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Saito

(54) **WATER STOPPING STRUCTURE OF CORE WIRES AND WATER STOPPING METHOD OF CORE WIRES**

(71) Applicant: **Yazaki Corporation**, Tokyo (JP)

(72) Inventor: **Takahiro Saito**, Kosai-shi (JP)

(73) Assignee: **YAZAKI CORPORATION**, Tokyo (JP)

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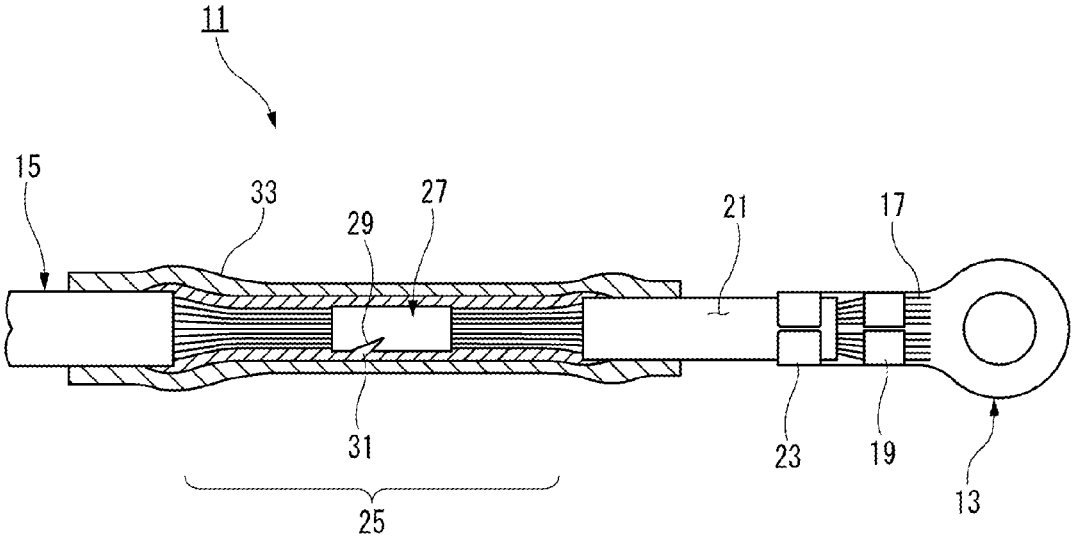
(57) **ABSTRACT**

A water stopping structure includes a covered electric having a plurality of core wires covered with an insulation cover, and a core wire welding portion provided in a part of the covered electric wire where the insulation cover is removed and the core wires are exposed to the outside. In the core wire welding portion, the core wires are welded to each other. A gap between the core wires, which has a size capable of being filled up with a low viscosity water stop material by capillarity action, is formed in the core wire welding portion. The gap is filled up with the water stop material.



