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Current measurement component, current measurement device, and current measurement method

Abstract

A current measurement component including a bridging portion bridging a pair of side surface portions, a pair of coaxial components attached to the pair of side surface portions, respectively, each coaxial pair including an inner conductor that extends through a hole formed in a corresponding side surface portion of the pair of side surface portions, a connection portion electrically connecting the inner conductors of the pair of coaxial components, and a tube-like portion enclosing the connection portion with a gap formed between the tube-like portion and an outer peripheral portion of the connection portion. The pair of side surface portions and the bridging portion are electrically conductive and electrically connected, and the tube-like portion includes a base end portion electrically connected to a first side surface portion of the pair of side surface portions and a distal end portion electrically separated from the outer conductor of coaxial component pairs.

Inventors:	**Nakazawa; Koki (Nagano, JP), Watanabe; Hideo (Nagano, JP), Ashida; Yutaka (Nagano, JP)**
Applicant:	**HIOKI E.E. CORPORATION** (Nagano, JP)
Family ID:	**1000008763160**
Assignee:	**HIOKI E.E. CORPORATION (Nagano, JP)**
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Primary Examiner: Phan; Huy Q

Assistant Examiner: Nguyen; Trung Q

Attorney, Agent or Firm: Conley Rose, P.C.

Background/Summary

TECHNICAL FIELD
(1) The present invention relates to a current measurement component, a current measurement device, and a current measurement method.
BACKGROUND ART
(2) JP 1979-078574 U describes a current measurement device in which a measurement coil is attached to a measurement fitting connected to a return conductor of a coaxial cable, and the current flowing through the measurement fitting is measured.
SUMMARY OF INVENTION
(3) With the current measurement device described above, current transmitted from a coaxial transmission path may be measured while a conductor is placed on the outer side of a current sensor configured of the measurement coil or the like. In such a case, the current sensor may be affected by factors such as the electric field and the electromagnetic field generated by a difference between an electrical potential at the conductor that runs along the outside of the current sensor and an electrical potential at the conductor that runs along the inside of the current sensor. This may cause a decrease in measurement accuracy.
(4) The present invention is directed at solving such problems, and an object of the present invention is to accurately measure a current transmitted from a coaxial transmission path.
(5) According to a first aspect of the present invention, a current measurement component includes a pair of side surface portions disposed spaced apart and opposing one another, a bridging portion bridging between the pair of side surface portions and forming a space between the pair of side surface portions, and a pair of coaxial components attached to the pair of side surface portions, respectively, each one of the pair of coaxial components including an inner conductor that extends through a hole portion formed in a corresponding side surface portion of the pair of side surface portions. The current measurement component further includes a connection portion electrically connecting the inner conductors of the pair of coaxial components, and a tube-like portion enclosing an outer peripheral portion of the connection portion with a gap formed between the tube-like portion and the outer peripheral portion of the connection portion. Also, the pair of side surface portions and the bridging portion are electrically conductive such that outer conductors of the pair of coaxial components are electrically connected, and the tube-like portion includes a base end portion electrically connected to a first side surface portion of the pair of side surface portions and a distal end portion electrically separated from the outer conductor of a coaxial component of the pair of coaxial components attached to a second side surface portion of the pair of side surface portions.
(6) According to a second aspect, a current measurement component includes a pair of side surface portions disposed spaced apart and opposing one another, a bridging portion bridging between the pair of side surface portions and forming a space between the pair of side surface portions, a pair of coaxial components attached to the pair of side surface portions, respectively, each one of the pair of coaxial components including an inner conductor that extends through a hole portion formed in a corresponding side surface portion of the pair of side surface portions, a connection portion electrically connecting the inner conductors of the pair of coaxial components, and a tube-like portion enclosing an outer peripheral portion of the connection portion with a gap formed between the tube-like portion and the outer peripheral portion of the connection portion. In the current

measurement component, outer conductors of the pair of coaxial components are electrically connected by using the pair of side surface portions and the bridging portion, a base end portion of the tube-like portion is electrically connected to a first side surface portion of the pair of side surface portions, and a distal end portion of the tube-like portion is electrically separated from the outer conductor of a coaxial component of the pair of coaxial components at a second side surface portion of the pair of side surface portions. The current measurement method is a method for measuring a current flowing through the coaxial components using the current measurement component and includes disposing a current sensor inside the space and enclosing the tube-like portion with the current sensor and detecting a current flowing through the connection portion with the current sensor.
(7) According to these aspects, the base end portion of the tube-like portion is electrically connected to the outer conductor of the coaxial component, and the distal end portion of the tube-like portion is electrically separated from the outer conductor of the other coaxial component.
(8) With such a configuration, the electrical potential at the outer conductor of one coaxial component, the tube-like portion, the pair of side surface portions, and the bridging portion and the electrical potential at the outer conductor of the other coaxial component can be made roughly the same. In addition, a current passing through the current sensor disposed in the current measurement component, that is, flowing through the inner conductor of the one coaxial component, the connection portion, and the inner conductor of the other coaxial component in this order can be prevented from passing through the current sensor, that is, turning back and flowing through the second electrode body of the outer conductor of the other coaxial component, the tube-like portion, and the outer conductor of the one coaxial component in this order.
(9) Accordingly, a current can be measured with the current sensor disposed around the tube-like portion, and, in the current sensor, the effects of electric fields, electromagnetic fields, and the like caused by a difference between an electrical potential at the pair of side surface portions and the bridging portion and an electrical potential at the inner conductors of the coaxial components can be lessened.
(10) Thus, a current transmitted from a coaxial transmission path connected to a current measurement component can be accurately measured.

Description

BRIEF DESCRIPTION OF DRAWINGS
(1) FIG. **1** is a diagram illustrating an example of a coaxial transmission system installed with a current measurement device according to a first embodiment of the present invention.
(2) FIG. **2** is a side view illustrating the appearance of the current measurement device.
(3) FIG. **3** is a cross-sectional view illustrating the structure of the current measurement device.
(4) FIG. **4** is a perspective view illustrating the appearance of a current measurement instrument constituting the current measurement device.
(5) FIG. **5** is a cross-sectional view taken along line V-V illustrated in FIG. **4**.
(6) FIG. **6** is a circuit diagram illustrating an example of an equivalent circuit in a measurement system installed with the current measurement device.
(7) FIG. **7** is a conceptual diagram illustrating a current path of the current measurement instrument.
(8) FIG. **8** is a diagram illustrating a modified example of a transmission path constituting the current measurement instrument.
(9) FIG. **9** is a cross-sectional view illustrating the structure of a current measurement device according to a second embodiment.
(10) FIG. **10** is a diagram for describing power loss that occurs in the current measurement

