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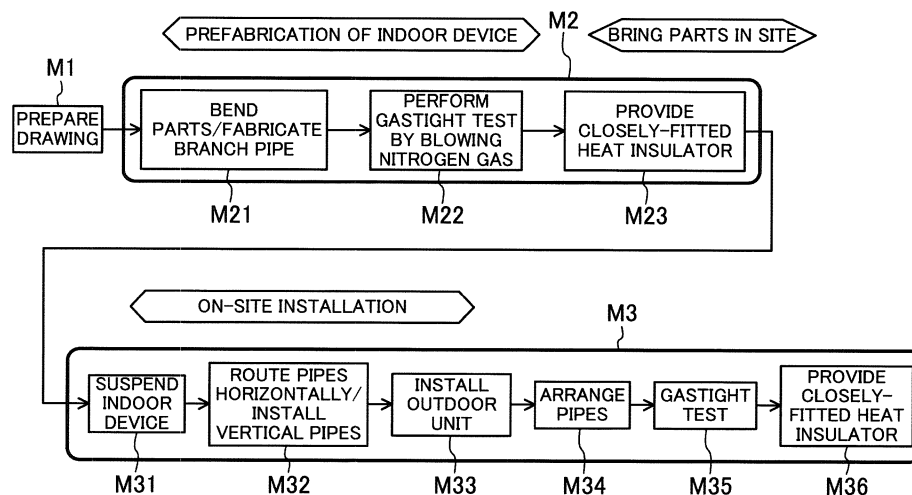
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(54) **CONSTRUCTION METHOD FOR AIR CONDITIONING DEVICE**

(57) An air conditioner includes an outdoor unit, an indoor unit, and a refrigerant circuit. A method for installing the air conditioner includes: a planning step (M1) of determining factory-assembled parts and site-assembled parts of the refrigerant circuit based on a construction drawing of a building; a part fabrication step (M2) of fabricating, in a factory, a plurality of parts (42) of the refrigerant circuit (40) corresponding to the factory-assembled parts determined in the planning step (M1); and

an installation step (M3) of installing and connecting in the building the plurality of parts (42) fabricated in the part fabrication step (M2) and a plurality of devices of the refrigerant circuit (40) corresponding to the site-assembled parts determined in the planning step (M1). The present invention allows for reducing the number of days required for the installation, cutting down the risk of fire accidents, and suppressing the occurrence of moisture condensation.

FIG.10



Description

TECHNICAL FIELD

[0001] The present invention relates to a method for installing an air conditioner, and more particularly relates to steps to install refrigerant pipes.

BACKGROUND ART

[0002] Some conventional air conditioners are installed in buildings by connecting a plurality of indoor units to a single outdoor unit as disclosed by Patent Document 1. In the present circumstances, most of the installation process of such an air conditioner, including pipe connection, is performed on site after the framework of the building is finished.

CITATION LIST

PATENT DOCUMENT

[0003] [Patent Document 1] Japanese Unexamined Patent Publication No. H07-280376

SUMMARY OF THE INVENTION

TECHNICAL PROBLEM

[0004] In the conventional installation process of the air conditioners, however, most of its piping work is done on site, and thus the installation takes many days. Specifically, pipe installation and heat insulation work need to be performed in confined space such as a roof space. Thus, it takes a great number of skilled workers and long working hours to get such installation done, which is a problem

[0005] Further, according to a conventional method, work involving brazing is performed on site in some cases. The on-site work using fire may increase the risk of fire accidents. If couplings that do not require fire are used to reduce the risk of fire accidents, however, the installation cost will increase due to the expensiveness of the couplings, which is also a problem.

[0006] In addition, the heat insulation work performed on site may result in failure at some points, and moisture condensation may possibly occur, which is another problem with the related art.

[0007] In view of these problems, the present invention has been made to reduce the number of days required for the installation, to reduce the risk of the fire accidents, and to reduce the occurrence of moisture condensation.

SOLUTION TO THE PROBLEM

[0008] A first aspect of the invention is a method for installing an air conditioner including an outdoor unit (20), an indoor unit (30) connected to the outdoor unit (20)

through a refrigerant pipe (41), and a refrigerant circuit (40) in which a refrigerant circulates between the outdoor unit (20) and the indoor unit (30). The method according to the first aspect of the present invention includes: a planning step (M1) of determining factory-assembled parts and site-assembled parts of the refrigerant circuit (40) based on a construction drawing of a construction (11) in which the air conditioner (10) is going to be installed; a part fabrication step (M2) of fabricating, in a factory, a plurality of parts (42) of the refrigerant circuit (40) corresponding to the factory-assembled parts determined in the planning step (M1); and an installation step (M3) of installing and connecting, in the construction, the plurality of parts (42) fabricated in the part fabrication step (M2) and a plurality of devices of the refrigerant circuit (40) corresponding to the site-assembled parts determined in the planning step (M1).