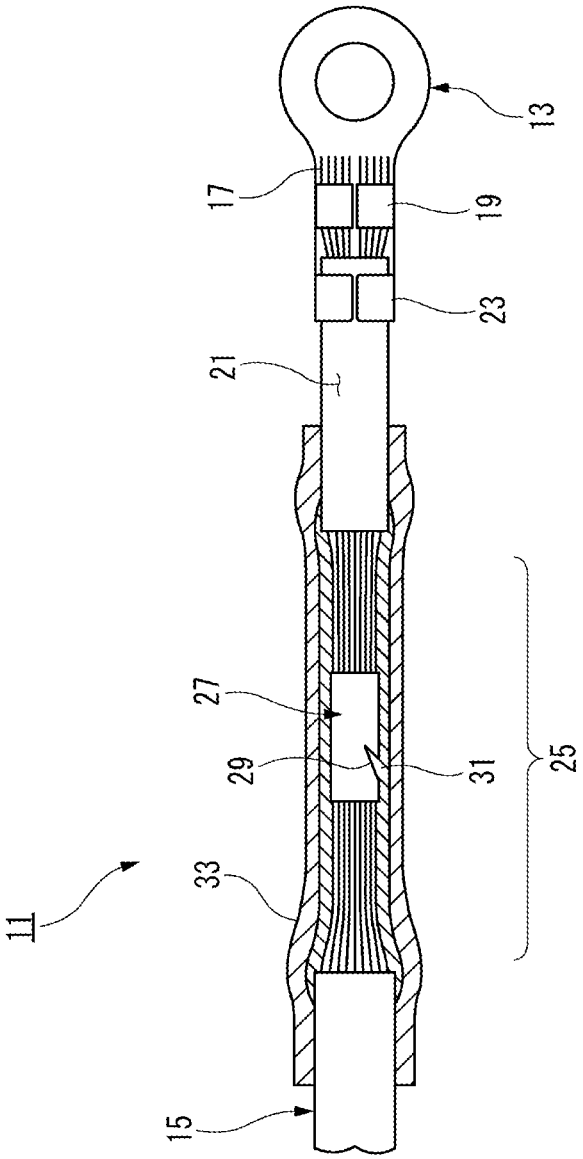



FIG. 1

FIG.2A

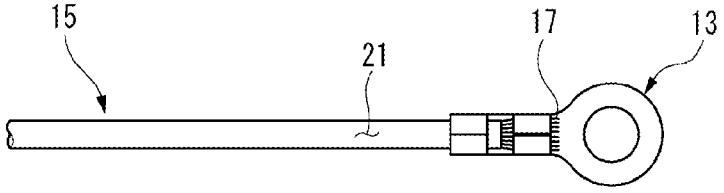



FIG.2B

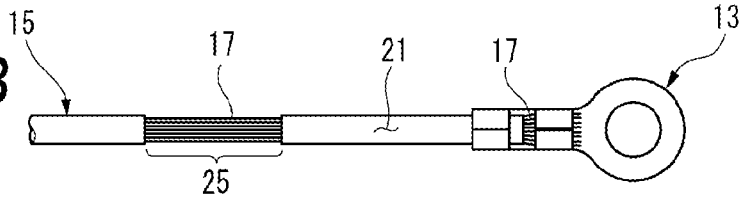



FIG.2C

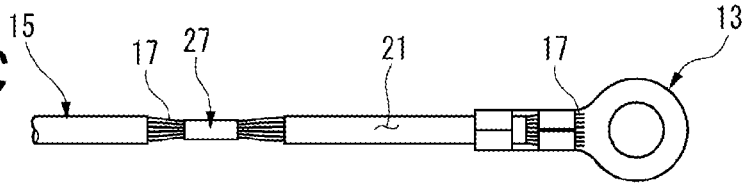



FIG.2D

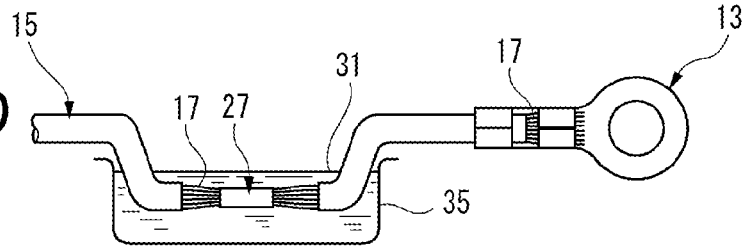



FIG.2E

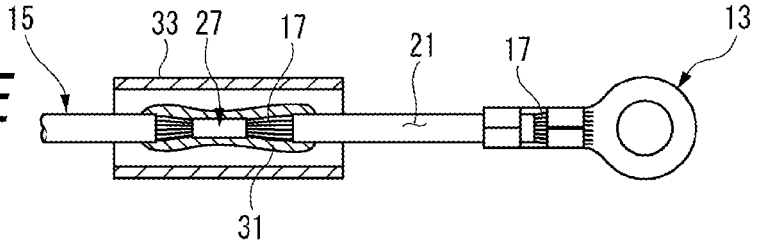



FIG.2F

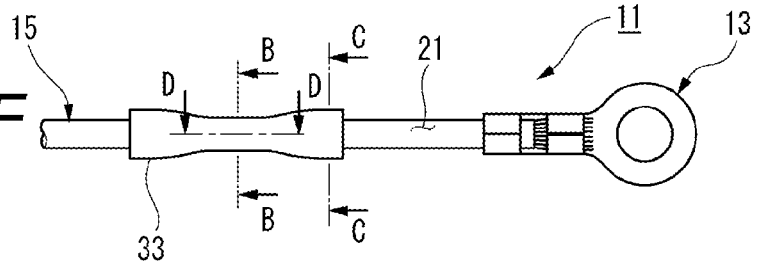


FIG.3A

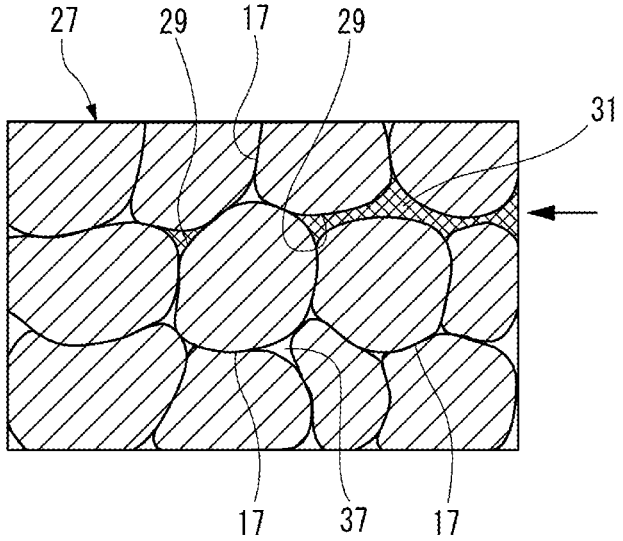



FIG.3B

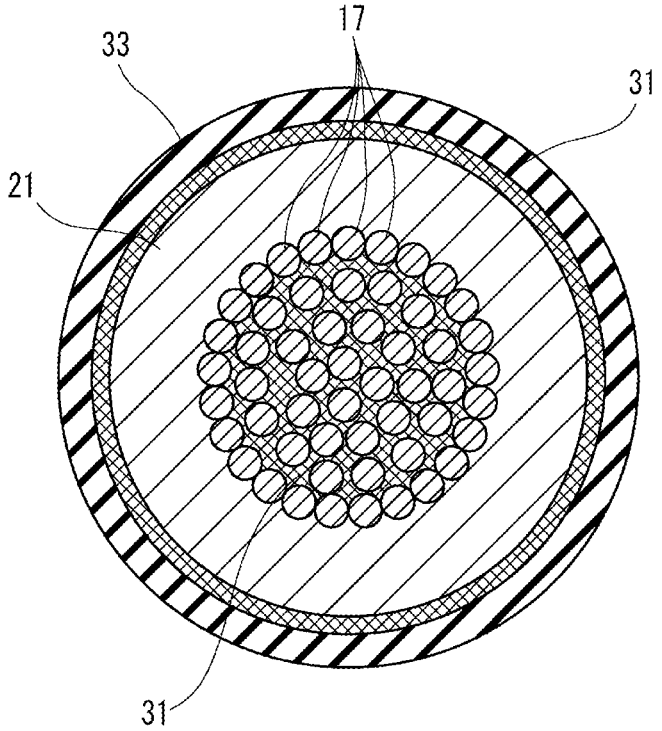


FIG.4

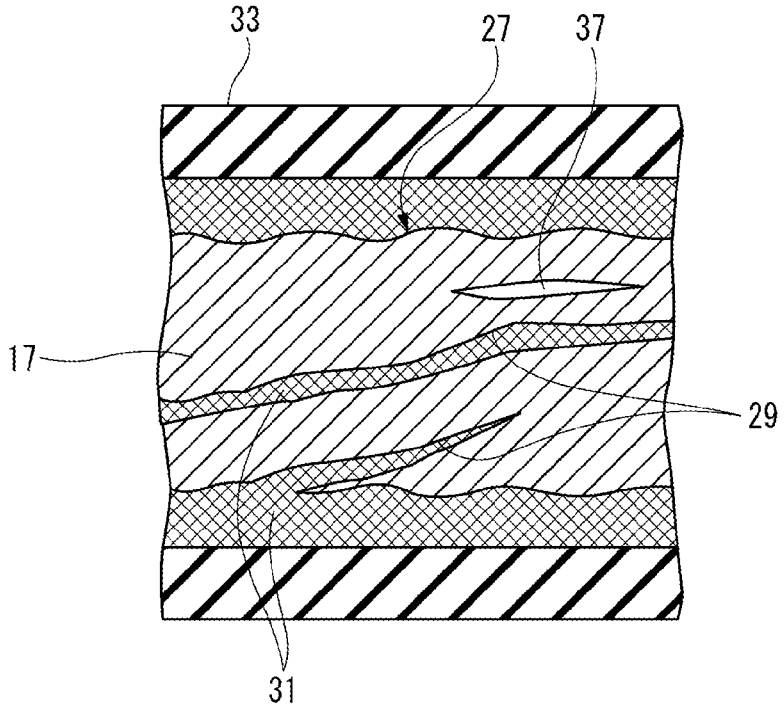


FIG.5A

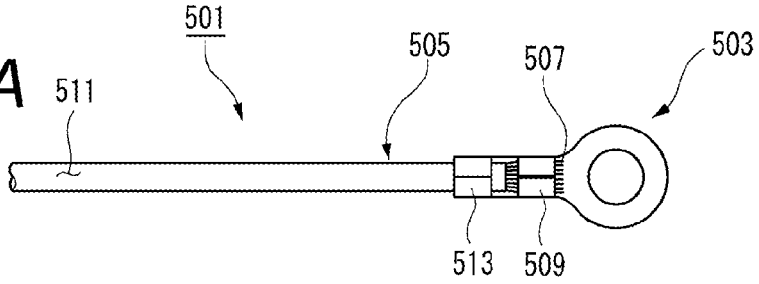



FIG.5B

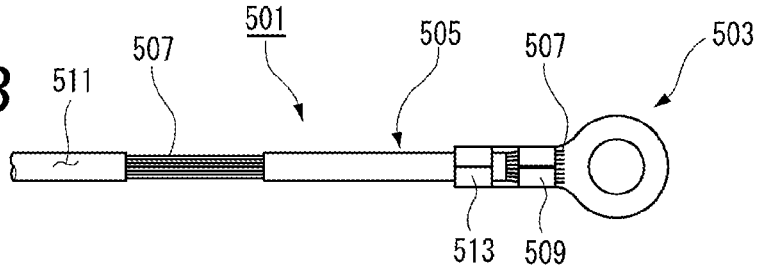



FIG.5C

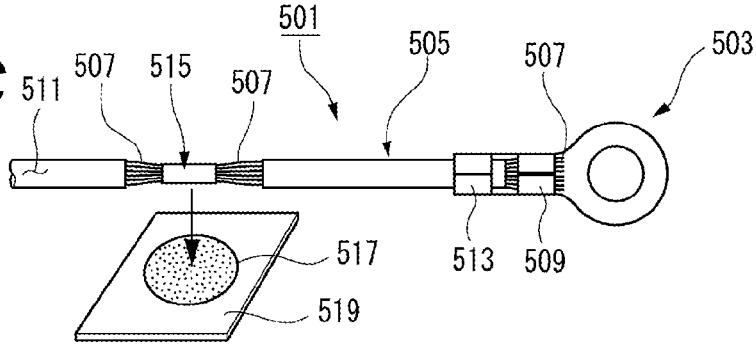



FIG.5D

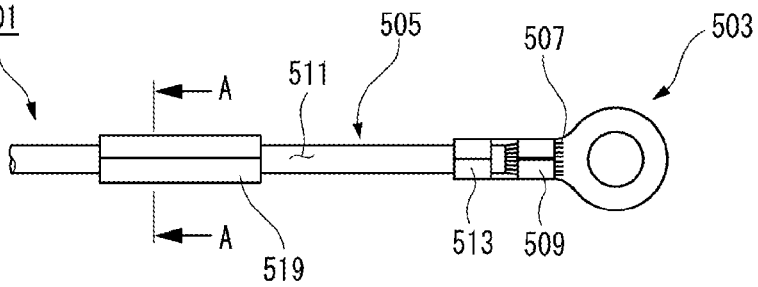


FIG.6

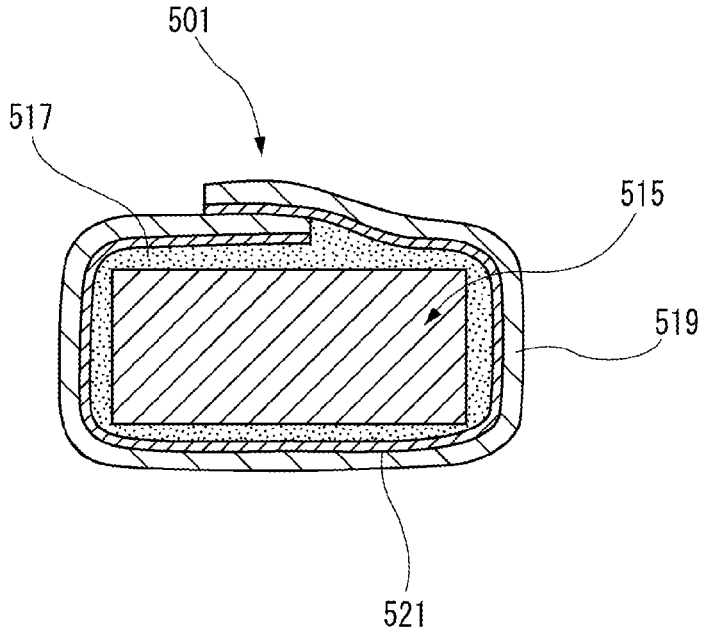


FIG.7A

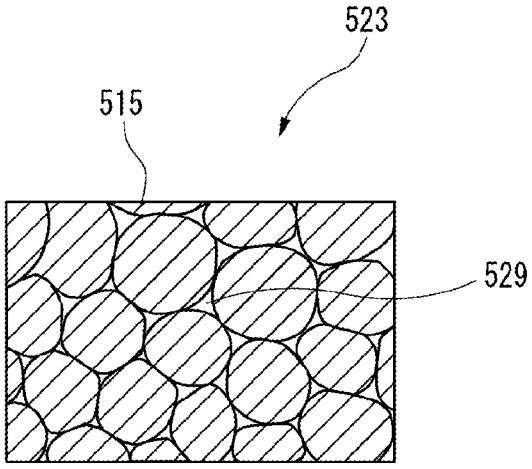
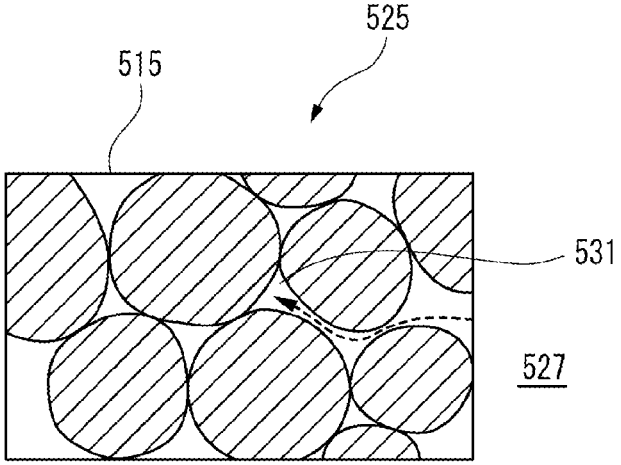



FIG.7B



# WATER STOPPING STRUCTURE OF CORE WIRES AND WATER STOPPING METHOD OF CORE WIRES

## TECHNICAL FIELD

**[0001]** The present disclosure relates to a water stopping structure of core wires and a water stopping method of the core wires that prevent water permeation into the core wires of a covered electric wire.