instrument.
(11) FIG. **11** is a cross-sectional view illustrating a modified example of a transmission path constituting the current measurement instrument.
(12) FIG. **12** is a flowchart illustrating an example of a current measurement method using the current measurement instrument.
DESCRIPTION OF EMBODIMENTS
(13) Embodiments of the present invention will be described below with reference to the accompanying drawings.
First Embodiment
(14) FIG. **1** is a diagram illustrating an example of a coaxial transmission system installed with a current measurement device according to the first embodiment.
(15) A current measurement device **100** is a device for measuring the current transmitted through a coaxial transmission path (coaxial line) in a coaxial transmission system **1**.
(16) The coaxial transmission system **1** is a system for transmitting electrical signals through a coaxial transmission path connected to a plurality of devices. The coaxial transmission system **1** includes an alternating current (AC) device **10**, a load device **20**, a plurality of coaxial cables **30***a* to **30***c*, a termination resistor **41** on the signal source side, and a termination resistor **42** on the load side.
(17) The AC device **10** is a device that generates an AC signal. The AC device **10** generates an alternating current ranging from several hertz (Hz) to several hundred hertz (MHz), for example. As illustrated in FIG. **1**, the equivalent circuit of the AC device **10** can be represented by a signal source impedance **11** and an AC signal source **12**.
(18) In the present embodiment, the AC device **10** includes a switch **13** used for measuring the alternating current output from the AC signal source **12**. The switch **13**, for example, forms a connection between the AC signal source **12** and the load device **20** when an alternating current is supplied from the AC signal source **12** to the load device **20**, and cuts the connection between the AC signal source **12** and the load device **20** when the alternating current of the AC signal source **12** is measured.
(19) The AC device **10** is, for example, a power supply device for supplying AC power to the load device **20**, or an analysis device for generating AC signals for transmission characteristic analysis. The AC device **10** supplies the generated AC signal to the load device **20** via the coaxial cable **30***b*.
(20) The coaxial cable **30***b* is a coaxial transmission path including an inner conductor **31** and an outer conductor **32** disposed concentrically. In the coaxial cable **30***b*, a dielectric is disposed between the inner conductor **31** and the outer conductor **32**. The interposing dielectric is, for example, an insulating member made of polyethylene or the like, or air. Also, the coaxial cable **30***b* has a characteristic impedance Z0 of 50Ω or 75Ω, for example. Similar to the coaxial cable **30***b*, the coaxial cables **30***a* and **30***c* each include the inner conductor **31** and the outer conductor **32**.
(21) The load device **20** is a device that operates by receiving AC signals supplied from the AC device **10** via the coaxial cable **30***b*. As illustrated in FIG. **1**, the equivalent circuit of the load device **20** can be represented by a load impedance **21**.
(22) In the present embodiment, the load device **20** includes a switch **22** for measuring the AC signals supplied to the load impedance **21**. The switch **22**, for example, cuts the connection between the AC signal source **12** and the load device **20** when an alternating current supplied from the AC signal source **12** via the coaxial cable **30***b* is measured.
(23) In the coaxial transmission system **1** described above, a plurality of the current measurement devices **100** according to the present embodiment are disposed at a plurality of points for specifying a failure point, for example. For example, the current measurement device **100** is disposed between the AC device **10** and the termination resistor **41** on the signal source side to measure the alternating current flowing through the coaxial cable **30***a*. Likewise, the current measurement device **100** is disposed between the AC device **10** and the load device **20** to measure

the alternating current flowing through the coaxial cable **30***b*, and the current measurement device **100** is disposed between the load device **20** and the termination resistor **42** on the load side to measure the alternating current flowing through the coaxial cable **30***c*.
(24) Next, the configuration of the current measurement device **100** according to the present embodiment will be described with reference to FIGS. **2** to **5**. Hereinafter, the coaxial cables **30***a* to **30***c* are collectively referred to as a coaxial cable **30**.
(25) FIG. **2** is a side view illustrating the appearance of the current measurement device **100**, and FIG. **3** is a cross-sectional view illustrating the internal structure of the current measurement device **100**. FIG. **4** is a perspective view illustrating the appearance of a current measurement instrument **300** constituting the current measurement device **100**, and FIG. **5** is a cross-sectional view of the current measurement instrument **300** taken along line V-V illustrated in FIG. **4**.
(26) As illustrated in FIGS. **2** and **3**, the current measurement device **100** includes a current sensor **200** that detects current without contact, and the current measurement instrument **300** including a housing (frame body) **300**A in which the current sensor **200** is installed.
(27) As illustrated in FIG. **3**, the current sensor **200** is a sensor that detects, without contact, an alternating current flowing through a measurement target such as an electrical path (electrical wire) through which the alternating current flows in a state in which the measurement target is inserted into an annular portion **220** of the current sensor **200**. The current sensor **200** is connected to a measuring instrument, such as an oscilloscope or a spectrum analyzer, and, on the basis of a detection signal of the current sensor **200**, the current measurement instrument measures the current flowing through the measurement target or a physical quantity such as the magnetic field produced from the measurement target.
(28) The current sensor **200**, for example, includes a coil **210** wound around the outer periphery of the measurement target, as illustrated in FIG. **3**. Alternatively, the current sensor **200** may include a coil of lead wire wound around an annular magnetic core into which the measurement target is inserted. Furthermore, the current sensor **200** may be a clamp-type sensor with a structure that can clamp the measurement target, or may be a pass through-type sensor with a mounting structure.
(29) The current measurement instrument **300** is a current measurement component for measuring the current flowing through the coaxial cable **30** by using the current sensor **200**. As illustrated in FIGS. **4** and **5**, the current measurement instrument **300** includes a transmission path **360** for transmitting an alternating current flowing through the coaxial cable **30** to the inside of the housing **300**A for housing the current sensor **200**.
(30) The shape of the housing **300**A is not limited to the rectangular tube-like shape illustrated in FIGS. **4** and **5** and may be a rectangular parallelepiped, a polygonal prism, or a tube-like shape such as a cylinder or an elliptic cylinder, for example. Further, the current measurement instrument **300** may be a structure that cannot be disassembled, or may be a structure that can be assembled to run the transmission path **360** through the annular portion **220** of the pass through-type current sensor **200**.
(31) The current measurement instrument **300** includes a pair of side surface portions **310** and **320** for housing the current sensor **200**, a bridging portion **330** bridging between the pair of side surface portions **310** and **320**, and a pair of coaxial connectors **340** and **350** attached to the pair of side surface portions **310** and **320**. Furthermore, the current measurement instrument **300** includes the transmission path **360** described above, and the transmission path **360** is inserted into the annular portion **220** of the current sensor **200** as illustrated in FIG. **3**.
(32) The pair of side surface portions **310** and **320** constituted by the first side surface portion **310** and the second side surface portion **320** are spaced apart from one another and disposed opposing one another.
(33) In the present embodiment, the pair of side surface portions **310** and **320** are plate-like members and are disposed opposing one another. Also, the pair of side surface portions **310** and **320** are conductors and are made of an electrically-conductive metal such as stainless steel, for

example.
(34) Since the pair of side surface portions **310** and **320** are provided, a space (installment space) S required for installing the current sensor **200** is formed between the first side surface portion **310** and the second side surface portion **320**. This allows the current sensor **200** to be physically separated from electrical paths, electronic components, and other components that are not the measurement target.
(35) Also, as illustrated in FIG. **3**, a pair of opposing hole portions **313** and **323** are formed in the pair of side surface portions **310** and **320**, respectively. A pin **341**, which is the inner conductor of the coaxial connector **340**, extends through one hole portion **313**. Likewise, a pin **351**, which is the inner conductor of the coaxial connector **350**, extends through the other hole portion **323**.
(36) Furthermore, as illustrated in FIGS. **4** and **5**, a plurality of threaded holes **324** used to attach the coaxial connector **350** are formed in the side surface portion **320**. In a similar manner to the side surface portion **320**, a plurality of threaded holes are also formed in the side surface portion **310**.
(37) The bridging portion **330** bridges between the pair of side surface portions **310** and **320** and forms the space S between the pair of side surface portions **310** and **320**.
(38) In the present embodiment, the bridging portion **330** is constituted by plate-like members that oppose one another. Specifically, the bridging portion **330** bridges between one end portion of the side surface portion **310** and one end portion of the side surface portion **320**, and bridges between the other end portion of the side surface portion **310** and the other end portion of the side surface portion **320**. In a similar manner to the pair of side surface portions **310** and **320**, the bridging portion **330** is a conductor and is made of an electrically-conductive metal, for example.
(39) The bridging portion **330** of the present embodiment is constituted by two plate-like members opposing one another. However, the bridging portion **330** may be constituted by one or three plate-like members or may be constituted by a tube-like member. Also, in the present embodiment, to insert the current sensor **200**, the bridging portion **330** is formed such that a part of the outer periphery of the bridging portion **330** is open. However, the bridging portion **330** may be formed covering the entire periphery of the current sensor **200**.
(40) The pair of coaxial connectors **340** and **350** are constituted by the first coaxial connector **340** and the second coaxial connector **350**, and the pair of coaxial connectors **340** and **350** are coaxial components for connecting the coaxial cable **30** to the transmission path **360** inside the housing **300**A.
(41) In a similar manner to the coaxial cable **30**, the coaxial connectors **340** and **350** each include an inner conductor and an outer conductor disposed coaxially. The coaxial connectors **340** and **350** are each constituted by a BNC connector, an SMA connector, an SMB connector, a TNC connector, an N connector, an M connector, or an F connector, for example.
(42) In the present embodiment, the coaxial connectors **340** and **350** share the same configuration, and the coaxial connectors **340** and **350** are connected to ends of the pair of coaxial cables **30**, respectively. In the example illustrated in FIGS. **3** and **5**, the structure for joining the coaxial connectors **340** and **350** and the coaxial cables **30** is simplified. Examples of a joining method that can be used include a screw method, a bayonet lock method, and a snap-lock method.
(43) The coaxial connector **340** includes the pin **341**, which is the inner conductor; a body portion **342**, which is the outer conductor; a dielectric layer **343** for insulating the pin **341** from the body portion **342**; and a flange **344** that projects from a distal end portion of the body portion **342** in a radial direction.
(44) The inner conductor **31** of the coaxial cable **30** is electrically connected to the pin **341** of the coaxial connector **340**, and the outer conductor **32** of the coaxial cable **30** is electrically connected to the body portion **342**. Also, as illustrated in FIG. **4**, a plurality of threaded holes **345** used to fix the coaxial connector **340** to the side surface portion **310** are formed in the flange **344**. The coaxial connector **340** is fixed to an outer surface **312** of the side surface portion **310** by inserting screws