[0009] According to the first aspect of the invention, factory-assembled parts and site-assembled parts of the refrigerant circuit (40) are determined first based on the construction drawing of a construction (11). Then, a plurality of parts (42) of the refrigerant circuit (40) corresponding to the factory-assembled parts are fabricated in a factory, and then the plurality of parts (42) and a plurality of devices of the refrigerant circuit (40) corresponding to the site-assembled parts are installed and connected together in the construction.

[0010] A second aspect of the invention is an embodiment of the first aspect of the invention. In the second aspect, the planning step (M1) includes a piping drawing preparation step (M13) of preparing, based on the construction drawing indicating a piping system of the refrigerant circuit (40), a piping drawing showing the piping system in detail.

[0011] According to the second aspect of the invention, a piping drawing showing a piping system of the refrigerant circuit (40) in detail is prepared based on the construction drawing in the planning step (M1). Thus, a piping drawing accurately representing the actual construction can be prepared.

[0012] A third aspect of the invention is an embodiment of the second aspect of the invention. In the third aspect, the piping drawing is prepared in the piping drawing preparation step (M13) based on an on-site survey of the construction (11).

[0013] According to the third aspect of the invention, the piping drawing is prepared based on an on-site survey of the construction (11). Thus, a piping drawing representing even more accurately the actual construction can be prepared.

[0014] A fourth aspect of the invention is an embodiment of the second or third aspect of the invention. In the fourth aspect, the planning step (M1) includes, subsequent to the piping drawing preparation step (M13), a determination step (M14) of giving distinguishing identifications to connection positions of the plurality of parts (42), and preparing an instruction indicating installation positions of the parts (42) based on the distinguishing

identifications.

[0015] According to the fourth aspect of the invention, an instruction indicating the installation positions of the parts (42) is prepared based on the distinguishing identifications and provided for a person in charge of the installation.

[0016] A fifth aspect of the invention is an embodiment of the fourth aspect of the invention. In the fifth aspect, in the part fabrication step (M2), the parts (42) are given the distinguishing identifications corresponding to the connection positions of the parts (42) determined in the determination step (M14).

[0017] According to the fifth aspect of the invention, the distinguishing identifications are given to the parts (42) by reference to the piping drawing prepared in the planning step (M1) so that the installation positions are identifiable easily.

[0018] A sixth aspect of the invention is an embodiment of any one of the first to fifth aspects of the invention. In the sixth aspect, the installation step (M3) is performed using only a coupling (43) to connect pipes.

[0019] According to the fifth aspect of the invention, the pipes are connected only with a coupling (43) such that fire is not used on site.

ADVANTAGES OF THE INVENTION

[0020] According to the present invention, factory-assembled parts and site-assembled parts of the refrigerant circuit (40) are determined in a planning step (M1), and parts (42) of the refrigerant circuit (40) are fabricated in a factory. This reduces the number of days required for the installation significantly. Specifically, the connecting work which has been carried out on site is replaced with work in the factory. This allows workers to get their work in a confined roof space and other time-consuming jobs done much more easily, thereby reducing the number of days required for the installation significantly.

[0021] Further, most parts of the refrigerant circuit (40) can be fabricated in the factory. Thus, on-site work using fire can be reduced, which will cut down the number of fire accidents to happen on site. In addition, the heat insulation work can also be performed in the factory. This increases the accuracy of the heat insulation work significantly, and prevents moisture condensation.

[0022] According to the second aspect of the invention, a piping drawing of the refrigerant circuit (40) is prepared based on a construction drawing. This increases the accuracy of the factory-assembled parts, and makes it possible to perform most of the piping work in the factory. This ensures that the number of days required for the installation is significantly reduced even more reliably.

[0023] According to the third aspect of the invention, the piping drawing is prepared based on an on-site survey. This increases the accuracy of the factory-assembled parts, and ensures that the number of days required for the installation is significantly reduced even more reliably.

[0024] According to the fourth aspect of the invention, an instruction indicating the installation positions of the parts (42) given the distinguishing identifications is prepared. This allows for preventing incorrect connection of the parts and other errors, thereby increasing the accuracy of the on-site installation.

[0025] According to the fifth aspect of the invention, distinguishing identifications are given to the parts (42) by reference to the piping drawing. This allows for indicating the installation positions of the parts (42) clearly so that the installation positions or any other group of positions of interest are easily identifiable.

