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(54) **PIPING COMMUNICATION SYSTEM**

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## Description

### Technical Field

[0001] The present invention relates to a piping communication system and, more particularly, to a piping communication system in which a signal transmission unit is installed within an outdoor unit or an indoor unit.

### Background Art

[0002] In general, an air-conditioner is divided into an indoor unit and an outdoor unit, and the indoor unit and the outdoor unit are electrically connected to transfer an electrical signal. However, when a plurality of indoor units are connected in parallel to a single outdoor unit or when a refrigerant piping is installed within a wall body of a building and a plurality of indoor units are connected in parallel to the refrigerant piping, it is difficult to electrically connect the respective indoor units to a smaller number of outdoor units in many cases.

[0003] Thus, a technique of transmitting and receiving an electrical signal by using a refrigerant piping connecting a plurality of indoor units and a smaller number of outdoor units than that of the indoor units has been introduced. For example, a gas refrigerant piping (referred to as a gas piping, hereinafter) and a liquid refrigerant piping (referred to as a liquid piping, hereinafter) are electrically connected to a control board of an outdoor unit and a control board of an indoor unit, respectively, so as to be used as communication mediums for transferring a control signal between the indoor units and the outdoor unit. To this end, a signal transmission unit is installed at the refrigerant piping and a signal line of the signal transmission unit electrically connects the respective control boards and the refrigerating piping.

[0004] The signal transmission unit may be installed at an outer side of an outdoor unit case or an indoor unit case, and according to circumstances, the signal transmission unit is installed within the outdoor unit case or the indoor unit case and the assembling state may be desirably maintained.

[0005] JP H06 2880 A discloses a separate type air conditioner in which an electrical insulator is provided respectively on an indoor unit side and an outdoor unit side of a gas side refrigerant pipe and a liquid side refrigerant pipe.

### Disclosure of Invention

#### Technical Problem

[0006] However, in the related art piping communication system, in case in which the signal transmission unit is installed within the outdoor unit case or the indoor unit case, when the refrigerant piping vibrates, the signal transmission unit may be brought into contact with a neighboring different conductor to cause a short.

## Solution to Problem

[0007] Therefore, an object of the present invention is to provide a piping communication system capable of restraining a refrigerant piping from vibrating to thus prevent a signal transmission unit coupled to the refrigerating piping from being shorted.

[0008] In order to achieve the above object, there is provided a piping communication system including: a refrigerant piping connecting an outdoor heat exchanger and an indoor heat exchanger through an outdoor unit case and an indoor unit case; a signal transmission unit electrically connected to the refrigerant piping to transfer a signal transmitted or received through the refrigerant piping to a microcomputer; and a vibration preventing member installed between the outdoor unit case or the indoor unit case and the refrigerant piping to support the refrigerant piping with respect to the outdoor unit case or the indoor unit case, wherein the short-circuit preventing member comprises: a support unit allowing the refrigerant piping to be inserted therethrough and supported; and a fixed unit formed to extend from an outer circumferential surface of the support unit and fixed to the outdoor unit case, wherein at least one side of the support unit is protruded than one side of the fixed unit and inserted into a piping hole provided in the outdoor unit case or the indoor unit case; and wherein the fixed unit comprises a through hole and is configured to be screw-fastened to a fastening hole of the outdoor unit case or the indoor unit case, or wherein the fixed unit comprises a hook projection and is configured to be hook-coupled to a hook hole of the outdoor unit case or the indoor unit case.

### Advantageous Effects of Invention

[0009] According to the piping communication system of the embodiments of the present invention, since the vibration preventing member covering the refrigerant piping is provided between the outdoor unit case or the indoor unit case and the refrigerant piping, although vibration is transferred to the refrigerant piping, the vibration is absorbed or suppressed by the vibration preventing member fixed to the outdoor unit case or the indoor unit case, thus reducing the amplitude of the refrigerant piping, whereby although the signal transmission unit is installed within the outdoor unit case of the indoor unit case, the signal transmission unit can be prevented from being brought into contact with neighboring components and shorted.