into the threaded holes **345**.
(45) As illustrated in FIGS. **3** and **5**, in a similar manner to the coaxial connector **340**, the coaxial connector **350** includes the pin **351**, which is the inner conductor; a body portion **352**, which is the outer conductor; a dielectric layer **353** for insulating the pin **351** from the body portion **352**; and a flange **354** that projects from a distal end portion of the body portion **352** in the radial direction. The pin **351**, the body portion **352**, the dielectric layer **353**, and the flange **354** are similar in configuration to those of the coaxial connector **340**, and thus these components will not be described.
(46) The pair of coaxial connectors **340** and **350** are attached to the pair of side surface portions **310** and **320**, respectively, and include the pins **341** and **351** which function as inner conductors that extend through the hole portions **313** and **323** formed in the corresponding side surface portion. That is, the pair of coaxial connectors **340** and **350** are attached to the outer surfaces **312** and **322** of the pair of side surface portions **310** and **320**, with the pins **341** and **351** passing through the hole portions **313** and **323**, respectively.
(47) Specifically, the coaxial connector **340** is attached to the outer surface **312** of the side surface portion **310** with the pin **341** extending through the hole portion **313** of the side surface portion **310**. This brings the flange **344** of the coaxial connector **340** into contact with the outer surface **312** of the side surface portion **310**.
(48) In a similar manner, the coaxial connector **350** is attached to the outer surface **322** of the side surface portion **320** with the pin **351** extending through the hole portion **323** of the side surface portion **320**. This brings the flange **354** of the coaxial connector **350** into contact with the outer surface **322** of the side surface portion **320**. Herein, the outer surfaces **312** and **322** refer to the surfaces of the pair of side surface portions **310** and **320** on the side opposite to inner surfaces **311** and **321**, which are surfaces opposing one another, respectively.
(49) As described above, the pair of side surface portions **310** and **320** and the bridging portion **330** constituting the housing **300**A are electrically conductive such that the body portions **342** and **352** of the pair of coaxial connectors **340** and **350** are electrically connected. Thus, the outer conductors of the pair of coaxial connectors **340** and **350** are electrically connected via the pair of side surface portions **310** and **320** and the bridging portion **330**. This suppresses noise entering the space S inside the housing **300**A from outside the current measurement instrument **300**.
(50) Next, the configuration of the transmission path **360** provided in the current measurement instrument **300** will be described.
(51) As illustrated in FIG. **5**, the transmission path **360** includes a connection portion **361** that electrically connects the inner conductors of the pair of coaxial connectors **340** and **350**, and a tube-like portion **362** disposed away from the outer peripheral portion of the connection portion **361**. A hollow portion **363** is formed between the connection portion **361** and the tube-like portion **362**.
(52) The transmission path **360** further includes a flange **365** that projects from the base end portion of the tube-like portion **362** in the radial direction. The flange **365** is fixed to the inner surface **311** of the side surface portion **310**.
(53) The connection portion **361** is an electrical path that electrically connects the pins **341** and **351** of the pair of coaxial connectors **340** and **350** to transmit electrical signals that flow through the inner conductor **31** of the coaxial cable **30**.
(54) In the present embodiment, the connection portion **361** is formed in a cylindrical shape. Also, the connection portion **361** is a conductor and is made of a metal such as copper, for example. A hole is formed in either end of the connection portion **361** in the longitudinal direction. The pin **341** of the coaxial connector **340** is inserted into one of the holes of the connection portion **361**, and the pin **351** of the coaxial connector **350** is inserted into the other hole of the connection portion **361**. The connection portion **361** is joined to both of the pins **341** and **351** by using a solder, for example.
(55) Alternatively, the connection portion **361** and the pins **341** and **351** may be joined via threaded

holes formed in both ends of the connection portion **361** and the pins **341** and **351** formed as male screws or via the pins **341** and **351** being press-fit into both the holes in the connection portion **361**. Also, instead of a cylindrical shape, the connection portion **361** may be formed in a polygonal prism shape or an elliptical prism shape.

(56) The tube-like portion **362** is a member for suppressing noise, such as electric fields and electromagnetic fields, that is radially emitted (radiated) from the outer periphery of the connection portion **361** and for reducing noise entering the connection portion **361** from outside the tube-like portion **362**. The tube-like portion **362** is inserted into the annular portion **220** of the current sensor **200** as illustrated in FIG. **3**.

(57) The tube-like portion **362** encloses the outer peripheral portion of the connection portion **361**, with a gap formed between the tube-like portion **362** and the outer peripheral portion of the connection portion **361**. Also, the base end portion of the tube-like portion **362** is electrically connected to the first side surface portion **310**, and the distal end portion of the tube-like portion **362** is electrically separated from the body portion **352**, which is the outer conductor of the coaxial connector **350** attached to the second side surface portion **320**.

(58) In the present embodiment, to electrically separate the distal end portion of the tube-like portion **362** from the body portion **352** of the coaxial connector **350**, a gap **364** is formed in the transmission path **360** so as to cut the electrical connection between the body portions **342** and **352** of the pair of coaxial connectors **340** and **350**.

(59) Accordingly, a current passing through the current sensor **200** with the tube-like portion **362** inserted, that is, flowing through the pin **341** of the coaxial connector **340**, the connection portion **361**, and the pin **351** of the coaxial connector **350** in this order can be prevented from passing through the current sensor **200**, that is, flowing back (turning back) through the body portion **352** of the coaxial connector **350**, the tube-like portion **362**, and the body portion **342** of the coaxial connector **340** in this order.

(60) Thus, it is possible to suppress cancellation of the magnetic field produced by the current flowing through the pin **341** of the coaxial connector **340**, the connection portion **361**, and the pin **351** of the coaxial connector **350** by the magnetic field produced by the return current flowing through the body portion **352** of the coaxial connector **350**, the tube-like portion **362**, and the body portion **342** of the coaxial connector **340**.

(61) In this manner, a magnetic field centered around the connection portion **361** at which the alternating current flows is produced in the space S inside the current measurement instrument **300**, and the current sensor **200** can detect the magnetic field produced by the alternating current flowing through the connection portion **361**.