[0026] According to the sixth aspect of the invention, a brazing process for connecting the parts (42) is performed only in the factory, and the on-site connection process is performed using only fitting couplings (43). That is, work using fire is restricted to the factory, and no work using fire is performed on site any longer. This eliminates the occurrence of fire accidents on site. In addition, the brazing process performed in the factory reduces the number of positions where the fitting couplings (43) are used. This reduces the number of expensive couplings (43) to use, which allows for cutting down the installation cost.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027]

[FIG. 1] FIG. 1 is a perspective view showing a general configuration for an air conditioner.

[FIG. 2] FIG. 2 is an exploded perspective view showing a disassembled branch coupling unit as a first pipe unit.

[FIG. 3] FIG. 3 is an exploded perspective view showing a disassembled pipe body of the first pipe unit.

[FIG. 4] FIG. 4 is a plan view showing the first pipe unit.

[FIG. 5] FIG. 5 is a perspective view showing a second pipe unit.

[FIG. 6] FIG. 6 is a plan view showing a coupling.

[FIG. 7] FIG. 7 is a plan view showing a band body of a suspending band.

[FIG. 8] FIG. 8 is a side view showing the band body of the suspending band.

[FIG. 9] FIG. 9 is a side view showing the suspending band in use.

[FIG. 10] FIG. 10 is a flow chart showing a procedure of installation of an air conditioner.

[FIG. 11] FIG. 11 is a flow chart showing a planning step of the air conditioner.

[FIG. 12] FIG. 12 is a plan view showing a design drawing of a building.

[FIG. 13] FIG. 13 is a plan view showing a piping drawing of the building.

DESCRIPTION OF EMBODIMENTS

[0028] Embodiments of the present invention will now be described in detail with reference to the drawings.

[0029] As shown in FIG. 1, an air conditioner (10) of the present embodiment is an air-conditioner for buildings installed in, for example, a building (1) which is a construction, and is a so-called multiple air conditioner in which each single outdoor unit (20) is connected to a plurality of indoor units (30).

[0030] The air conditioner (10) includes refrigerant systems (1A, 1B, 1C), each of which includes a single outdoor unit (20) and a plurality of indoor units (30) and is provided for an associated one of multiple different floors. For example, the air conditioner (10) includes three refrigerant systems. The air conditioner (10) includes, in each of the refrigerant systems (1A, 1B, 1C), a refrigerant circuit (40) which performs a vapor compression refrigeration cycle by circulating a refrigerant between the outdoor unit (20) and the indoor units (30).

[0031] The outdoor unit (20) is installed on the roof floor of the building (11), for example, and includes a casing that houses devices such as a compressor, an outdoor heat exchanger and an outdoor fan. On the other hand, each of the indoor units (30) is configured to be mounted on the ceiling of an associated one of multiple different rooms, and includes a casing that houses devices such as an indoor heat exchanger and an indoor fan.

[0032] The refrigerant circuit (40) connecting the outdoor unit (20) and the indoor units (30) is configured by connecting the compressor and other devices together with a refrigerant pipe (41). The refrigerant pipe (41) includes a liquid pipe through which a liquid refrigerant flows, and a gas pipe through which a gaseous refrigerant flows, and is composed of a plurality of parts (42). Examples of the parts (42) include straight pipes, elbows, branched pipes, and headers.

[0033] In particular, the refrigerant pipe (41) includes factory-assembled parts and site-assembled parts. Most of the refrigerant pipe (41) is comprised of the factory-assembled parts. The factory-assembled parts include a pipe unit (50), which is one of the parts (42), and the site-assembled parts include the outdoor unit (20), the indoor units (30), and couplings (43).

[0034] The pipe unit (50) is one of the parts (42), and includes, as shown in FIGS. 2-5, a pipe body (53) including a liquid pipe (51) and a gas pipe (52), and a heat insulator (54) covering the outside of the pipe body (53).

[0035] The first pipe unit (50) shown in FIGS. 2-4 is implemented as a branch pipe unit. Each of the liquid pipe (51) and the gas pipe (52) of the first pipe unit (50) includes a branch coupling (55) and extension pipes (56) connected to the branch coupling (55). The branch coupling (55) includes a bifurcated branch pipe (55a) and short pipes (55b) connected to the bifurcated branch pipe (55a).

[0036] One end of each of the short pipes (55b) is con-

nected to the branch pipe (55a) by brazing. The other end of each of the short pipes (55b) forms a large-diameter connector (55c), to which the extension pipe (56) is connected by brazing. The extension pipe (56) has its length and degree of bending determined by the planning step to be described later.

[0037] The heat insulator (54) is provided for each of the liquid pipe (51) and the gas pipe (52) to coat the liquid pipe (51) and the gas pipe (52) entirely outside.

[0038] The liquid pipe (51) and the gas pipe (52) coated with the heat insulator (54) are fixed together with a tape (57) or any other fixing member to form the pipe body (53). An end of the pipe unit (50) is marked with a number indicating a connection position determined in the planning step. The tape (57) may be implemented as a colored tape indicating the connection position.