## BACKGROUND ART

**[0002]** In a case where a ground terminal crimped to an electric wire, for example, is connected to a vehicle body which is present in a water exposed area, water permeates the inside of the electric wire from an exposed core wire portion which is crimped in the ground terminal and then the water often permeates devices or equipment which are connected to the opposite end of the electric wire. In order to prevent the permeation of water through such a route, there are cases where a water proofing treatment is performed with respect to a terminal swage portion or the water proofing treatment is performed with respect to a core wire portion positioned at a middle part of the electric wire (for example, refer to PTL 1).

**[0003]** As illustrated in FIG. **5**A, in a ground electric wire **501** disclosed in PTL 1, core wires **507** which are exposed from the terminal of an electric wire (covered electric wire) **505** is swaged and crimped by a core wire crimping barrel **509** with respect to a ground terminal **503**, and an insulation cover **511** is crimped by an insulation cover crimping barrel **513**. Each of the core wires **507** is formed from a twisted wire which is not a single core wire, but configured by twisting multiple element wires together.

**[0004]** As illustrated in FIG. **5**B, the electric wire **505**, whose end portion is crimped and connected to a ground terminal **503**, has an insulation cover **511** removed at a position close to a ground terminal connecting portion, thereby the core wire **507** is exposed.

**[0005]** Next, as illustrated in FIG. **5**C, a welding portion **515** is formed by welding the exposed core wire **507** and integrating each of the twisted element wires together.

**[0006]** Then, as illustrated in FIG. **5**D, a wide tape **519**, made of insulation resin and on which silicon **517** is applied, is wound around the welding portion **515** and the core wire **507** exposed by removing the insulation cover **511**.

**[0007]** As illustrated in FIG. **6**, in the tape **519**, an adhesive layer **521** is provided on the inner surface to which the silicon **517** is applied, and is firmly fixed by being wound around the core wire **507** and the welding portion **515**.