### Brief Description of Drawings

[0010]

FIG. 1 is a distribution diagram of an air-conditioner having a piping communication system according to an embodiment of the present invention;

FIG. 2 is a perspective view showing an assembling state of a refrigerant piping and an outdoor unit case when a signal transmission unit is installed within an outdoor unit in the air-conditioner according to FIG. 1;

FIG. 3 is an enlarged view of a portion A in FIG. 2 and exploded perspective view of a vibration preventing member;

FIG. 4 is a vertical sectional view showing an embodiment of a method for assembling a vibration preventing member according to FIG. 3;

FIG. 5 is a vertical sectional view showing another embodiment of a method for assembling a vibration preventing member according to FIG. 3; and

FIG. 6 is a front view showing another embodiment of a support portion of the vibration preventing member according to FIG. 3.

### Best Modes for Carrying out the Invention

**[0011]** Hereinafter, a piping communication system according to embodiments of the present invention will be described in detail with reference to the accompanying drawings.

**[0012]** FIG. 1 is a distribution diagram of an air-conditioner having a piping communication system according to an embodiment of the present invention. FIG. 2 is a perspective view showing an assembling state of a refrigerant piping and an outdoor unit case when a signal transmission unit is installed within an outdoor unit in the air-conditioner according to FIG. 1.

**[0013]** As illustrated, in the air-conditioner having a piping communication system according to an embodiment of the present invention, an indoor unit 10 and an outdoor unit 20 are disposed with an outer wall of a building interposed therebetween and connected such that an electrical signal is transmitted and received between the outdoor unit 10 and the indoor unit 20 through a liquid piping 40 or a gas piping 30.

**[0014]** An outdoor heat exchanger 11 of the outdoor unit 10 and an indoor heat exchanger 21 of the indoor unit 20 are connected to both ends of the gas piping 30 and the liquid piping 40, and an outdoor signal transmission unit 13 and an indoor signal transmission unit 23 are installed between the outdoor heat exchanger 11 and the indoor heat exchanger 21 in order to transfer a transferred electric signal to the outdoor control unit 12 of the outdoor unit 10 and the indoor control unit 22 of the indoor unit 20.

**[0015]** The outdoor signal transmission unit 13 (here, the outdoor signal transmission unit and the indoor signal transmission unit have the same configuration, so, hereinafter, the outdoor signal transmission unit will be described as a representative example) includes a core assembly 50 coupled to the refrigerant piping 40 (here, the refrigerant piping may correspond to a gas piping or a liquid piping, and hereinafter, a liquid piping will be described) and making impedance with respect to an AC

electrical signal, and a plurality of signal terminals 61 and 62 separated from the core assembly 50 and coupled to the liquid piping 40 and electrically connecting the liquid piping 40 and the outdoor control unit 12.

**[0016]** In the core assembly 50, a pair of cores generally formed to have a hemispherical section are accommodated in a core holder and coupled to cover up the liquid piping 40. The core assembly 50 has magnetism to make inductance corresponding to one time of winding and is coupled to cover up the gas piping 30 or the liquid piping 40.

**[0017]** For example, in case of a toroidal core having an inner diameter  $R_1$ , an outer diameter  $R_2$ , a height  $h$ , and magnetic permeability  $m$ , self-inductance ( $L$ ) is  $L = (\mu h / 2\pi) \ln(R_2/R_1)$ , and it has impedance of  $Z = j2\pi fL$  with respect to an AC signal of a frequency  $f$ . Thus, with respect to an AC control signal transmitted by the outdoor control unit 12, a transmission line terminated with impedance of  $2 \cdot Z$  is formed at the outer heat exchanger 11 according to the operation of the core through which the gas piping 30 and the liquid piping 40 penetrates.

**[0018]** Thus, when an AC signal flows through the refrigerant pipings 30 and 40 installed between the outdoor unit 10 and the indoor unit 20, the AC signal has attenuation characteristics according to a distance by the transmission line impedance  $Z_0$  of the pipings themselves. The impedance  $Z_0$  of the transmission line is proportional to the distance, and the signal strength of the AC signal used for detecting the distance of the refrigerant pipings 30 and 40 is reduced by the transmission line impedance  $Z_0$  and the core. Namely, when the impedance value of the core and the strength of the AC control signal of the transmitter and the receiver are known, inversely, the distance information can be known. The refrigerant pipings may be used as a transmission path of a distance detection signal, whereby a piping distance between the outdoor unit and the indoor unit used for calculating an amount of a refrigerant can be automatically calculated.