(62) The tube-like portion **362** is a conductor and is made of a metal such as copper, for example. Also, the tube-like portion **362** is formed in a cylindrical shape. Instead of a cylindrical shape, the tube-like portion **362** may be formed in a polygonal prism shape or an elliptic cylinder shape, for example.

(63) As illustrated in FIGS. **3** and **5**, the tube-like portion **362** extends from the inner surface **311** of the side surface portion **310** toward the inner surface **321** of the side surface portion **320** and is spaced apart from the side surface portion **320** to form the gap **364**.

(64) By providing the gap **364** at or near the hole portion **323** of the side surface portion **320**, the current sensor **200** can be separated from the gap **364**. Thus, noise, such as electric fields and electromagnetic fields, emitted from the exposed connection portion **361** toward current sensor **200** can be reduced.

(65) The gap **364** provided at the distal end of the tube-like portion **362** is designed to be narrower than the length (width) of the current sensor **200** in the longitudinal direction between the pair of side surface portions **310** and **320**. Accordingly, the length of the connection portion **361** exposed from the tube-like portion **362** is relatively short, and thus noise, such as electric fields and electromagnetic fields, emitted from the exposed connection portion **361** can be reduced.

(66) By providing the gap **364** at the distal end of the tube-like portion **362**, the electrical connection between the body portions **342** and **352** of the pair of coaxial connectors **340** and **350** is cut and the characteristic impedance of the transmission path **360** can be easily adjusted to the same orientation and magnitude as those of the characteristic impedance Z0 of the coaxial cable **30**.
(67) In the present embodiment, as described above, the distal end of the tube-like portion **362** is formed spaced apart from the inner surface **321** of the side surface portion **320**. However, no such limitation is intended.
(68) For example, in a case in which the side surface portion **320** is thick and the inner diameter of the hole portion **323** is greater than the outer diameter of the tube-like portion **362**, as long as the tube-like portion **362** and the body portion **352** of the coaxial connector **350** do not come into contact, the distal end of the tube-like portion **362** may further extend beyond the inner surface **321** of the side surface portion **320**. In this case, the distal end of the tube-like portion **362** is formed spaced apart from at least the body portion **352** of the coaxial connector **350**.
(69) Also in the present embodiment, the tube-like portion **362** is attached to the inner surface **311** of the side surface portion **310**. However, the tube-like portion **362** may be attached to the inner surface **321** of the side surface portion **320**. In this case, the distal end of the tube-like portion **362** is formed extending from the side surface portion **320** toward the side surface portion **310** and spaced apart from the body portion **342** of the coaxial connector **340**.
(70) Next, the electrical characteristics of the current measurement instrument **300** according to the present embodiment will be described with reference to FIGS. **6** and **7**.
(71) FIG. **6** is a circuit diagram illustrating an equivalent circuit of a measurement system **1**A. The measurement system **1**A is the part of the coaxial transmission system **1** illustrated in FIG. **1** where the current measurement device **100** is disposed on the coaxial cable **30***a* connecting the AC device **10** and the termination resistor **41** on the signal source side.
(72) A resistor Rm and characteristic impedance Zm of the current measurement instrument **300** constituting the current measurement device **100**, the characteristic impedance Z0 of the pair of coaxial cables **30***a* connected to the current measurement instrument **300**, and a resistor Rt of the termination resistor **41** are illustrated in FIG. **6**.
(73) In the measurement system **1**A, to suppress reflection of the alternating current output from the AC signal source **12** at the termination resistor **41**, the resistor Rt of the termination resistor **41** is set to the same value as the signal source impedance **11**.
(74) To suppress power loss in the alternating current transmitted from the AC signal source **12** to the termination resistor **41**, the resistor Rm of the current measurement instrument **300** is set to a low value to give a resistance value of zero (0). Also, the characteristic impedance Zm of the current measurement instrument **300** is designed to have the same value as the characteristic impedance Z0 of the coaxial cable **30***a*. This makes it possible to accurately measure the alternating current flowing through the coaxial cable **30***a* in the current measurement instrument **300**.
(75) In the present embodiment, the impedance of the current measurement instrument **300** can be adjusted by adjusting the gap **364** for insulating the tube-like portion **362** from the coaxial connector **350**, the distance between the connection portion **361** and the tube-like portion **362**, and the dielectric inserted between the connection portion **361** and the tube-like portion **362**. By adjusting the structure of the connection portion **361** and the tube-like portion **362** constituting the transmission path **360** in this manner, the characteristic impedance Zm of the current measurement instrument **300** can be adjusted to the characteristic impedance Z0 of the coaxial cable **30**.
(76) Accordingly, since the characteristic impedance Zm of the current measurement instrument **300** can be adjusted by adjusting the gap **364** of the tube-like portion **362**, the distance between the tube-like portion **362** and the connection portion **361**, and the like, the impedance between the AC device **10** and the termination resistor **41** can be easily made consistent.
(77) FIG. **7** is a conceptual diagram illustrating the path of the current flowing through the current measurement instrument **300** when the alternating current flowing through the coaxial cable **30***a* is

positive (+).
(78) First, the current flowing through the inner conductor **31** of one of the coaxial cables **30***a* is transmitted through the pin **341** of the coaxial connector **340**, the connection portion **361**, and the pin **351** of the coaxial connector **350** in this order to the inner conductor **31** of the other of the coaxial cables **30***a*. Then, the current flows, via the termination resistor **41**, from the outer conductor **32** of the other of the coaxial cables **30***a* toward the body portion **352** of the coaxial connector **350**.
(79) Here, since the housing **300**A constituted by the pair of side surface portions **310** and **320** and the bridging portion **330** is electrically conductive, the body portions **342** and **352** of the pair of coaxial connectors **340** and **350** are electrically connected. Thus, as illustrated in FIG. **7**, the current flows from the body portion **352** of the coaxial connector **350**, through the pair of side surface portions **310** and **320** and the bridging portion **330**, to the body portion **342** of the coaxial connector **340**.
(80) Also, since the tube-like portion **362** is electrically conductive like the housing **300**A, the current also flows from the body portion **342** of the coaxial connector **340** through the tube-like portion **362**. As a result, the electrical potential at the housing **300**A and the electrical potential at the tube-like portion **362** are roughly the same. Accordingly, the tube-like portion **362** with roughly the same electrical potential as the housing **300**A blocks noise, such as electric fields and electromagnetic fields, produced between the housing **300**A and the connection portion **361**. Thus, electric fields and electromagnetic fields emitted as noise from the connection portion **361** to the space S inside the housing **300**A can be suppressed.
(81) Also, since the body portion **352** of the coaxial connector **350** and the tube-like portion **362** are not in contact due to the gap **364**, a magnetic field produced by the current flowing through the connection portion **361** can be produced in the space S housing the current sensor **200**.
(82) By providing the gap **364** at the distal end of the tube-like portion **362** in this manner, a magnetic field produced by the current flowing through the connection portion **361** can be produced on the inner side of the annular portion **220** of the current sensor **200**, and the electrical potentials around the current sensor **200** can be made roughly the same. Thus, since the space S inside the housing **300**A is put in a state in which it is difficult for noise to enter the current sensor **200**, the current sensor **200** can accurately detect a magnetic field produced by the current flowing through the connection portion **361**.
(83) Noise produced in the space S in the current measurement instrument **300** will now be described in detail. First, in a configuration in which the electrically-conductive tube-like portion **362** is not provided around the connection portion **361**, a difference between an electrical potential at the housing **300**A and an electrical potential at the connection portion **361** may cause noise, such as electric fields and electromagnetic fields, to be produced in the space S inside the current measurement instrument **300**. This noise may impair the detection accuracy of the current sensor **200** disposed in the space S.
(84) In contrast, in the present embodiment, the tube-like portion **362** is provided around the outer peripheral portion of the connection portion **361**, and the tube-like portion **362** and the housing **300**A are electrically connected. Thus, the difference between the electrical potential at the housing **300**A and the electrical potential at the tube-like portion **362** is roughly zero, and so noise, such as electric fields and electromagnetic fields as described above, is less likely to be produced in the space S where the current sensor **200** is disposed. Accordingly, noise entering the current sensor **200** can be suppressed, unlike in a configuration without the tube-like portion **362**.
(85) Next, the effects of the first embodiment will be described.
(86) In the present embodiment, the current measurement instrument **300** constituting a current measurement component includes the pair of side surface portions **310** and **320** disposed spaced apart and opposing one another, and the bridging portion **330** bridging between the pair of side surface portions **310** and **320**. The current measurement instrument **300** also includes a pair of

