, and a polybutylene terephthalate fiber, synthetic fibers such as a polyvinyl alcohol fiber, a polyvinyl chloride fiber, a polyvinylidene chloride fiber, a polyethylene fiber, a polypropylene fiber, a polyacrylonitrile fiber, a polystyrene fiber, a polyurethane fiber, a polyphenylene sulfide fiber, an aramid fiber, a nylon fiber, a polyether sulfone fiber, a polyether ketone fiber, and an ethylene tetrafluoride fiber, and natural fibers such as cotton, hemp, flax, silk, and sheep's wool. In addition, thermally fusible fibers with a sheath-core structure in which a sheath made of a low-melting point material is formed on an outer circumference of a core made of a high-melting point material may be used. By using such a thermally fusible fiber when the thermal fusion bonding portion **9** is formed in an outermost layer of the cord-shaped heater **10**, since the sheath portion of the thermally fusible fiber and the thermal fusion bonding portion **9** become thermally fused and integrated with each other in a state where the core portion of the thermally fusible fiber is surrounded, extremely tight bonding between the cord-shaped heater **10** and the base material **11** is realized. These fibers may be appropriately selected in consideration of usage conditions or the like. Obviously, the nonwoven fabric **11b** may be made of fibers of a single type or fibers of a plurality of types may be combined to form a hybrid nonwoven fabric **11b**. In addition, as the fibers that constitute the nonwoven fabric **11b**, a filament (long fiber) without a fiber length may be used or a staple (short fiber) having a predetermined fiber length may be used. A filament is more preferable since a filament produces higher strength as the nonwoven fabric **11b** and enables the cord-shaped heater **10** to be reliably

fixed. Furthermore, as the base material **11**, a base material with sufficient flame retardancy to pass FMVSS No. 302, test for Flammability of Interior Materials is preferable. FMVSS stands for the Federal Motor Vehicle Safety Standard and a flammability test for interior materials of motor vehicles is stipulated therein as Standard No. 302. To this end, as the fibers that constitute the structural yarn **11a** and the nonwoven fabric **11b**, a flame-retardant fiber capable of passing a flame retardancy test (for example, JIS-L1091: 1999) is preferably used. Using such a flame-retardant fiber imparts superior flame retardancy to the base material. A thickness (a value measured when dry) of the nonwoven fabric **11b** is desirably set to, for example, around 0.6 mm to 1.4 mm. This is because when bonding and fixing the cord-shaped heater **10** and the base material **11** to each other by heating and pressurization, using the nonwoven fabric **11b** with such a thickness enables the nonwoven fabric **11b** to favorably bond to 30% or more and preferably bond to 50% or more of the outer circumference of the cord-shaped heater and, accordingly, a tight bonding state can be produced. In addition, a basis weight (a weight per a unit area) of the nonwoven fabric **11b** is desirably set to around 80 to 120 g/m² for the base material **11** as a whole. The nonwoven fabric **11b** with such a basis weight can provide superior ventilation characteristics and sufficient mechanical strength.

(42) When thermally fusible fibers are to be used in the nonwoven fabric **11b**, a mixing ratio of the thermally fusible fibers is preferably 5% or higher and preferably 20% or lower. When the mixing ratio of the thermally fusible fibers is lower than 5%, sufficient adhesion cannot be obtained. On the other hand, when the mixing ratio of the thermally fusible fibers is higher than 20%, the nonwoven fabric hardens and may not only cause a seated person to feel a sense of discomfort but may also cause a decline in adhesion with the cord-shaped heater. A mixing ratio of flame-retardant fibers is 70% or higher and preferably 70% or higher and 95% or lower. When the mixing ratio of the flame-retardant fibers is lower than 70%, sufficient flame retardancy may not be obtained. On the other hand, when the mixing ratio of the flame-retardant fibers exceeds 95%, the mixing ratio of the thermally fusible fibers becomes relatively deficient and sufficient adhesion cannot be obtained. Note that a sum of the mixing ratio of the thermally fusible fibers and the mixing ratio of the flame-retardant fibers need not be 100% and other fibers may be mixed as appropriate.

(43) In addition, fibers that constitute the nonwoven fabric **11b** may conceivably be colored. For example, in a case of the vehicular seat **41** using artificial leather or natural leather as the material of the seat cover **43**, since these materials lack ventilation characteristics, a plurality of through-holes are to be formed in the seat cover **43** in order to impart ventilation characteristics. When the heater unit **31** is disposed inside the vehicular seat **41** described above, the heater unit **31** is to be visible from the through-holes. Therefore, the fibers that constitute the nonwoven fabric **11b** are preferably colored in black or a similar type of color as the seat cover to make the nonwoven fabric **11b** as inconspicuous as possible. It is also obvious that, conceivably, the structural yarn **11a** and the cord-shaped heater **10** may be colored in black or a similar type of color as the seat cover.