**[0019]** Here, the refrigerant pipings 30 and 40 are connected to the outdoor heat exchanger 11 through an outdoor unit case 14 (the indoor unit case is the same and, here, the outdoor unit case will be described as an example), and the core assembly 50 and the signal terminals 61 and 62 may be installed outside the outdoor unit case 14 or may be installed within the outdoor unit case 14.

**[0020]** When the core assembly 50 and the signal terminals 61 and 62 are installed outside the outdoor unit case 14, although the liquid piping 40 is slightly shaken by a surrounding environment, it does not generate a short with components in the vicinity of the outdoor unit 10, but when the door assembly 50 and the signal terminals 61 and 62 are installed within the outdoor unit case 14, when the liquid piping 40 vibrates, the liquid piping 40 comes into contact with the neighboring components to generate a short.

**[0021]** Thus, when the core assembly 50 and the signal

terminals 61 and 62 are installed within the outdoor unit case 14, a vibration preventing member for preventing vibration of the liquid piping 40 is required.

**[0022]** FIG. 3 is an enlarged view of a portion A in FIG. 2 and exploded perspective view of a vibration preventing member. FIG. 4 is a vertical sectional view showing an embodiment of a method for assembling a vibration preventing member according to FIG. 3. FIG. 5 is a vertical sectional view showing another embodiment of a method for assembling a vibration preventing member according to FIG. 3.

**[0023]** As illustrated, a vibration preventing member 100 is provided between the refrigerant piping 40 (hereinafter, the liquid piping will be described as an example) and the outdoor unit case or the indoor unit case 14 (hereinafter, the outdoor unit case will be described as an example) and coupled to support the liquid piping 40 with respect to the outdoor unit case 11.

**[0024]** The vibration preventing member 100 may include a support unit 110 in which the liquid piping 40 is insertedly supported and a fixed unit 120 formed to extend from an outer circumferential surface of the support unit 110 and fixed to the outdoor unit case 14. Preferably, the vibration preventing member 100 is made of a material having an elastic modulus greater than that of the outdoor unit case 14.

**[0025]** The support unit 110 is formed to have a cylindrical shape having a predetermined length, namely, a length which is longer than the thickness of the outdoor unit case 14 and protruded than one side of the fixing unit 110, and inserted into a piping hole 14a of the outdoor unit case 14. However, the outer circumferential surface of the support unit 110 may not necessarily have the circular shape but may be formed to have a quadrangular shape or any other shapes.

**[0026]** The support unit 110 may have the cylindrical shape as shown in FIG. 3, or according to circumstances, the support unit 110 may be formed to have a cutout face 111 as shown in FIG. 6. When the support unit 110 has the cutout face 111, when the vibration preventing member 100 is coupled to the liquid piping 40, the support unit 110 can be open to both sides to insert the liquid piping 40 in a radial direction. Thus, the vibration preventing member 100 can be coupled even in a state in which the core assembly is already assembled or the liquid piping is already connected.

**[0027]** As illustrated, the fixed unit 120 may be formed to be protruded from both sides or protruded from only one side, and three or more fixed units 120 may be formed. The fixed unit 120 may be formed to be protruded from the entire outer circumferential surface of the support unit 110 in an annular manner.

**[0028]** The fixed units 120 include either a through hole 121, respectively, and are screw-fastened to a fastening hole 14b provided on the outdoor unit case 14 or, as shown in FIG. 5, the fixed unit 120 has a hook projection 122 and is hook-coupled in a hook hole 14c provided in the outdoor unit case 14.

**[0029]** The piping communication system according to the present invention as described above has the following operational effects.

**[0030]** Namely, the vibration preventing member 100 is installed between the piping hole 14a of the outdoor unit case 14 and the liquid piping 40 inserted into the piping hole 14a. The vibration preventing member 100 includes the support unit 110 in which the liquid piping 40 is inserted and the fixed unit 120 fixed to the outdoor unit case 14 in order to support the liquid piping 40. Thus, although vibration is transferred to the liquid piping 40, the vibration is absorbed or suppressed by the vibration preventing member 100 fixed to the outdoor unit case 14, thus reducing amplitude of the liquid piping 40.