**[0008]** The tape **519** is wound around by being extended up to the outer peripheral surface positioned at both sides of the insulation cover **511** of a peeled portion where the core wire **507** is exposed, and it is configured such that water permeation does not occur from a boundary between the exposed core wire **507** and the insulation cover **511**. As illustrated in FIG. **6**, according to such a procedure, the welding portion **515** and a portion between element wires of the front and the rear core wires **507** are filled up with the silicon **517**, and are completely covered by the tape **519**.

## CITATION LIST

### Patent Literature

**[0009]** [PTL 1] JP-A-2004-72943

## SUMMARY OF INVENTION

### Technical Problem

**[0010]** However, in the above water stopping structure of a ground electric wire **501** in the related art, stable waterproofing properties have been obtained in the case of a thin cable **523** which has a relatively small core wire diameter, illustrated in FIG. **7**A. However, fluctuations in the waterproofing properties have occurred in a case of a thick cable **525** which has a large core wire diameter, illustrated in FIG. **7**B. More specifically, the stable properties cannot be obtained except in a case of the thin cable **523** whose cross sectional area is up to 1.25 sq.

**[0011]** It is conceivable that the reason of lack of the stable waterproofing properties is because a gap occurring at a welding portion **515** in a case of the thick cable **525** is not considered in the water stopping structure of the ground electric wire **501** in the related art. That is, as illustrated in FIG. **7**A, the welding portion **515** of the thin cable **523** brings the core wires into substantially close contact with each other, or is a closed space even if a minute gap **529** is formed. On the other hand, as illustrated in FIG. **7**B, in some cases, the welding portion **515** of the thick cable **525** comes to have large gaps **531** and the gaps are communicated with each other. Since such large gaps **531** are formed in the thick cable **525** during actual work, it is important to eliminate the gaps **531**.

**[0012]** In the above water stopping structure of the ground electric wire **501** in the related art, the tape **519** to which the silicon **517** is applied is wound around the welding portion **515**. However, it is extremely difficult to fill up the large gaps **531** formed in the center vicinity of the welding portion **515** and communicate with the outside **527**, with the silicon **517** applied to the tape **519**. In addition, it is extremely difficult to heat the welding portion **515** until the large gaps **531** are completely eliminated, and thereby there is also a possibility that the welding portion **515** is melted and then flows out depending on fluctuations in heat capacity of the welding portion **515**.

**[0013]** The present disclosure is made in consideration of the above-described circumstance and an object thereof is to provide a water stopping structure of core wires and a water stopping method of the core wires which enable stable waterproofing properties regardless of the thickness of a covered electric wire.

### Solution to Problem

**[0014]** The above-described object according to the present disclosure is achieved by the following configurations.

**[0015]** (1) There is provided a water stopping structure comprising:

**[0016]** a covered electric wire configured to have a plurality of core wires and an insulation cover covering the core wires; and

**[0017]** a core wire welding portion configured to be provided in a part of the covered electric wire where the insulation cover is removed and the core wires are exposed to the outside,

**[0018]** wherein in the core wire welding portion, the core wires are welded to each other;

**[0019]** wherein a gap between the core wires, which has a size capable of being filled up with a low viscosity water stop material by capillarity action, is formed in the core wire welding portion; and

**[0020]** wherein the gap is filled up with the water stop material.

**[0021]** According to the water stopping structure with the above-described configuration (1), in the core wire welding portion which is formed at the core wires of the covered electric wire by the welding process, there remains the gap with the size capable of being filled up with the low viscosity water stop material by the capillarity action. The size of the gap can be determined depending on the viscosity of the water stop material, wettability of the core wires or the like. Then, the gap of the core wire welding portion, where the capillarity action is easily induced, is filled up with the water stop material. Accordingly, water going through one side core wires across the core wire welding portion can no longer permeate the other side since the permeating route is reliably blocked and waterproofed in the core wire welding portion.

**[0022]** That is, the water transmitting between each of the core wires is stopped in the core wire welding portion. In addition, the water transmitting between the insulation cover and the outer periphery of a core wire bundle is stopped by the water stop material which covers the insulation cover and the core wire welding portion.

**[0023]** (2) The water stopping structure with above-described configuration (1), further comprises:

**[0024]** a heat shrinkable tube configured to cover the core wire welding portion and configured to be extended to the insulation cover adjacent at both ends of the core wire welding portion,

**[0025]** wherein the heat shrinkable tube is brought into close contact with the core wire welding portion and an outer peripheral surface of the insulation cover adjacent at both ends of the core wire welding portion.

**[0026]** According to the water stopping structure with the above-described configuration (2), the heat shrinkable tube is extended up to and brought into close contact with the outer peripheral surface of the insulation cover positioned at both ends of the core wire welding portion. Therefore, the water is also stopped between the core wire welding portion and the heat shrinkable tube. In addition, if the heat shrinkable tube is shrunk while the water stop material is in an uncured state, the uncured water stop material can be press-fitted into the gap of the core wire welding portion due to shrinking pressure of the heat shrinkable tube.

**[0027]** (3) There is provided a water stopping method comprising:

**[0028]** forming a core wire exposed portion by removing an insulation cover of a covered electric wire in which a plurality of core wires is covered with the insulation cover;

**[0029]** forming a core wire welding portion having a gap between the core wires, by shrinking to a size of the gap capable of being filled up with a low viscosity water stop material by capillarity action by performing a welding processing for the core wires of the core wire exposed portion; and

**[0030]** filling up the gap with the low viscosity water stop material by the capillarity action.

**[0031]** According to the water stopping method with the above-described process (3), the core wire exposed portion is formed by removing the middle of the insulation cover of the covered electric wire. The core wire welding portion is formed at the core wire exposed portion by performing the welding processing, for example, such as ultrasonic welding or resistance welding.