coaxial components that are attached to the pair of side surface portions **310** and **320**, respectively, and include inner conductors that extend through the hole portions **313** and **323** formed in the corresponding side surface portions **310** and **320**. Examples of a pair of coaxial components include a coaxial connector constituted by an inner conductor and an outer conductor formed on the outer periphery of the inner conductor, or a terminator. The coaxial components in the present embodiment correspond to the pair of coaxial connectors **340** and **350** including the pins **341** and **351** that function as inner conductors, respectively. The current measurement instrument **300** further includes the connection portion **361** that electrically connects the pins **341** and **351** of the pair of coaxial connectors **340** and **350**.
(87) The current measurement instrument **300** further includes the tube-like portion **362** that encloses the outer peripheral portion of the connection portion **361**, with a gap formed between the tube-like portion **362** and the outer peripheral portion of the connection portion **361**. Also, the pair of side surface portions **310** and **320** and the bridging portion **330** are electrically conductive such that the body portions **342** and **352** functioning as the outer conductors of the pair of coaxial connectors **340** and **350** are electrically connected. Furthermore, the tube-like portion **362** includes the base end portion electrically connected to the first side surface portion **310** and the distal end portion electrically separated from the body portion **352** of the one coaxial connector **350** attached to the second side surface portion **320**.
(88) According to the configuration described above, the bridging portion **330** is provided between the pair of side surface portions **310** and **320**. This allows an electrical path, electronic component, or the like different from the coaxial cable **30** connected to at least one of the coaxial connectors **340** and **350** to be physically separated from the connection portion **361** inside the current measurement instrument **300**. Thus, noise produced in the space S formed by the pair of side surface portions **310** and **320** and the bridging portion **330** can be reduced. This allows the current transmitted from a coaxial transmission path such as the coaxial cable **30** to the current measurement instrument **300** to be accurately measured.
(89) Also, since the pair of side surface portions **310** and **320** and the bridging portion **330** are electrically conductive, the body portions **342** and **352** of the pair of coaxial connectors **340** and **350** are electrically connected. This makes it easier to block noise that may enter from outside of the current measurement instrument **300**. Furthermore, since the tube-like portion **362** is disposed spaced apart from the outer peripheral portion of the connection portion **361**, electric fields and electromagnetic fields produced from the connection portion **361** can be kept inside the tube-like portion **362**.
(90) As illustrated in FIG. **7**, the pair of side surface portions **310** and **320**, the bridging portion **330** and the tube-like portion **362** are electrically connected, making the space S roughly equipotential. Accordingly, noise caused by a difference between an electrical potential at the pair of side surface portions **310** and **320** and the bridging portion **330** and an electrical potential at the tube-like portion **362** can be reduced.
(91) Also, since the gap **364** is provided at the distal end of the tube-like portion **362**, a current passing through the current sensor **200**, that is, a current flowing through the pin **341** of the one coaxial connector **340**, the connection portion **361**, and the pin **351** of the other coaxial connector **350** in this order can be prevented from passing through the current sensor **200**, that is, flowing back through the body portion **352** of the other coaxial connector **350**, the tube-like portion **362**, and the body portion **342** of the one coaxial connector **340** in this order. Thus, the current flowing through the connection portion **361** can produce a magnetic field centered around the connection portion **361** in the space S inside the current measurement instrument **300**.
(92) In this manner, since the tube-like portion **362** is provided around the outer peripheral portion of the connection portion **361** and the tube-like portion **362** is electrically connected to the pair of side surface portions **310** and **320** and the bridging portion **330**, noise entering the space S inside the current measurement instrument **300** can be reduced. Accordingly, the current flowing through

the connection portion **361** can be accurately measured.

(93) Also, in the present embodiment, the current measurement device **100** includes the current sensor **200** that detects a current flowing through a measurement target in a state in which the measurement target is inserted into the current sensor **200** and the current measurement instrument **300** described above. The bridging portion **330** forms the space S between the pair of side surface portions **310** and **320**, and the current sensor **200** is disposed inside the space S while enclosing the tube-like portion **362** and detects the current transmitted through the connection portion **361**.

(94) According to this configuration, providing the bridging portion **330** between the pair of side surface portions **310** and **320** ensures the space S for disposing the current sensor **200**. Accordingly, an electrical path or electronic component other than the coaxial cable **30** that transmits the current to the connection portion **361** can be physically separated from the current sensor **200**. Thus, noise entering the current sensor **200** can be reduced, which in turn improves measurement accuracy when using the current sensor **200** to measure the current flowing through the connection portion **361**.

(95) Also, in the present embodiment, the structure of the tube-like portion **362** and the connection portion **361** is configured to have the same characteristic impedance as that of the coaxial connectors **340** and **350**. This makes it possible to reduce the reflection that occurs at the current measurement instrument **300** when a high-frequency current flows through the coaxial cable **30**. Accordingly, a current transmitted from the coaxial cable **30** to the connection portion **361** of the current measurement instrument **300** can be accurately measured.

(96) Also, in the present embodiment, the pair of side surface portions **310** and **320** and the bridging portion **330** are conductors. According to this configuration, the current measurement instrument **300** can be easily manufactured without requiring a process of attaching conduction portions to the surfaces of the pair of side surface portions **310** and **320** and the bridging portion **330** or a process of applying a conductive material.

(97) In addition, in the present embodiment, the gap **364** formed at the distal end of the tube-like portion **362** in the direction between the pair of side surface portions **310** and **320**, i.e., the longitudinal direction of the connection portion **361** is narrower than the width of the current sensor **200**. According to this configuration, the exposed portion of the connection portion **361** can be reduced, and thus noise, such as electric fields and electromagnetic fields, radiated from the exposed portion can be reduced.

(98) Also, in the present embodiment, the tube-like portion **362** extends from the inner surface **311** of the first side surface portion **310** and is spaced apart from the second side surface portion **320** to form the gap **364**. According to this configuration, since the gap **364** is formed at or near the second side surface portion **320**, the current sensor **200** can be disposed separated from the gap **364**. Thus, noise, such as electric fields and electromagnetic fields, emitted from the exposed connection portion **361** toward current sensor **200** can be reduced.

Modified Example

(99) Next, a modified example of the current measurement instrument **300** according to the first embodiment will be described with reference to FIG. **8**. FIG. **8** is a cross-sectional view illustrating the structure of a current measurement instrument **301**, which is a modified example of the current measurement instrument **300**.

(100) The current measurement instrument **301** according to the present modified example includes a transmission path **360**A instead of the transmission path **360** of the current measurement instrument **300** illustrated in FIGS. **2** to **5**. The transmission path **360**A includes, in addition to the tube-like portion **362** with the distal end retracted toward the first side surface portion **310**, a tube-like portion **462** and a flange **465** that projects from the base end portion of the tube-like portion **462** in the radial direction. As illustrated in FIG. **8**, other configurations are the same as the configurations of the current measurement instrument **300**, and thus the same reference signs are used and redundant descriptions are omitted.