**[0031]** Accordingly, even when the core assembly and the signal terminals are coupled to be positioned within the outdoor unit case 14, the core assembly and the signal terminals can be prevented from being in contact with neighboring outdoor unit components, thereby preventing the piping communication system from being shorted.

## Mode for the Invention

**[0032]** Meanwhile, in the present embodiment, the case in which the vibration preventing member is installed between the outdoor unit case and the liquid piping has been described, but the vibration preventing member may also be installed between the indoor unit case and the liquid piping, between the outdoor unit case and the gas piping, or between the indoor unit case and the gas piping. In these cases, the basic configuration and operational effect are similar to those of the foregoing embodiment.

## Claims

1. A piping communication system, comprising:

- an outdoor unit case (14) having a piping hole (14a), wherein an outdoor heat exchanger (11) is installed in the outdoor unit case (14);
- an indoor unit case having a piping hole, wherein an indoor heat exchanger (21) is installed in the indoor unit case;
- a refrigerant piping (40) configured to connect the outdoor heat exchanger and the indoor heat exchanger through the piping hole of the outdoor unit case and the piping hole of the indoor unit case; and
- a signal transmission unit (13) electrically connected to the refrigerant piping to transfer a signal transmitted or received through the refrigerant piping to a microcomputer,

### characterized in that

the piping communication system further comprises a short-circuit preventing member (100) installed between the outdoor unit case or the

indoor unit case and the refrigerant piping to support the refrigerant piping with respect to the outdoor unit case or the indoor unit case; and the short-circuit preventing member comprises:

- a support unit (110) allowing the refrigerant piping to be inserted therethrough and supported; and
- a fixed unit (120) formed to extend from an outer circumferential surface of the support unit and fixed to the outdoor unit case or the indoor unit case,

wherein at least one side of the support unit (110) is protruded than one side of the fixed unit (120) and inserted into the piping hole (14a) provided in the outdoor unit case or the indoor unit case; and

wherein the fixed unit (120) comprises a through hole (121) and is configured to be screw-fastened to a fastening hole (14b) of the outdoor unit case or the indoor unit case, or

wherein the fixed unit (120) comprises a hook projection (122) and is configured to be hook-coupled to a hook hole (14c) of the outdoor unit case or the indoor unit case.

2. The piping communication system of claim 1, wherein one side of the support unit (110) is cut out so as to be opened to both sides to allow the piping to be inserted therethrough.
3. The piping communication system of claim 1, wherein one half and another half of the support unit (110) are paired to be coupled to face the piping.
4. The piping communication system of any one of claims 1 to 3, wherein the fixed unit (120) is formed to be protruded radially from a portion of the support unit (110) in a circumferential direction.
5. The piping communication system of any one of claims 1 to 3, wherein the fixed unit (120) is formed and coupled in an annular manner along the circumferential direction of the support unit (110).
6. The piping communication system of any one of claims 1 to 5, wherein the short-circuit preventing member is made of a material having elastic modulus greater than that of the outdoor unit case or the indoor unit case.

## Patentansprüche

1. Rohrleitungskommunikationssystem, mit:  
einem Außeneinheitsgehäuse (14), das ein

Rohrleitungsloch (14a) aufweist, wobei ein Außenwärmetauscher (11) im Außeneinheitsgehäuse (14) installiert ist;

einem Inneneinheitsgehäuse, das ein Rohrleitungsloch aufweist, wobei ein Innenwärmetauscher (21) im Inneneinheitsgehäuse installiert ist;

einer Kühlmittelrohrleitung (40), die konfiguriert ist, durch das Rohrleitungsloch des Außeneinheitsgehäuses und das Rohrleitungsloch des Inneneinheitsgehäuses den Außenwärmetauscher und den Innenwärmetauscher zu verbinden; und

einer Signalübertragungseinheit (13), die elektrisch mit der Kühlmittelrohrleitung verbunden ist, um ein durch die Kühlmittelrohrleitung empfangenes oder gesendetes Signal zu einem Mikrocomputer zu übertragen,