**[0032]** Then, the gap with the size capable of being filled up with the low viscosity water stop material by the capillarity action remains at the core wire welding portion. The size of the gap can be controlled, for example, using ultrasonic vibration of an ultrasonic welding machine or an electric current generated by a resistance welding machine. In this manner, the core wire welding portion having the gap where the capillarity is easily induced is dipped into the water stop material, for example, and thereby the gap which communicates with the outside is filled up with the water stop material. Accordingly, the water transmitting through one side of the core wires across the core wire welding portion can no longer permeate the other side since the permeating route is reliably blocked and waterproofed in the core wire welding portion.

**[0033]** That is, the water transmitting between the core wires is stopped in the core wire welding portion. In addition, the water transmitting between the insulation cover and the outer periphery of a core wire bundle is stopped by the water stop material which covers the insulation cover and the core wire welding portion.

**[0034]** (4) For example, the water stopping method, further comprises:

**[0035]** covering the core wire welding portion and the insulation cover adjacent at both ends of the core wire welding portion with a heat shrinkable tube; and

**[0036]** applying heat to the heat shrinkable tube so that the heat shrinkable is brought into close contact with the core wire welding portion and an outer peripheral surface of the insulation cover adjacent at both ends of the core wire welding portion.

**[0037]** (5) For example, the heat shrinkable tube is shrunk when the water stop material is in an uncured state so that the uncured water stop material is press-fitted into the gap due to shrinking pressure of the heat shrinkable tube.

## Advantageous Effects of Invention

**[0038]** According to the water stopping structure and the water stopping method of the present disclosure, it is possible to provide a water stopping structure of core wires and a water stopping method of the core wires which enable stable waterproofing properties regardless of thickness of cables.

**[0039]** The present disclosure is described with concision. In addition, the details of the present disclosure will be further clarified with reference to the accompanying drawings by reading aspects (hereinafter referred to as an "embodiment") for implementing the present disclosure which is to be described below.

## BRIEF DESCRIPTION OF DRAWINGS

**[0040]** FIG. **1** is a plan view where a portion is cut away from a covered electric wire having a water stopping structure of core wires according to an embodiment of the present disclosure.

**[0041]** FIGS. **2**A to **2**F are process drawings illustrating a procedure of a water stopping process for core wires of the covered electric wire illustrated in FIG. **1**.

**[0042]** FIG. **3**A is an enlarged view of a main portion along the B-B cross-section in FIG. **2**F, and FIG. **3**B is a cross-sectional view along the C-C cross-section in FIG. **2**F.

**[0043]** FIG. **4** is a cross-sectional view along the D-D cross-section in FIG. **2**F.

**[0044]** FIGS. **5**A to **5**D are process drawings illustrating procedures of a water stopping process for core wires of a covered electric wire in the related art.

**[0045]** FIG. **6** is a cross-sectional view along the A-A cross-section in FIG. **5**D.

**[0046]** FIG. **7**A is an enlarged cross-sectional view of a core wire welding portion of a thin cable according to a water stopping structure of the core wires in the related art, and FIG. **7**B is an enlarged cross-sectional view of a core wire welding portion of a thick cable according to a water stopping structure of the core wires in the related art.

## DESCRIPTION OF EMBODIMENTS

**[0047]** Hereinafter, an embodiment according to the present disclosure will be described with reference to the accompanying drawings.

**[0048]** A covered electric wire **15** having a water stopping structure of core wires according to the present embodiment is applied to a ground electric wire (covered electric wire) **11**, for example. The ground electric wire **11** can be preferably used in a case of blocking water which permeates the inside of the electric wire from an exposed core wire portion in a water exposed area and attempts to permeate a device or equipment connected to the opposite end of the ground electric wire **11**. Furthermore, water is exemplified for water stopping in this description, but the present disclosure is effective for liquids in general, including oil, alcohol or the like in addition to the water.

**[0049]** As illustrated in FIG. **1**, for example, an LA terminal **13** is connected to an end portion of the ground electric wire **11**. In the ground electric wire **11**, core wires **17** exposed from an end portion of the covered electric wire **15** is crimped with a core wire crimping barrel **19** of the LA terminal **13**, and an insulation cover **21** is crimped with an insulation cover crimping barrel **23**. Each of the core wires **17** is not formed by a single core wire, but is formed from twisted wires configured by twisting a plurality of core wires **17**. The core wires **17** are conductive wires made of copper, a copper alloy, aluminum, an aluminum alloy or the like.

**[0050]** In the ground electric wire **11** whose end portion is crimped and connected to the LA terminal **13**, the insulation cover **21** is removed at a position close to the LA terminal **13**, and a core wire exposed portion **25** is formed where the core wire **17** is exposed. A core wire welding portion **27** where the core wires **17** are bonded to each other by performing a welding processing for the core wires **17** is formed at the core wire exposed portion **25**. That is, the bundled core wires **17** are welded to form a bonding portion where the core wires **17** are welded to each other.

**[0051]** As a method of welding each of the core wires **17**, for example, an ultrasonic welding method, a resistance welding method or the like may be exemplified. Among them, it is preferable to adopt the ultrasonic welding method in view of a simple work and a reliable bonding. In order to perform the ultrasonic welding, the resistance welding or the like, a general ultrasonic welding machine or resistance welding machine can be used.

**[0052]** Herein, each of gaps **29** which is shrunk to a size capable of being filled up with a low viscosity water stop material **31** by capillarity action remains in the core wire welding portion **27** where each of the core wires **17** is welded together. In particular, in a case where the covered electric wire **15** is a thick cable, the gaps **29** easily remain in the core wire welding portion **27** (refer to FIG. **3**A). The gaps **29** are filled up with the water stop material **31** by being dipped as will be described later.