[0039] The second pipe unit (50) shown in FIG. 5 is implemented as a bent unit. This pipe unit (50) also includes a pipe body (53) and a heat insulator (54) covering the outside of the pipe body (53). A colored tape (57) indicating the connection position is wound around each end of the heat insulator (54) of the pipe unit (50). The pipe unit (50) is marked with a number indicating the connection position.

[0040] Some coupling (43), which is one of the parts (42), may be implemented as a reducing pipe coupling connecting a large-diameter pipe and a small-diameter pipe together as shown in FIG. 6. The reducing pipe coupling (43) includes a fitting coupling (43a) and a reducing pipe (43b) which form integral parts of a single piece. The fitting coupling (43a) allows for connection without using fire, and has one end configured to be connectable to a large-diameter pipe, and the other end to which one end of the reducing pipe (43b) as a small-diameter pipe is connected. The other end of the reducing pipe (43b) includes a flared portion (43c) and provided with a nut (43d) as a fastening member. The flared portion (43c) of the reducing pipe is configured to be flare-connected to another refrigerant pipe (41).

[0041] As shown in FIGS. 7-9, the refrigerant pipe (41) is attached to an attachment position such as the ceiling of the building with a suspending band (60). The suspending band (60) includes a band body (61) which is a general-purpose band, a band coupling (62), and an elastic member (63).

[0042] The band body (61) is in the shape of a thin strip, and is provided with a plurality of attachment holes (64) which are arranged at regular intervals in the longitudinal direction of the band body. The band body (61) is configured to be bendable to hold the pipe unit (50), for example, and is suitably cut and set to have a predetermined length according to the diameter of the refrigerant pipe (41).

[0043] The band coupling (62) includes an interconnecting member (65) mounted on a suspending metal fitting attached to the attachment position such as the ceiling, and a fastening member (66) including a bolt and a nut for fastening both ends of the band body (61) to the

interconnecting member (65). Specifically, the fastening member (66) is configured to fasten both of the ends of the band body (61) that is wound around the refrigerant pipe (41).

[0044] The elastic member (63) has the shape of a cylinder, in which the band body (61) is inserted. With the band body (61) holding the refrigerant pipe (41), the elastic member (63) is located between the heat insulator and the band body (61) to protect the heat insulator (41 a) of the refrigerant pipe (41).

-Method for Installing the Air Conditioner (10)-

[0045] An installation procedure, which is a method for installing the air conditioner (10), will be described below. The installation method includes a method for conducting a gastight test.

[0046] First, the installation of the air conditioner (10) begins by receiving an architectural drawing after accepting an order of installation work as shown in FIG. 10. For example, the installation begins by receiving a design drawing of the building (11).

[0047] The installation of the air conditioner (10) includes a planning step (M1), a part fabrication step (M2), and an installation step (M3). The planning step (M1) includes a design drawing receiving step (M11), a piping drawing preparation step (M13), and a determination step (M14) as shown in FIG. 11.

[0048] In the planning step (M1), a piping drawing is prepared based on the design drawing of the building (11) in which the air conditioner (10) will be installed, and factory-assembled parts and site-assembled parts of the refrigerant circuit (40) are determined.

[0049] As shown in FIG. 11, in performing the planning step (M1), the flow starts with the design drawing receiving step (M11) in which the design drawing is received, and then may proceed to the piping drawing preparation step (M13) after an on-site survey step (M12). Alternatively, the piping drawing preparation step (M13) may be performed while obtaining information about the site concurrently.

[0050] Specifically, in the case of renewal work, the building (11) already exists. Thus, survey of the building (11) is carried out to check the actual structure of the building (11) such as a beam structure. When the site survey step (M12) is finished, the flow will proceed to the piping drawing preparation step (M13) to prepare the piping drawing based on the actual structure of the building (11).

[0051] In constructing a new building, on the other hand, the survey of the building (11) is impossible. Thus, when the design drawing is received, the piping drawing preparation step (M13) is performed while obtaining information about the site as the construction progresses to prepare the piping diagram with the progress of the construction of the building (11).

[0052] Specifically, the design drawing may be a plan view of each floor of the building (11) which shows lines

indicating the piping of the air conditioner as shown in FIG. 12, for example. The design drawing shows unit marks (UI) indicating the indoor units (30) and line marks (L1) indicating the refrigerant pipes.