**dadurch gekennzeichnet, dass**

das Rohrleitungskommunikationssystem ferner ein Kurzschlussverhinderungselement (100) aufweist, das zwischen dem Außeneinheitsgehäuse oder dem Inneneinheitsgehäuse und der Kühlmittelrohrleitung installiert ist, um die Kühlmittelrohrleitung bezüglich des Außeneinheitsgehäuses oder des Inneneinheitsgehäuses zu halten; und

das Kurzschlussverhinderungselement aufweist:

eine Halteeinheit (110), die es ermöglicht, dass die Kühlmittelrohrleitung dort hindurch eingesetzt und gehalten wird; und

eine Befestigungseinheit (120), die so ausgebildet ist, dass sie sich von einer Außenumfangsfläche der Halteeinheit erstreckt, und am Außeneinheitsgehäuse oder am Inneneinheitsgehäuse befestigt ist,

wobei mindestens eine Seite der Halteeinheit (110) von einer Seite der Befestigungseinheit (120) vorsteht und in das Rohrleitungsloch (14a) eingesetzt ist, das im Außeneinheitsgehäuse oder im Inneneinheitsgehäuse vorgesehen ist; und

wobei die Befestigungseinheit (120) ein Durchgangsloch (121) aufweist und konfiguriert ist, an einem Befestigungsloch (14b) des Außeneinheitsgehäuses oder des Inneneinheitsgehäuses befestigt zu werden, oder

wobei die Befestigungseinheit (120) einen Hakenvorsprung (122) aufweist und konfiguriert ist, mit einem Hakenloch (14c) des Außeneinheitsgehäuses oder des Inneneinheitsgehäuses hakengekoppelt zu werden.

2. Rohrleitungskommunikationssystem nach Anspruch 1, wobei eine Seite der Halteeinheit (110)

ausgeschnitten ist, um nach beiden Seiten geöffnet zu werden, um es zu ermöglichen, dass die Rohrleitung dort hindurch eingesetzt wird.

3. Rohrleitungskommunikationssystem nach Anspruch 1, wobei eine Hälfte und eine andere Hälfte der Halteeinheit (110) gepaart sind, um gekoppelt zu werden, um zur Rohrleitung zu weisen. 5
4. Rohrleitungskommunikationssystem nach einem der Ansprüche 1 bis 3, wobei die Befestigungseinheit (120) so ausgebildet ist, dass sie von einem Abschnitt der Halteeinheit (110) in eine Umfangsrichtung vorsteht. 10
5. Rohrleitungskommunikationssystem nach einem der Ansprüche 1 bis 3, wobei die Befestigungseinheit (120) in einer ringförmigen Weise längs der Umfangsrichtung der Halteeinheit (110) ausgebildet und gekoppelt ist. 15
6. Rohrleitungskommunikationssystem nach einem der Ansprüche 1 bis 5, wobei das Kurzschlussverhinderungselement aus einem Material besteht, das ein größeres Elastizitätsmodul als das Außeneinheitengehäuse oder das Inneneinheitengehäuse aufweist. 20 25

## Revendications

1. Système de communication de conduite, comprenant :

un boîtier d'unité extérieure (14) présentant un trou pour conduite (14a), un échangeur de chaleur extérieur (11) étant installé dans ledit boîtier d'unité extérieure (14) ;

un boîtier d'unité intérieure présentant un trou pour conduite, un échangeur de chaleur intérieur (21) étant installé dans ledit boîtier d'unité intérieure ;

une conduite de réfrigérant (40) prévue pour relier l'échangeur de chaleur extérieur à l'échangeur de chaleur intérieur en passant par le trou pour conduite du boîtier d'unité extérieure et le trou pour conduite du boîtier d'unité intérieure ; et

une unité de transmission de signal (13) reliée électriquement à la conduite de réfrigérant pour transférer à un micro-ordinateur un signal transmis ou reçu par la conduite de réfrigérant,