**[0053]** As the water stop material **31**, a low viscosity cyanoacrylate adhesive or the like may be exemplified. The low viscosity cyanoacrylate adhesive can easily permeate the gaps **29** by being simply dropped on the core wire welding portion **27** using a commercially available liquid dispensing instrument.

**[0054]** In addition, a core wire exposed portion **25** where the core wire welding portion **27** is formed, and the insulation cover **21** positioned at both sides of the core wire exposed portion **25** are also covered by the water stop material **31**.

**[0055]** A heat shrinkable tube **33** is provided on the core wire exposed portion **25** covered by the water stop material **31**, and then is heated to a desired temperature (approximately 200° C.), shrunk and brought into close contact therewith. The heat shrinkable tube **33** is extended up to and brought into close contact with the outer peripheral surface of the insulation cover **21** positioned at both sides of the core wire welding portion **27**. As the heat shrinkable tube **33**, for example, a product made by Raychem Corp. (waterproofing heat shrinkable tube: product name: ES-1) can be exemplified. Furthermore, the heat shrinkable tube **33** may be a hot melt type.

**[0056]** Next, an operation of the above-described water stopping structure of core wires will be described.

**[0057]** In the water stopping structure of core wires of the ground electric wire **11** according to the present embodiment, the core wires **17** are processed by welding, in the core wire exposed portion **25** where the insulation cover **21** of the covered electric wire **15** is removed, and the core wire welding portion **27** is formed. In a case of a thick cable, the gaps **29** generally remain in the core wire welding portion **27**. However, each of the gaps **29** is shrunk to a size by a welding processing. The size of each of the shrunk gaps **29** is capable of being filled up with the low viscosity water stop material **31** by the capillarity action. In brief, it is in a state where each of the gaps **29** with the size capable of being filled up with the water stop material **31** is intentionally provided.

**[0058]** The size of each of the gaps **29** can be determined depending on viscosity of the water stop material **31**, wettability of the core wire **17** or the like. The core wire welding portion **27** having the gaps **29** with size where the capillarity action is easily induced is dipped into the water stop material **31**, and thereby the gaps **29** are filled up with the water stop material **31**. Accordingly, water transmitting through one side core wires **17** across the core wire welding portion **27** can no longer permeate the other side since the permeating route is blocked and waterproofed in the core wire welding portion **27**.

**[0059]** That is, if the water permeates the inside portion of the covered electric wire **15** from the exposed core wire which is crimped with the LA terminal **13**, the water transmitting in spaces between the core wires **17** is stopped at the core wire welding portion **27**. In addition, the water transmitting between the insulation cover **21** and the outer periphery of a core wire bundle is stopped by the water stop material **31** which covers the insulation cover **21** and the core wire welding portion **27**. In addition, the heat shrinkable tube **33** is extended up to and brought into close contact with the outer peripheral surface of the insulation cover **21** positioned at both sides of the core wire welding portion **27**. Therefore, the water is also stopped between the outer peripheral surface of

the cured water stop material **31** and the heat shrinkable tube **33**. In addition, if the heat shrinkable tube **33** is shrunk when the water stop material **31** is in an uncured state, the uncured water stop material **31** can be press-fitted into the gaps **29** due to shrinking pressure of the heat shrinkable tube **33**.

**[0060]** Next, a procedure of a water stopping method of core wires according to an embodiment of the present disclosure will be described.

**[0061]** In the water stopping method of the core wires of the present embodiment, first, the insulation cover **21** of the covered electric wire **15** where the core wires **17** are covered with the insulation cover **21** illustrated in FIG. **2**A is removed, and then the core wire exposed portion **25** illustrated in FIG. **2**B is formed.

**[0062]** As illustrated in FIG. **2**C, welding processing is performed for the core wires **17** of the core wire exposed portion **25** using ultrasonic welding, and the core wire welding portion **27** having the gaps **29** between the core wires **17** is formed.

**[0063]** Then, in the ultrasonic welding, the core wire exposed portion **25** is placed on an anvil of an ultrasonic welding machine (not illustrated), and a horn (vibrator) of the ultrasonic welding machine is disposed at a position coupling with the anvil by pinching the bundled core wires **17**. Continuously, in a state where the bundled core wires **17** are pinched by the anvil and the horn, the horn is subjected to ultrasonic vibration. As the horn is in the ultrasonic vibration, the core wires **17** are heated due to friction and the core wires **17** are bonded to each other.

**[0064]** As illustrated in FIGS. **3**A and **4**, the gaps **29** remain in the core wire welding portion **27**. However, the gaps **29** are shrunk to the size capable of being filled up with the low viscosity water stop material **31** by the capillarity action by welding processing for the gaps between the core wires **17**. The gaps **29** penetrates through the inside of the core wire welding portion **27** in the axial direction thereof, or is extended from the outer peripheral portion of the core wire welding portion **27** to the inside thereof. The size of the gaps **29** is controlled by the ultrasonic vibration of the ultrasonic welding machine.

**[0065]** Next, as illustrated in FIG. **2**D, the core wire welding portion **27** having the gaps **29** where the capillarity action is easily induced is dipped into a dip bath **35** which is full of the low viscosity water stop material **31**, and then the gaps **29** are filled up with the water stop material **31**.