[0053] On the other hand, as shown in FIG. 13, the piping drawing is a detailed drawing showing a piping system in which combined are part marks (P1-P8) corresponding to the parts (42) determined as the factory-assembled parts based on the design drawing and the results of the on-site survey and other data. Specifically, first to fifth part marks (P1-P5) indicate the parts (42) obtained by bending or curving the straight pipes, with their dimensions such as lengths (not shown). Sixth and seventh part marks (P6, P7) indicate the parts (42) obtained by connecting the extension pipes (56) to the branch coupling (55), with their dimensions such as lengths (not shown). The sixth part mark (P6) indicates, for example, the pipe unit (50) shown in FIGS. 2-4. The eighth part mark (P8) indicates the part (42) serving as a riser pipe, with its dimension such as a length (not shown).

[0054] Subsequent to the piping drawing preparation step (M13), the flow proceeds to the determination step (M14) to distinguish the plurality of parts (42) by color-coding, for example. Specifically, the refrigerant pipe (41) of the refrigerant circuit (40) is comprised of the parts (42) such as the straight pipes and the pipe units (50). Thus, those parts (42) are given distinguishing identifications in accordance with their positions to which they are attached.

[0055] For example, as shown in FIGS. 4 and 5, the pipe unit (50) is provided with the distinguishing identifications such as the tapes (57) which are colored in, e.g., red, and wound around both ends of the pipe unit. Thus, an instruction indicating installation positions of the color-coded parts (42) is prepared in the determination step (M14). Specifically, the installation positions of the parts (42) are provided in a written form such that workers in charge of the installation can understand the installation positions of the parts (42). For example, the instruction specifies the colors and numbers given to both ends of the pipe unit (50) as shown in FIGS. 4 and 5.

[0056] Subsequent to the planning step (M1), the flow proceeds to the part fabrication step (M2) to fabricate, in the factory, the plurality of parts (42) of the refrigerant circuit (40) corresponding to the factory-assembled parts.

[0057] Specifically, the part fabrication step (M2) includes a fabrication step (M21), a gastight test step (M22), and a heat retention step (M23). In the fabrication step (M21), the parts (42) are fabricated, and the distinguishing identifications indicating their installation positions are given to the parts by color coding and numbering, for example, based on the piping drawing. Specifically, the pipe unit (50), which is one of the parts (42), is fabricated. For example, in the pipe unit (50) as the branch pipe unit, the short pipe (55b) and the coupling (56) are connected together by brazing to fabricate the

liquid pipe (51) and the gas pipe (52). That is, the pipe unit (50) is fabricated in the factory, and the brazing process using fire is performed there.

[0058] Subsequent to the fabrication step (M21), the gastight test step (M22) is performed. For example, when the pipe body (53) is fabricated, a gastight test is performed by blowing a nitrogen gas before covering the pipe body (53) with the heat insulator (54).

[0059] If the gastight test step reveals that the parts (42) are gastight, the flow proceeds to the heat retention step (M23) to provide each of the parts (42) with the heat insulator (54). For example, in the fabrication of the pipe unit (50), the liquid pipe (51) and the gas pipe (52) are each covered with the heat insulator (54), and then the liquid and gas pipes (51, 52) covered with the heat insulator (54) are fixed together to finish the fabrication of the pipe unit (50). A fitting coupling (43) is attached to one end of the pipe unit (50).

[0060] The liquid pipe (51) and the gas pipe (52) of the pipe unit (50) are fixed together with the colored tape (57) indicating the installation position, and the pipe unit (50) is numbered.

[0061] The lengths of those parts (42) that are the factory-assembled parts are set to be shorter than 4 m. Specifically, even the straight pipe parts (42) have their length set to be shorter than 4 m. In most cases, a general elevator has an opening (a width) of 2150 mm, a depth of 1600 mm, a height of 2300 mm, and a diagonal length of 3467 mm. Thus, the length of each of those parts (42) is set to be shorter than 4 m such that the workers can take the elevator to carry the parts. Conversely, if the length of any of those parts (42) were 4 m or more, the workers would have to go up the stairs to carry that part (42).

[0062] Subsequent to the part fabrication step (M2), the flow proceeds to the installation step (M3) to install the plurality of parts (42) fabricated in the part fabrication step (M2) and the plurality of devices of the refrigerant circuit (40) corresponding to the site-assembled parts determined in the planning step (M1) (namely, the pipe unit (50), the outdoor unit (20), and the indoor unit (30)) in the building (11).

[0063] Specifically, the installation step begins with an indoor device installation step (M31). The indoor units (30) as the indoor devices are suspended such that the indoor units (30) are installed on the ceiling of those rooms. Then, the flow proceeds from the indoor device installation step (M31) to a piping step (M32) to attach vertical pipes as the straight pipes, for example.

[0064] In this piping step (M32), the pipe unit (50) and the straight pipes fabricated in the factory are connected together. In this step, the pipe unit (50) and every one of the straight pipes are connected together via the fitting couplings (43), i.e., a brazing process or any other work using fire is not performed. The refrigerant pipe (41) is mounted onto the ceiling with the suspending band (60).