(101) The tube-like portion **462** extends in the longitudinal direction of the connection portion **361** from the inner surface **321** of the side surface portion **320**. The distal end of the tube-like portion **462** is spaced apart from and opposes the distal end of the tube-like portion **362**.
(102) A gap **364**A formed between the distal end of the tube-like portion **362** and the distal end of the tube-like portion **462** is formed in an intermediate region between the pair of side surface portions **310** and **320**. In a similar manner to the current measurement instrument **300**, the length of the gap **364**A is designed to be less than the width of the current sensor **200** so that noise emitted from the connection portion **361** is suppressed. Also, in a similar manner to the flange **365**, the flange **465** is fixed to the inner surface **311** of the side surface portion **310**.
(103) By providing the tube-like portion **462** opposing the tube-like portion **362** in this manner, the gap **364**A formed at the distal end of the tube-like portion **362** is formed in an intermediate region between the pair of side surface portions **310** and **320**. With this configuration as well, noise emitted from the connection portion **361** to the space S can be suppressed and a magnetic field produced by an alternating current flowing through the connection portion **361** can be produced in the space S of the current measurement instrument **301**.
(104) Note that in the present modified example, the housing **300**A constituted by the pair of side surface portions **310** and **320** and the bridging portion **330** is a conductor. However, for the housing **300**A, it is sufficient that the body portions **342** and **352** of the pair of coaxial connectors **340** and **350** are electrically connected. Thus, the body portions **342** and **352** of the pair of coaxial connectors **340** and **350** may be electrically connected via a process of attaching a conduction portion to the surfaces of the pair of side surface portions **310** and **320** and the bridging portion **330**, which have insulating properties, or a process of applying a conductive material.
Second Embodiment
(105) FIG. **9** is a cross-sectional view illustrating the structure of a current measurement device **101** according to the second embodiment. The current measurement device **101** includes the current sensor **200** illustrated in FIGS. **2** and **3** and a current measurement instrument **302**.
(106) In the present embodiment, the current measurement instrument **302** includes a terminator **450** instead of the coaxial connector **350**. The other configurations are the same as the configurations of the current measurement instrument **300** illustrated in FIGS. **2** to **5**. Thus, configurations that are the same as those of the current measurement instrument **300** are given the same reference numerals, and the descriptions are omitted.
(107) The terminator **450** is a coaxial component for terminating one end of the transmission path **360** of the current measurement instrument **302**. In the present embodiment, the terminator **450** is a connector component having a termination resistance and houses the termination resistor **41** illustrated in FIGS. **1** and **6**.
(108) As illustrated in FIG. **9**, the termination resistor **41** is constituted by a first electrode body **411**, a resistor body **412**, and a second electrode body **413** constituting the inner conductor of the coaxial component. The first electrode body **411** includes a first electrode **411**A and a pin **411**B projecting from the first electrode **411**A in the extending direction of the resistor body **412**.
(109) The terminator **450** includes the termination resistor **41** described above, a spring electrode **451** that covers the second electrode body **413** of the termination resistor **41**, and a body portion **452** that houses the termination resistor **41** and the spring electrode **451**. The terminator **450** further includes a hole portion **453** that opens from the distal end portion of the body portion **452** and a flange **454** that projects from the distal end portion of the body portion **452** in the radial direction. Note that the second electrode body **413**, the spring electrode **451**, and the body portion **452** of the terminator **450** constitute the outer conductor of the coaxial component.
(110) The spring electrode **451** is configured to be fit into a bottom portion of the hole portion **453**, and the body portion **452** is constituted by a conductor. The termination resistor **41** is press-fitted to the bottom surface of the hole portion **453** so that the spring electrode **451** is in contact with the bottom surface. Accordingly, the termination resistor **41** is fixed to the body portion **452**, and the

pin **411**B of the termination resistor **41** projects from the body portion **452**.
(111) Also, although not illustrated in FIG. **9**, in a similar manner to the flange **344** illustrated in FIGS. **4** and **5**, in the flange **454**, a plurality of threaded holes are formed, and the terminator **450** is fixed to the outer surface **322** of the side surface portion **320** by screws inserted into the threaded holes.
(112) The terminator **450** configured as described above is attached to the outer surface **322** of the second side surface portion **320**, with the pin **411**B constituting the first electrode body **411** passing through the hole portion **323** of the second side surface portion **320**. Further, the connection portion **361** electrically connects the pin **341** constituting the inner conductor of the coaxial connector **340** and the pin **411**B constituting a portion of the inner conductor of the terminator **450**.
(113) Also, in a similar manner to the first embodiment, the pair of side surface portions **310** and **320** and the bridging portion **330** are electrically conductive such that the body portion **342** constituting the outer conductor of the coaxial connector **340** and the second electrode body **413** of the terminator **450** are electrically connected. Furthermore, the tube-like portion **362** is electrically connected at the base end portion to the first side surface portion **310** and electrically separated at the distal end portion from the body portion **452** of the terminator **450** attached to the second side surface portion **320**.
(114) Note that in the present embodiment, the gap **364** is formed on the side near the side surface portion **320** of the tube-like portion **362**. However, no such limitation is intended. For example, as illustrated in FIG. **8**, the gap **364** may be formed in the intermediate region between the pair of side surface portions **310** and **320**.
(115) Now, the power loss of the current measurement instrument **302** according to the present embodiment will be described with reference to FIG. **10**.
(116) FIG. **10** is a diagram for describing the relationship between frequency (Hz) of the alternating current flowing from the coaxial cable **30** to the transmission path **360** via the coaxial connector **340** of the current measurement instrument **302** and power loss (dB) of the current measurement instrument **302**.
(117) In FIG. **10**, the frequency characteristic of an input reflection coefficient S11 of the current measurement instrument **302** is represented by a solid line, and, as a comparative example, the frequency characteristic of the input reflection coefficient S11 of a comparative instrument without the tube-like portion **362** is represented by a dashed line.
(118) In the example shown in FIG. **10**, the characteristic impedance Z0 of the coaxial cable **30** is 50Ω, and the value of the termination resistor **41** inside the terminator **450** attached to the current measurement instrument **302** is 50Ω. Also, instead of the terminator **450**, a different terminator that short-circuits the housing **300**A and the connection portion **361** is attached to the comparative instrument.
(119) As shown in FIG. **10**, the input reflection coefficient S11 of the current measurement instrument **302** according to the present embodiment approaches zero as the frequency of the alternating current flowing through the transmission path **360** increases. In other words, the higher the frequency of the alternating current flowing through the coaxial cable **30**, the smaller the power loss in the current measurement instrument **302**.
(120) Also, it is clear that the input reflection coefficient S11 of the current measurement instrument **302** is better than the input reflection coefficient S11 of the comparative instrument across all frequencies. This is because, not only is reflection of the alternating current at the terminator **450** suppressed, but also the electromagnetic waves leaking from the connection portion **361** to the space S of the housing **300**A is reduced by providing the tube-like portion **362** electrically connected to the housing **300**A in the current measurement instrument **302**.
(121) Now, the effects of the second embodiment will be described.
(122) In the present embodiment, the current measurement instrument **302** includes the pair of side surface portions **310** and **320** disposed spaced apart and opposing one another and the bridging

portion **330** bridging between the pair of side surface portions **310** and **320**. The current measurement instrument **302** further includes the coaxial connector **340** that is attached to the first side surface portion **310** and includes the pin **341**, which is an inner conductor, extending through the hole portion **313** formed in the first side surface portion **310**, and the terminator **450** that is attached to the second side surface portion **320** and includes the pin **411**B constituting the first electrode body **411** extending through the hole portion **323** formed in the second side surface portion **320**.

(123) The coaxial connector **340** and the terminator **450** constitute a pair of coaxial components. In the present embodiment, in one of the coaxial components, the inner conductor is implemented by the pin **341** of the coaxial connector **340** and the outer conductor is implemented by the body portion **342** of the coaxial connector **340**. In the other coaxial component, the inner conductor is implemented by the first electrode body **411** of the terminator **450** and a portion of the outer conductor is implemented by the second electrode body **413** of the terminator **450**.