**[0066]** As illustrated in FIG. **3**A, in the core wire welding portion **27** which is dipped into the low viscosity water stop material **31**, the water stop material **31** permeates the gaps **29** which communicate with the outside. In the covered electric wire **15** taken out from the dip bath **35**, a water permeation route is blocked in the core wire welding portion **27** in such a manner that the water stop material **31** fills up the gaps **29**.

**[0067]** Furthermore, as illustrated in FIG. **4**, a minute gap **37** to be sealed is present in the core wire welding portion **27** in addition to the gaps **29**. However, the minute gap **37** does not influence the waterproofing function since the minute gap **37** is not communicated with the outside or the other gaps **29**. In other words, the water stop material **31** permeates only the gaps **29** which has influence on the waterproofing function.

**[0068]** In addition, the water stop material **31** which fills up the gaps **29** covers the core wire welding portion **27**, the core wires **17** of the core wire exposed portion **25**, and the insulation cover **21** positioned at both sides of the core wire exposed portion **25** as well. Accordingly, as illustrated in FIG. **3**B, the water stop material **31** which covers the core wire exposed portion **25** also fills up portions among the core wires **17**.

**[0069]** Next, as illustrated in FIG. **2**E, the heat shrinkable tube **33** is laid over both of the core wire welding portion **27** and the insulation cover **21** positioned at both sides of the core wire welding portion **27**. The heat shrinkable tube **33** is heated at a desired temperature and is shrunk. As illustrated in FIG. **2**F, the heat shrinkable tube **33** is extended up to and brought into contact with the outer peripheral surface of the insulation cover **21** positioned at both sides of the core wire welding portion **27**. Accordingly, as illustrated in FIG. **4**, the water stop material **31** which covers the outer periphery of the insulation cover **21** is covered by the heat shrinkable tube **33**.

**[0070]** Therefore, according to the water stopping structure of the core wires and the water stopping method of the core wires of the present embodiment, water transmitting through one side core wires **17** across the core wire welding portion **27** can no longer permeate the other side since the permeating route is reliably blocked and waterproofed in the core wire welding portion **27**. That is, the water transmitting in spaces between the core wires **17** is reliably stopped in the core wire welding portion **27**. In addition, the water transmitting between the insulation cover **21** and the outer periphery of a core wire bundle is stopped by the water stop material **31** which covers the insulation cover **21** and the core wire welding portion **27**. Therefore, stable waterproofing properties can be obtained regardless of thickness of the covered electric wire **15**.

**[0071]** Furthermore, the water stopping structure of the core wires and the water stopping method of the core wires of the present disclosure are not limited to the above-described embodiment, but may be appropriately changed or improved. In addition, a material quality, shape, dimension, number, disposed location or the like of each constituent element according to the above-described embodiment may be arbitrarily selected without any limitation as long as the present disclosure can be achieved.

**[0072]** For example, in the above-described embodiment, a case where the covered electric wire **15** is a thick cable is exemplified for the description. However, even in a case where the covered electric wire **15** is a thin cable, good waterproofing properties can be secured similarly.

**[0073]** The present application is based on Japanese Patent Application No. 2011-251726 filed on Nov. 17, 2011, the contents of which are incorporated herein by reference.

## INDUSTRIAL APPLICABILITY

**[0074]** A water stopping structure of core wires of a covered electric wire and a water stopping method of the core wires which enable stable waterproofing properties regardless of the thickness of the covered electric wire can be obtained.

## REFERENCE SIGNS LIST

**[0075]** **11** ground electric wire (covered electric wire)
**[0076]** **15** covered electric wire
**[0077]** **17** core wire
**[0078]** **21** insulation cover
**[0079]** **25** core wire exposed portion
**[0080]** **27** core wire welding portion
**[0081]** **29** gap
**[0082]** **31** water stop material
**[0083]** **33** heat shrinkable tube

**1**. A water stopping structure comprising:

a covered electric wire configured to have a plurality of core wires and an insulation cover covering the core wires; and

a core wire welding portion configured to be provided in a part of the covered electric wire where the insulation cover is removed and the core wires are exposed to the outside,

wherein in the core wire welding portion, the core wires are welded to each other;

wherein a gap between the core wires, which has a size capable of being filled up with a low viscosity water stop material by capillarity action, is formed in the core wire welding portion; and

wherein the gap is filled up with the water stop material.

**2**. The water stopping structure according to claim **1**, further comprising:

a heat shrinkable tube configured to cover the core wire welding portion and configured to be extended to the insulation cover adjacent at both ends of the core wire welding portion,

wherein the heat shrinkable tube is brought into close contact with the core wire welding portion and an outer peripheral surface of the insulation cover adjacent at both ends of the core wire welding portion.

**3**. A water stopping method comprising:

forming a core wire exposed portion by removing an insulation cover of a covered electric wire in which a plurality of core wires is covered with the insulation cover;

forming a core wire welding portion having a gap between the core wires, by shrinking to a size of the gap capable of being filled up with a low viscosity water stop material by capillarity action by performing a welding processing for the core wires of the core wire exposed portion; and

filling up the gap with the low viscosity water stop material by the capillarity action.

**4**. The water stopping method according to claim **3**, further comprising:

covering the core wire welding portion and the insulation cover adjacent at both ends of the core wire welding portion with a heat shrinkable tube; and

applying heat to the heat shrinkable tube so that the heat shrinkable is brought into close contact with the core wire welding portion and an outer peripheral surface of the insulation cover adjacent at both ends of the core wire welding portion.

**5**. The water stopping method according to claim **4**, wherein the heat shrinkable tube is shrunk when the water stop material is in an uncured state so that the uncured water stop material is press-fitted into the gap due to shrinking pressure of the heat shrinkable tube.

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