**caractérisé en ce que**

ledit système de communication de conduite comprend en outre un élément de prévention de court-circuit (100) installé entre le boîtier d'unité extérieure ou le boîtier d'unité intérieure et la conduite de réfrigérant pour supporter la con-

duite de réfrigérant par rapport au boîtier d'unité extérieure ou au boîtier d'unité intérieure ; et l'élément de prévention de court-circuit comprend :

une unité de support (110) dans laquelle la conduite de réfrigérant peut être insérée et permettant le support de celle-ci ; et une unité de fixation (120) prévue pour s'étendre depuis une surface circonférentielle extérieure de l'unité de support et fixée au boîtier d'unité extérieure ou au boîtier d'unité intérieure,

où au moins un côté de l'unité de support (110) est en saillie depuis un côté de l'unité de fixation (120) et introduit dans le trou pour conduite (14a) prévu dans le boîtier d'unité extérieure ou le boîtier d'unité intérieure ; et

où l'unité de fixation (120) comprend un trou traversant (121) et est prévue pour être fixée par vis à un trou de fixation (14b) du boîtier d'unité extérieure ou du boîtier d'unité intérieure, ou où l'unité de fixation (120) comprend une saillie en crochet (122) et est prévue pour être accouplée par un trou pour crochet (14c) du boîtier d'unité extérieure ou du boîtier d'unité intérieure.

2. Système de communication de conduite selon la revendication 1, où un côté de l'unité de support (110) est découpé de manière à être ouvert par écartement pour permettre l'insertion de la conduite. 30

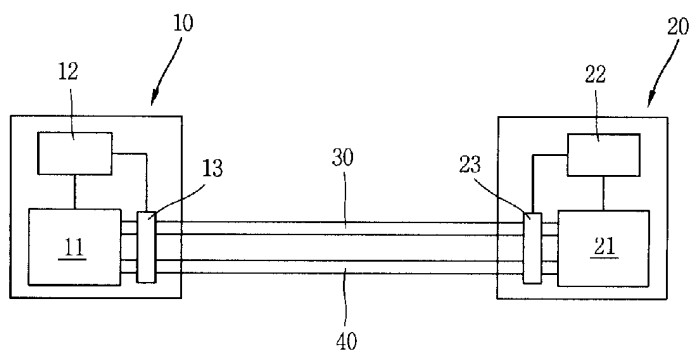
3. Système de communication de conduite selon la revendication 1, où une moitié et une autre moitié de l'unité de support (110) correspondent pour être accouplées afin d'opposer la conduite. 35

4. Système de communication de conduite selon l'une des revendications 1 à 3, où l'unité de fixation (120) est formée en saillie radiale depuis une partie de l'unité de support (110) dans la direction circonférentielle. 40

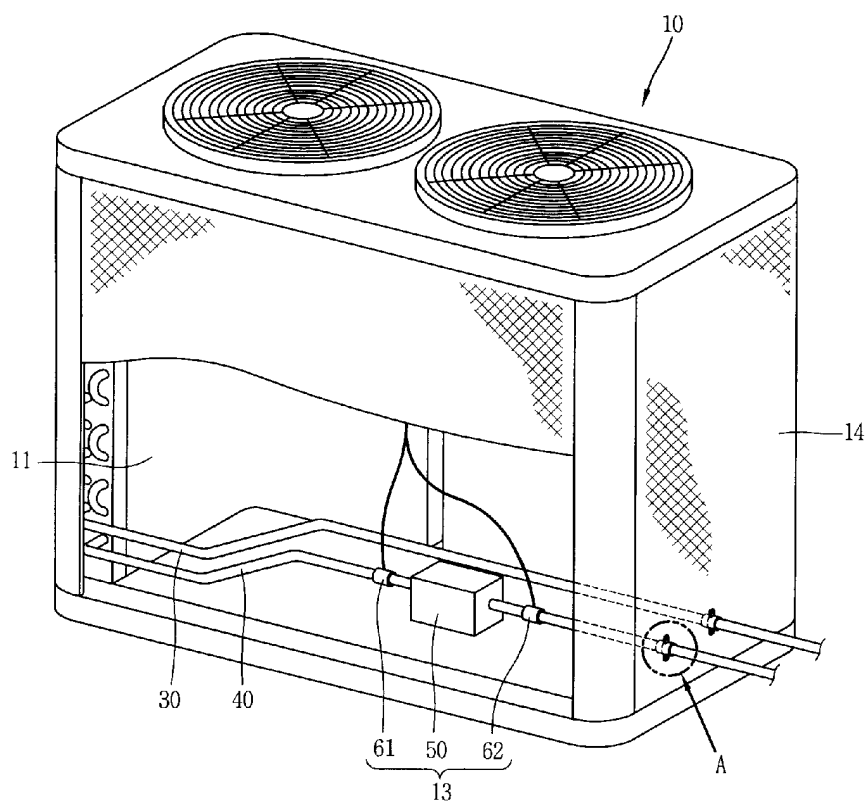
5. Système de communication de conduite selon l'une des revendications 1 à 3, où l'unité de fixation (120) est formée et raccordée en anneau dans la direction circonférentielle de l'unité de support (110). 45