[0065] When the piping step (M32) is finished, the flow proceeds to an outdoor device installation step (M33) to

install the outdoor unit (20) as the outdoor device. Then, the flow proceeds from the outdoor device installation step (M33) to a piping step (M34) to arrange pipes around the outdoor device. Also in this step, the fitting couplings (43) are used to connect every pair of pipes, i.e., a brazing process or any other work using fire is not performed.

[0066] When the piping step (M34) is finished, the flow proceeds to the gastight test step (M35) to perform a gastight test on the refrigerant circuit (40) by blowing a nitrogen gas. Specifically, the gastight test is performed to check whether there is any gas leakage from the couplings (43) or not. This gastight test is performed on the refrigerant systems (1A, 1 B, 1C) by dividing each of these systems into a plurality of sections.

[0067] If the result of this gastight test reveals that the refrigerant circuit (40) is gastight, the flow proceeds to the heat retention step (M36) to apply the heat insulators (not shown) to the straight pipes and other members. Thus, the installation of the pipes is completed.

-Advantages of Embodiment-

[0068] As can be seen from the foregoing description, according to the present embodiment, the factory-assembled parts and site-assembled parts of the refrigerant circuit (40) are determined in the planning step (M1), and the parts (42) of the refrigerant circuit (40) are fabricated in the factory. This reduces the number of days required for the installation significantly. Specifically, the connecting work which has been carried out on site is replaced with the work in the factory. This allows workers to get their work in a confined roof space and other time-consuming jobs done much more easily, thereby reducing the number of days required for the installation significantly.

[0069] Further, most parts of the refrigerant circuit (40) can be fabricated in the factory. Thus, on-site work using fire can be reduced, which will cut down the number of fire accidents to happen on site. In addition, the heat insulation work can also be performed in the factory. This increases the accuracy of the heat insulation work significantly, and prevents moisture condensation.

[0070] The piping drawing of the refrigerant circuit (40) is prepared based on the design drawing. This increases the accuracy of the factory-assembled parts, and makes it possible to perform most of the piping work in the factory. This ensures that the number of days required for the installation is significantly reduced even more reliably.

[0071] In particular, the piping drawing is prepared based on the on-site survey. This increases the accuracy of the factory-assembled parts, and ensures that the number of days required for the installation is significantly reduced even more reliably.

[0072] The piping drawing gives the parts (42) distinguishing identifications. This clarifies the installation positions of the parts (42), simplifies the on-site installation, and ensures that the number of days required for the

installation is significantly reduced even more reliably.

[0073] Further, the instruction indicating the installation positions of the parts (42) given the distinguishing identifications is prepared. This allows for preventing incorrect connection of the parts and other errors, thereby increasing the accuracy of the on-site installation.

[0074] The brazing process for connecting the parts (42) is performed only in the factory, and the on-site pipe connection process is performed using only the fitting couplings (43). Thus, work using fire is restricted to the factory, and no work using fire is performed on site any longer. This eliminates the occurrence of fire accidents on site. In addition, the brazing process performed in the factory reduces the number of positions where the fitting couplings (43) are used. This reduces the number of expensive couplings (43) to use, which allows for cutting down the installation cost.

[0075] The pipe unit (50) fabricated in the factory is covered with the heat insulator (54) in the factory. This reduces significantly the need for covering the parts with the heat insulators (54) on site. As a result, the accuracy of the heat insulation process increases significantly, thereby preventing the moisture condensation with reliability. In particular, the moisture condensation may occur after a year or more has passed since the installation was finished. The pipe unit (50) is very effective at preventing such moisture condensation.

[0076] The pipe unit (50) fabricated in the factory has already turned out to be gastight by being subjected to a gastight test in the factory. This simplifies the gastight test to be performed on site. Specifically, even if any leakage is found by the on-site gastight test, the leakage point can be spotted easily, because there is no leakage point in the pipe unit (50).

[0077] Further, use of the general-purpose band as the band body (61) of the suspending band (60) makes the on-site installation very simple.

[0078] Further, with the plurality of (64) attachment holes cut through the band body (61), the refrigerant pipes (41) with multiple different diameters are held by the single band body (61).

[0079] The band coupling (62) mounted to the building (11) allows for both of the fastening of the band body (61) and the mounting of the band body (61) to the building (11) using a single member.

<Other Embodiments>

[0080] The above-described embodiment of the present invention may be modified in the following manner.

[0081] The three refrigerant systems (1A, 1B, 1C) of the air conditioner (10) may be replaced with only a single refrigerant system.

[0082] The embodiments described above are merely illustrative ones in nature, and do not intend to limit the scope of the present invention or applications or uses thereof.