(124) The current measurement instrument **302** further includes the connection portion **361** that electrically connects the pin **341** of the coaxial connector **340** and the pin **411**B of the terminator **450**, and the tube-like portion **362** that encloses the outer peripheral portion of the connection portion **361**, with a gap formed between the tube-like portion **362** and the outer peripheral portion of the connection portion **361**. Also, the pair of side surface portions **310** and **320** and the bridging portion **330** are electrically conductive such that the body portion **342**, which is the outer conductor of the coaxial connector **340**, and the second electrode body **413** of the terminator **450** are electrically connected. Furthermore, the tube-like portion **362** includes the base end portion electrically connected to the first side surface portion **310** and the distal end portion electrically separated from the second electrode body **413** of the terminator **450** attached to the second side surface portion **320**.

(125) According to this configuration, in a similar manner to the first embodiment, the bridging portion **330** is provided between end portions of the pair of side surface portions **310** and **320**. This allows electrical paths, electronic components, and other components different from the coaxial cable **30** connected to the coaxial connector **340** to be physically separated from the connection portion **361** inside the current measurement instrument **302**. Thus, noise entering the space S formed by the pair of side surface portions **310** and **320** and the bridging portion **330** can be reduced. This allows the current transmitted from the coaxial cable **30** to the current measurement instrument **302** to be accurately measured.

(126) Also, in a similar manner to the first embodiment, since the pair of side surface portions **310** and **320** and the bridging portion **330** are electrically conductive, noise that may enter the space S inside the housing **300**A from outside the current measurement instrument **302** can be easily blocked. Furthermore, since the tube-like portion **362** is disposed enclosing the outer peripheral portion of the connection portion **361**, electric fields and electromagnetic fields produced from the connection portion **361** can be kept inside the tube-like portion **362**.

(127) Also, the pair of side surface portions **310** and **320**, the bridging portion **330**, and the tube-like portion **362** are electrically connected to one another. Thus, in the space S inside the housing **300**A, noise caused by a difference between an electrical potential at the pair of side surface portions **310** and **320** and the bridging portion **330** and an electrical potential at the tube-like portion **362** can be reduced.

(128) In a similar manner to the first embodiment, in the present embodiment, since the tube-like portion **362** is provided and the tube-like portion **362** is electrically connected to the pair of side surface portions **310** and **320** and the bridging portion **330**, noise entering the space S inside the current measurement instrument **302** can be reduced. Accordingly, a current flowing through the current measurement instrument **302** can be accurately measured.

(129) Also, in the present embodiment, the current measurement device **101** includes the current sensor **200** that detects a current flowing through a measurement target, and the current

measurement instrument **302** described above. The bridging portion **330** forms the space S between the pair of side surface portions **310** and **320**, and the current sensor **200** is disposed inside the space S enclosing the tube-like portion **362** and detects the current transmitted through the connection portion **361**.
(130) According to this configuration, in a similar manner to the first embodiment, noise entering the current sensor **200** disposed in the space S inside the current measurement instrument **300** is reduced. Thus, a current flowing through the connection portion **361** can be accurately measured by using the current sensor **200**.
(131) Also, in the present embodiment, the structure of the tube-like portion **362** and the connection portion **361** is configured to have the same characteristic impedance as those of the coaxial connector **340** and the terminator **450**. This makes it possible to reduce the reflection that occurs at the current measurement instrument **302** when a high-frequency current flows through the coaxial cable **30**. Accordingly, a current transmitted from the coaxial cable **30** to the tube-like portion **362** and the connection portion **361** of the current measurement instrument **302** can be accurately measured.
(132) Also, in a similar manner to the first embodiment, in the present embodiment, the pair of side surface portions **310** and **320** and the bridging portion **330** are conductors. According to this configuration, the current measurement instrument **302** can be easily manufactured without requiring a process of attaching a conduction portion to the surfaces of the pair of side surface portions **310** and **320** and the bridging portion **330**, or a process of applying a conductive material.
(133) In a similar manner to the first embodiment, in the present embodiment, the gap **364** provided at the distal end of the tube-like portion **362** in the direction between the pair of side surface portions **310** and **320** is narrower than the width of the current sensor **200** disposed between the pair of side surface portions **310** and **320**. According to this configuration, the exposed portion of the connection portion **361** can be reduced, and thus noise, such as electric fields and electromagnetic fields, radiated from the exposed portion can be reduced.
(134) Also, in a similar manner to the first embodiment, in the present embodiment, the tube-like portion **362** extends from the inner surface **311** of the first side surface portion **310** and is spaced apart from the second side surface portion **320** to form the gap **364**. According to this configuration, since the gap **364** is formed at or near the second side surface portion **320**, the current sensor **200** can be disposed separated from the gap **364**. Thus, noise, such as electric fields and electromagnetic fields, emitted from the exposed connection portion **361** toward current sensor **200** can be reduced.
(135) Also, as illustrated in FIG. **11**, the current measurement instrument **302** constituting the current measurement device **100** according to the present embodiment may include, between the connection portion **361** and the tube-like portion **362**, a dielectric **363**A having a dielectric constant less than that of air. In this manner, compared to the transmission path **360** including the hollow portion **363**, the distance between the connection portion **361** and the tube-like portion **362** can be reduced, allowing the current measurement instrument **302** to be made smaller in size.
(136) Note that, in the present embodiment, the coaxial connector **340** is attached to the first side surface portion **310** and the terminator **450** is attached to the second side surface portion **320**. However, the terminator **450** may be attached to the first side surface portion **310** and the coaxial connector **340** may be attached to the second side surface portion **320**. In this case, the tube-like portion **362** includes the base end portion electrically connected to the first side surface portion **310** and the distal end portion electrically separated from the body portion **342**, which is the outer conductor of the coaxial connector **340** attached to the second side surface portion **320**.
(137) Also, in the present embodiment, the terminator **450** including the termination resistor **41** is attached to the side surface portion **320**. However, a terminator that short-circuits the transmission path **360** of the current measurement instrument **302** may be attached to the side surface portion **320**. In a similar manner to the present embodiment, this configuration also can reduce noise

produced in the space S inside the current measurement instrument **302**.
Modified Example
(138) Now, a modified example of the transmission path **360** constituting the current measurement instrument **302** according to the second embodiment will be described with reference to FIG. **11**. FIG. **11** is a cross-sectional view illustrating the structure of a transmission path **360**B, which is a modified example of the transmission path **360**.
(139) The transmission path **360**B according to the present modified example includes, instead of the hollow portion **363** of the transmission path **360** illustrated in FIG. **9**, the dielectric **363**A having a dielectric constant less than that of the hollow portion **363**. Polyethylene or the like may be used as the dielectric **363**A, for example.
(140) In this manner, compared to the transmission path **360** described above, for the transmission path **360**B, the distance between the connection portion **361** and the tube-like portion **362** can be reduced, allowing the current measurement instrument **302** to be made smaller in size and allowing the current sensor **200** having a small annular portion **220** to be used.
(141) Next, a current measurement method for measuring the current flowing through the coaxial connector **340** by using any one of the current measurement components of the current measurement instruments **300** to **302** according to the embodiments described above will be described with reference to FIG. **12**.
(142) FIG. **12** is a flowchart illustrating an example of a current measurement method using the current measurement instrument **300**.
(143) In this example, first, the coaxial cables **30** illustrated in FIG. **1** are connected to the pair of coaxial connectors **340** and **350** constituting the current measurement instrument **300**. Note that in a case in which the current measurement instrument **302** is used, the coaxial cable **30** is only connected to the coaxial connector **340**.
(144) In step S1, the current sensor **200** is placed inside the space S formed between the pair of side surface portions **310** and **320** by the bridging portion **330**, and the tube-like portion **362** is enclosed by the current sensor **200**.
(145) In step S2, the current flowing through the connection portion **361** of the current measurement instrument **300** is detected by using the current sensor **200**. At this time, the current sensor **200** is electrically connected to a measuring instrument, and the measuring instrument, for example, measures the magnitude of the current flowing through the coaxial connector **340** on the basis of a detection signal output from the current sensor **200**.
(146) After the current flowing through the connection portion **361** is detected by the current sensor **200** and the current flowing through the coaxial connector **340** is measured by the measuring instrument, the current measurement method ends.
(147) In this manner, the current measurement method includes measuring the current flowing through the coaxial components by using any one of the current measurement components of the current measurement instruments **300** to **302**. In the current measurement component, the pair of side surface portions **310** and **320** and the bridging portion **330** are used to electrically connect the outer conductors of the pair of coaxial components, the base end portion of the tube-like portion **362** is electrically connected to the first side surface portion **310**, and the distal end portion of the tube-like portion **362** is electrically separated from the outer conductor of the coaxial components at the second side surface portion **320**. For example, one coaxial component is the coaxial connector **340**, and the other coaxial component is the coaxial connector **350** or the terminator **450**. In the second embodiment, one of the pair of coaxial components is the coaxial connector **340**, and the other is the terminator **450**. Also, the other inner conductor is the first electrode body **411** of the terminator **450**, and the other outer conductor is the second electrode body **413** of the terminator **450**.
(148) The current measurement method includes step S1 in which the current sensor **200** is disposed inside the space S and the tube-like portion **362** is enclosed by the current sensor **200**, and