6. Système de communication de conduite selon l'une des revendications 1 à 5, où l'élément de prévention de court-circuit est constitué d'un matériau ayant un module d'élasticité supérieur à celui du boîtier d'unité extérieure ou du boîtier d'unité intérieure. 50

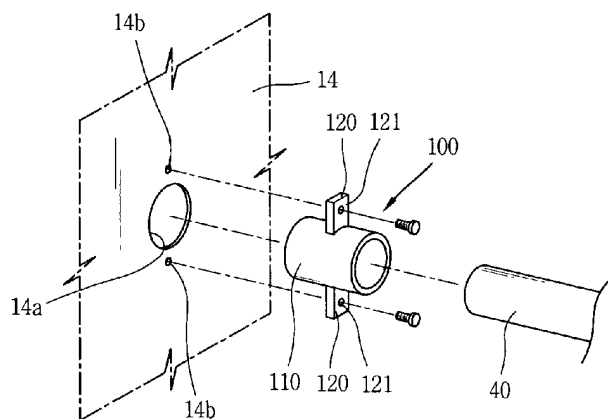
[Fig. 1]



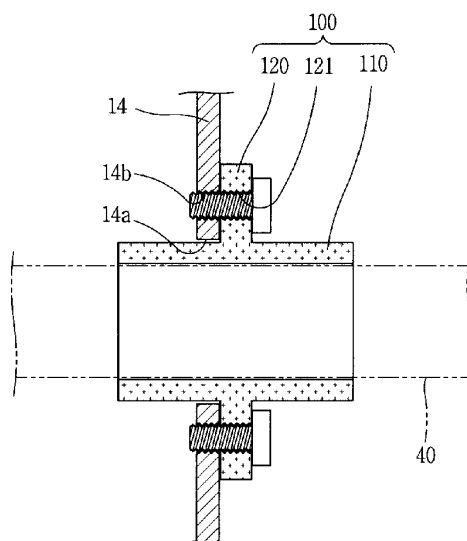
[Fig. 2]



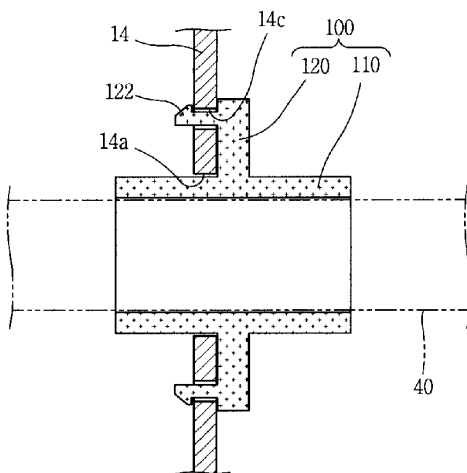
[Fig. 3]



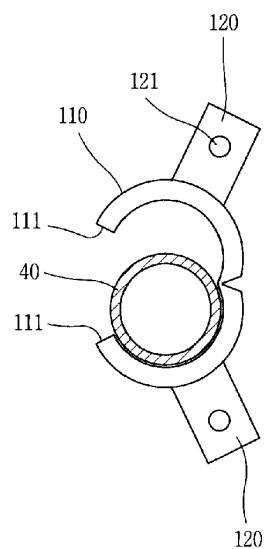
[Fig. 4]



[Fig. 5]



[Fig. 6]



**REFERENCES CITED IN THE DESCRIPTION**

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