INDUSTRIAL APPLICABILITY

[0083] As can be seen from the foregoing description, the present invention is useful as air conditioners to be installed in buildings and other constructions.

DESCRIPTION OF REFERENCE CHARACTERS

[0084]

10	Air conditioner
11	Building (construction)
20	Indoor unit
30	Outdoor unit
40	Refrigerant circuit
41	Refrigerant pipe
42	Part
50	Pipe unit
60	Suspending band
M1	Planning step
M2	Part fabrication step
M3	Installation step
M11	Temporary drawing preparation step
M12	On-site survey step
M13	Final drawing preparation step
M 14	Determination step
M22	Airtight test step
M35	Airtight test step

Claims

1. A method for installing an air conditioner comprising an outdoor unit (20), an indoor unit (30) connected to the outdoor unit (20) through a refrigerant pipe (41), and a refrigerant circuit (40) in which a refrigerant circulates between the outdoor unit (20) and the indoor unit (30), the method comprising:

a planning step (M1) of determining factory-assembled parts and site-assembled parts of the refrigerant circuit (40) based on a construction drawing of a construction (11) in which the air conditioner (10) is going to be installed;

a part fabrication step (M2) of fabricating, in a factory, a plurality of parts (42) of the refrigerant circuit (40) corresponding to the factory-assembled parts determined in the planning step (M1); and

an installation step (M3) of installing and connecting, in the construction, the plurality of parts (42) fabricated in the part fabrication step (M2) and a plurality of devices of the refrigerant circuit (40) corresponding to the site-assembled parts determined in the planning step (M1).

2. The method of claim 1, wherein the planning step (M1) includes a piping drawing

preparation step (M13) of preparing, based on the construction drawing indicating a piping system of the refrigerant circuit (40), a piping drawing showing the piping system in detail.

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3. The method of claim 2, wherein the piping drawing is prepared in the piping drawing preparation step (M13) based on an on-site survey of the construction (11).

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4. The method of claim 2 or 3, wherein the planning step (M1) includes, subsequent to the piping drawing preparation step (M13), a determination step (M14) of giving distinguishing identifications to connection positions of the plurality of parts (42), and preparing an instruction indicating installation positions of the parts (42) based on the distinguishing identification.

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5. The method of claim 4, wherein in the part fabrication step (M2), the parts (42) are given the distinguishing identifications corresponding to the connection positions of the parts (42) determined in the determination step (M14).

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6. The method of any one of claims 1-5, wherein the installation step (M3) is performed using only a coupling (43) to connect pipes.