step S2 in which the current flowing through the connection portion **361** is detected by the current sensor **200**.
(149) According to this configuration, the tube-like portion **362** is electrically connected to the pair of side surface portions **310** and **320** and the bridging portion **330**. Thus, noise entering the current sensor **200** disposed in the space S can be reduced. Accordingly, a current flowing through the connection portion **361** can be accurately measured.
(150) The embodiments of the present invention described above merely illustrate a portion of the application examples of the present invention, and the technical scope of the present invention is not intended to be limited to the specific configurations of the embodiments described above.
(151) For example, in the embodiments described above, the current measurement device **100**, **101** is used to measure the current flowing through the coaxial cable **30**. However, the current measurement device **100**, **101** may be used to calibrate the current sensor **200**. In this case, the current sensor **200** is calibrated by comparing an AC signal with high accuracy output from the AC device **10** and a measurement result obtained by the current sensor **200**. Even in this case, the effect of noise entering the current sensor **200** can be reduced, allowing the current sensor **200** to be accurately calibrated.
(152) In the embodiments described above, the housing **300**A has a rectangular tube-like shape. However, the housing **300**A can be formed concentric centered around the transmission path **360**. Accordingly, a magnetic field concentric centered around the transmission path **360**, **360**A, **360**B can be produced by the current flowing through the transmission path **360**, **360**A, **360**B. Thus, since the current sensor **200** is disposed correctly in the current measurement instrument **301** to **303**, the accuracy of the current sensor **200** detecting the current flowing through the transmission path **360**, **360**A, **360**B can be increased.
(153) Also, the modified example of the second embodiment illustrated in FIG. **11** can also be applied to the current measurement device **100**, **101** of the first embodiment. In this case also, the outer diameter of the transmission path **360**B can be decreased.
(154) The present application claims priority based on JP 2020-109004 filed on Jun. 24, 2020 in Japan, and the present application claims priority based on JP 2021-080639 filed on May 11, 2021 in Japan, the entire contents of which are incorporated by reference herein.
REFERENCE SIGNS LIST
(155) **100**, **101** Current measurement device **200** Current sensor **300** to **302** Current measurement instrument (current measurement component) **300**A Housing **310**, **320** Side surface portion (first side surface portion, second side surface portion) **311**, **321** Inner surface **312**, **322** Outer surface **313**, **323** Hole portion **330** Bridging portion **340**, **350** Coaxial connector (coaxial component) **341**, **351** Pin (inner conductor) **342**, **352**, **452** Body portion (outer conductor) **361** Connection portion **362** Tube-like portion **363**A Dielectric **364**, **364**A Gap **411** First electrode body (inner conductor) **411**A First electrode (first electrode body) **411**B Pin (first electrode body) **413** Second electrode body (outer conductor) **450** Terminator (coaxial component)

Claims

1. A current measurement component comprising: a pair of side surface portions disposed spaced apart and opposing one another; a bridging portion bridging between the pair of side surface portions and forming a space between the pair of side surface portions; a pair of coaxial components attached to the pair of side surface portions, respectively, each one of the pair of coaxial components including an inner conductor that extends through a hole formed in a corresponding side surface portion of the pair of side surface portions; a connector electrically connecting the inner conductors of the pair of coaxial components; and a tube enclosing an outer peripheral portion a connector perimeter of the connector with an insulating gap formed between the tube and the connector perimeter of the connector, wherein the pair of side surface portions and

the bridging portion are electrically conductive such that outer conductors of the pair of coaxial components are electrically connected, and the tube includes a base end portion physically and electrically connected to a first side surface portion of the pair of side surface portions and a distal end portion physically and electrically separated from the outer conductor of a coaxial component of the pair of coaxial components attached to a second side surface portion of the pair of side surface portions.

2. The current measurement component according to claim 1, wherein a structure including the tube and the connector has a characteristic impedance identical to a characteristic impedance of the pair of coaxial components.

3. The current measurement component according to claim 1, wherein the pair of side surface portions and the bridging portion are conductors.

4. The current measurement component according to claim 1, wherein an insulating gap provided at a distal end of the tube is narrower than a width of a current sensor disposed between the pair of side surface portions.

5. The current measurement component according to claim 1, wherein the tube extends from an inner surface of the first side surface portion and is spaced apart from the second side surface portion to form an insulating gap provided at a distal end of the tube.

6. The current measurement component according to claim 1, further comprising, between the connector and the tube, a dielectric having a dielectric constant less than a dielectric constant of air.

7. The current measurement component according to claim 1, wherein the pair of coaxial components are coaxial connectors.

8. The current measurement component according to claim 1, wherein one of the pair of coaxial components is a coaxial connector and the other coaxial component is a terminator; the inner conductor of the other coaxial component is a first electrode body of the terminator; and the outer conductor of the other coaxial component is a second electrode body of the terminator.

9. A current measurement device comprising: the current measurement component according to claim 1; and a current sensor disposed inside the space formed between the pair of side surface portions by the bridging portion and configured to detect a current flowing through the connector in a state in which the current sensor encloses the tube.

10. A current measurement method using a current measurement component including a pair of side surface portions disposed spaced apart and opposing one another, a bridging portion bridging between the pair of side surface portions and forming a space between the pair of side surface portions, a pair of coaxial components attached to the pair of side surface portions, respectively, each one of the pair of coaxial components including an inner conductor that extends through a hole formed in a corresponding side surface portion of the pair of side surface portions, a connector electrically connecting the inner conductors of the pair of coaxial components, and a tube enclosing an connector perimeter of the connector with an insulating gap formed between the tube and the connector perimeter of the connector, outer conductors of the pair of coaxial components being electrically connected by using the pair of side surface portions and the bridging portion, a base end portion of the tube being physically and electrically connected to a first side surface portion of the pair of side surface portions, and a distal end portion of the tube being physically and electrically separated from the outer conductor of a coaxial component of the pair of coaxial components at a second side surface portion of the pair of side surface portions, to measure a current flowing through the pair of coaxial components, the method comprising: disposing a current sensor inside the space and enclosing the tube with the current sensor; and detecting a current flowing through the connector with the current sensor.

11. The current measurement method according to claim 10, wherein the pair of coaxial components are coaxial connectors.

12. The current measurement method according to claim 10, wherein one of the pair of coaxial components is a coaxial connector and another is a terminator; the inner conductor of the other

coaxial connector is a first electrode body of the terminator; and the outer conductor of the other coaxial connector is a second electrode body of the terminator.