(44) As a mode which combines the structural yarn **11a** and the nonwoven fabric **11b**, for example, a mode in which the structural yarn **11a** disposed in a planar shape is pasted on one surface of the nonwoven fabric **11b** and a mode in which the structural yarn **11a** disposed in a planar shape is sandwiched between a pair of the nonwoven fabric **11b** are conceivable. In doing so, for example, the structural yarn **11a** and the nonwoven fabric **11b** are conceivably pasted together by an adhesive. In addition, when using a pair of the nonwoven fabric **11b**, the sheets of the nonwoven fabric **11b** are conceivably pasted together by an adhesive. While various types of adhesives are known and an adhesive may be appropriately selected in consideration of compatibility with the structural yarn **11a** or the nonwoven fabric **11b**, an adhesive which takes VOC into consideration is preferably selected in light of recent environmental circumstances. Furthermore, using a thermoplastic resin as the material of the fibers of the structural yarn **11a** and/or the nonwoven fabric **11b** enables the structural yarn **11a** and the nonwoven fabric **11b** or sheets of the nonwoven fabric **11b** to be pasted together by applying heat and pressure under suitable conditions in a state

where the structural yarn **11a** and the nonwoven fabric **11b** are stacked on top of each other. Specifically, for example, a method of using a press hot plate such as that described earlier or a method involving passing between heating rolls may be used.

(45) In addition, when using a pair of the nonwoven fabric **11b**, each of the pair may be made of a different material. For example, the following modes are conceivable. As one of the sheets of the nonwoven fabric **11b**, a nonwoven fabric with a high degree of porosity or, in other words, a small amount of fiber per a unit volume is conceivably selected. By selecting a nonwoven fabric with a high degree of porosity as the nonwoven fabric **11b** on the side where the cord-shaped heater **10** is to be present on a heater unit surface enables the cord-shaped heater **10** to more reliably penetrate into the nonwoven fabric **11b** and the heater unit **31** with a flat shape can be obtained. Furthermore, a nonwoven fabric with a high degree of porosity may be selected as the nonwoven fabric **11b** and the nonwoven fabric **11b** may be fused with and filled by another resin to create a composite material. In addition, the heater unit **31** imparted with additional functions can be realized by combining various types of nonwoven fabric including a nonwoven fabric with superior flame retardancy, a nonwoven fabric with high tensile strength, a nonwoven fabric with superior chemical resistance, a nonwoven fabric with superior heat resistance, a nonwoven fabric with superior voltage resistance characteristics, a nonwoven fabric with electromagnetic wave shielding characteristics, a nonwoven fabric with low resilience, a nonwoven fabric with superior low temperature brittleness, and a nonwoven fabric with high (or low) thermal conductivity.

(46) In addition, as far as an adhesion layer for fixing the heater unit **31** to a seat is concerned, the adhesion layer is preferably formed by forming an adhesion layer solely constituted of an adhesive on a release sheet or the like and transferring the adhesion layer onto a surface of the base material **11** from the release sheet when considering stretchability of the base material **11** or the retention of a high-quality texture. Furthermore, as the adhesion layer, an adhesion layer with flame retardancy is preferable and an adhesion layer with sufficient flame retardancy to pass FMVSS No. 302, Flammability of Interior Materials by itself is more preferable. Examples include an acrylic polymer pressure sensitive adhesive.

(47) In addition, when arranging the cord-shaped heater **10** on the base material **11**, instead of an aspect in which the cord-shaped heater **10** is bonded and fixed to the base material **11** due to thermal fusion by applying heat and pressure, the cord-shaped heater **10** may be fixed to the base material **11** by other aspects. For example, the cord-shaped heater **10** may be fixed to the base material **11** by sewing, the cord-shaped heater **10** may be fixed to the base material **11** by sandwiching and fixing the cord-shaped heater **10** with a pair of the base material **11** with adhesive backing, or another aspect may be used. When fixing the cord-shaped heater **10** to the base material **11**, an aspect in which the cord-shaped heater **10** is fixed in direct contact with the structural yarn **11a** of the base material **11** is preferable. When fixing the cord-shaped heater **10** to the base material **11** by sewing, for example, conceivably, the base material **11** with the structural yarn **11a** disposed on a surface thereof or the base material **11** including the nonwoven fabric **11b** with sufficiently low density (basis weight) may be used so that the cord-shaped heater **10** and the structural yarn **11a** come sufficiently close to each other, and the cord-shaped heater **10** and the structural yarn **11a** may be tightened and brought into contact with each other by sewing.

(48) An arrangement of a serpentine shape in the cord-shaped heater **10** may also be designed in a predetermined shape by appropriately combining the linear portions **10a** and the curved portions **10b** in accordance with an object to be heated, an installation location, or the like. While the linear portions **10a** are preferably arranged to be at an angle that differs from the angles of the first structural yarn group **11x** and the second structural yarn group **11y**, all of the linear portions **10a** need not satisfy this arrangement. A part of the linear portions **10a** may be parallel to the first structural yarn group **11x** or the second structural yarn group **11y**. The advantageous effect of the present invention can be sufficiently produced as long as 50% or more regions among the linear portions **10a** of the disposed cord-shaped heater **10** are arranged to be at an angle that differs from

the angles of the first structural yarn group **11x** and the second structural yarn group **11y**.

INDUSTRIAL APPLICABILITY

(49) As described in detail above, according to the present invention, a heater unit with superior ventilation characteristics and mechanical strength can be obtained. The heater unit is suitably applicable as heating means that requires ventilation characteristics such as an electric blanket, an electrically heated carpet, a car seat heater, a steering wheel heater, a heated toilet seat, an antifog mirror heater, a cooking utensil, and a heater for floor panel heating.

REFERENCE SIGNS LIST

(50) **10** CORD-SHAPED HEATER **10a** LINEAR PORTION **10b** CURVED PORTION **11** BASE MATERIAL **11a** STRUCTURAL YARN **11b** NONWOVEN FABRIC **11c** OPENING PORTION **11x** FIRST STRUCTURAL YARN GROUP **11y** SECOND STRUCTURAL YARN GROUP **31** HEATER UNIT **41** VEHICULAR SEAT

Claims

1. A heater unit comprising: a base material; and a cord-shaped heater, the cord-shaped heater being disposed on and fixed to the base material, wherein the base material is made by combining a structural yarn that is disposed in an approximately planar shape and a nonwoven fabric with each other, wherein the structural yarn is woven, or knitted, or parallel alignments of the structural yarn in different directions are stacked and the heater unit has an opening portion that is larger than an apparent diameter of the structural yarn, and the cord-shaped heater is fixed in direct contact with the structural yarn.
2. The heater unit according to claim 1, wherein a thermal fusion bonding portion is formed on an outermost layer of the cord-shaped heater, and the thermal fusion bonding portion is fixed to the nonwoven fabric and the structural yarn by thermal fusion bonding.
3. The heater unit according to claim 1, wherein the base material is made of a structural yarn and a pair of a nonwoven fabric, and the structural yarn is sandwiched by the pair of the nonwoven fabric.
4. A vehicular seat comprising: a seat cover; and a seat pad, wherein the heater unit according to claim 1 is arranged between the seat cover and the seat pad.
5. A heater unit comprising: a base material; and a cord-shaped heater, the cord-shaped heater being disposed on and fixed to the base material, wherein the base material is made by combining a plurality of structural yarns that are disposed in an approximately planar shape and a nonwoven fabric with each other, the plurality of structural yarns is made up of at least a first structural yarn group that is linearly disposed with respect to a predetermined direction and a second structural yarn group that is linearly disposed with respect to a direction different from the direction of the first structural yarn group, the cord-shaped heater is disposed on the base material in a serpentine shape created by a combination of linear portions and curved portions, and the linear portions of the cord-shaped heater are arranged so as to assume an angle that differs from the angles of the first structural yarn group and the second structural yarn group.
6. The heater unit according to claim 5, wherein the structural yarn is woven or parallel alignments of the structural yarn in different directions are stacked and the heater unit has an opening portion larger than an apparent diameter of the structural yarn.
7. The heater unit according to claim 5, wherein the base material is made of a structural yarn and a pair of a nonwoven fabric, and the structural yarn is sandwiched by the pair of the nonwoven fabric.
8. The heater unit according to claim 5, wherein a thermal fusion bonding portion is formed on an outermost layer of the cord-shaped heater, and the thermal fusion bonding portion is fixed to the nonwoven fabric and the structural yarn by thermal fusion bonding.

9. A vehicular seat comprising: a seat cover; and a seat pad, wherein the heater unit according to claim 5 is arranged between the seat cover and the seat pad.