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FIG.1

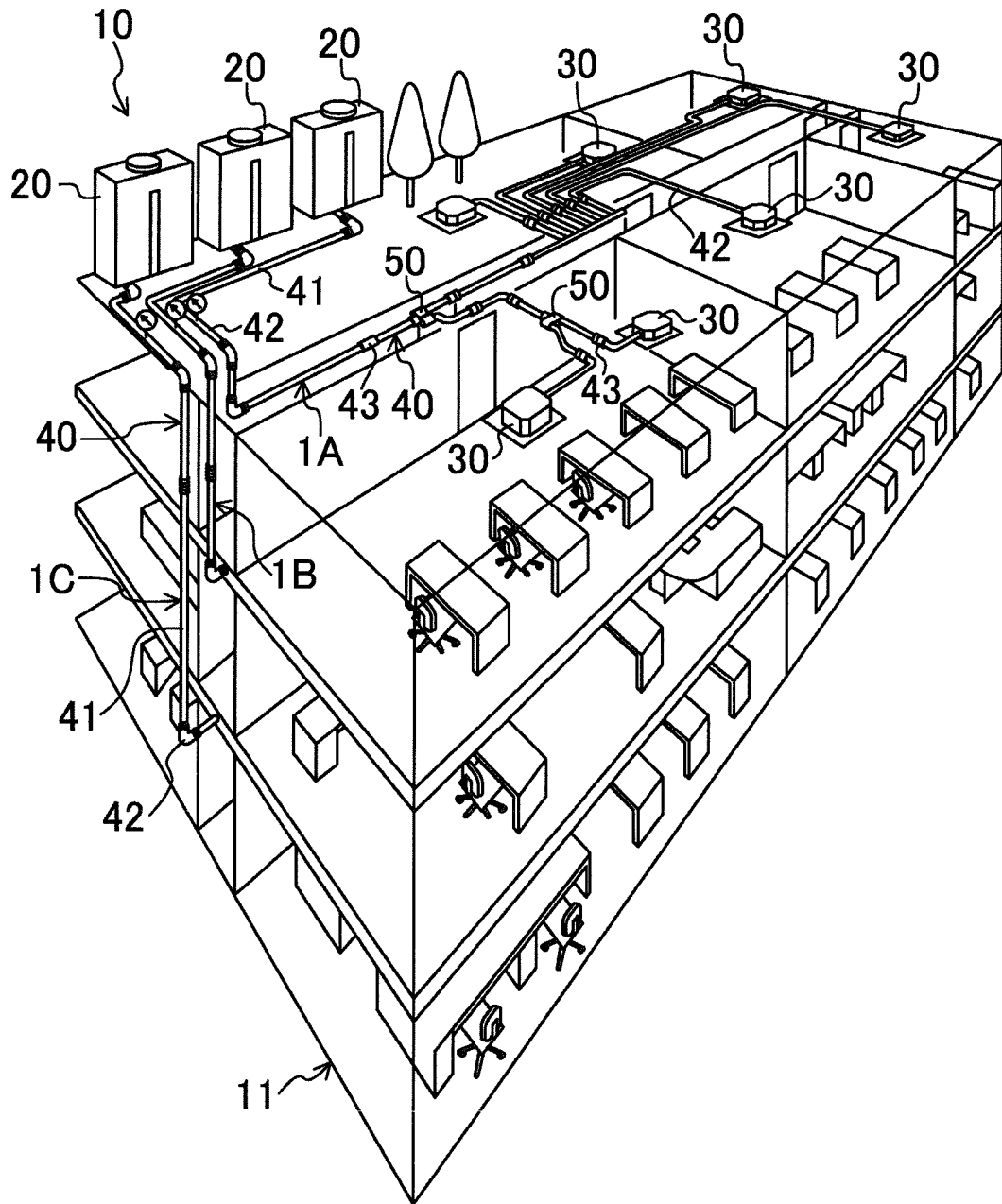


FIG.2

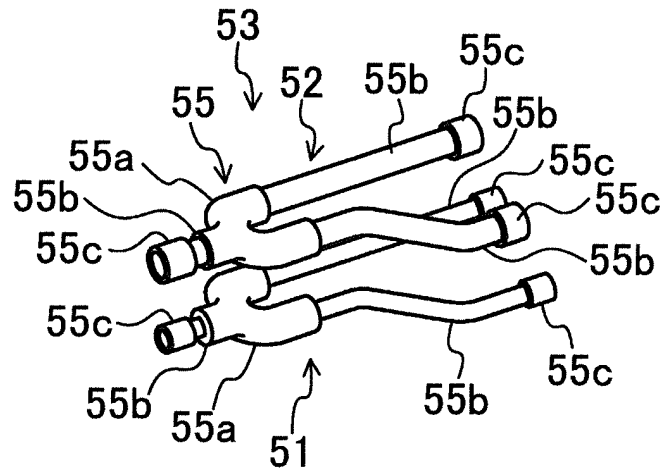


FIG.3

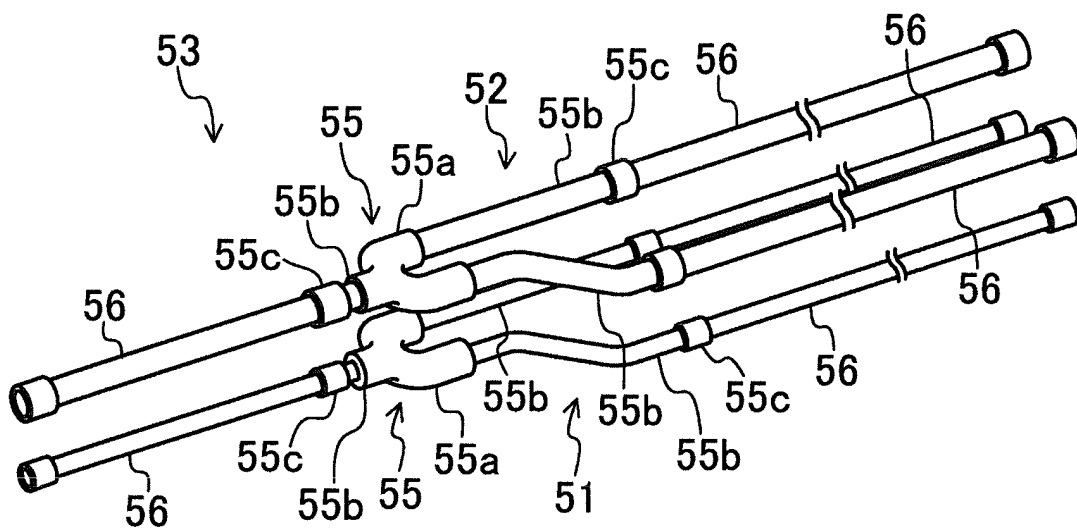


FIG.4

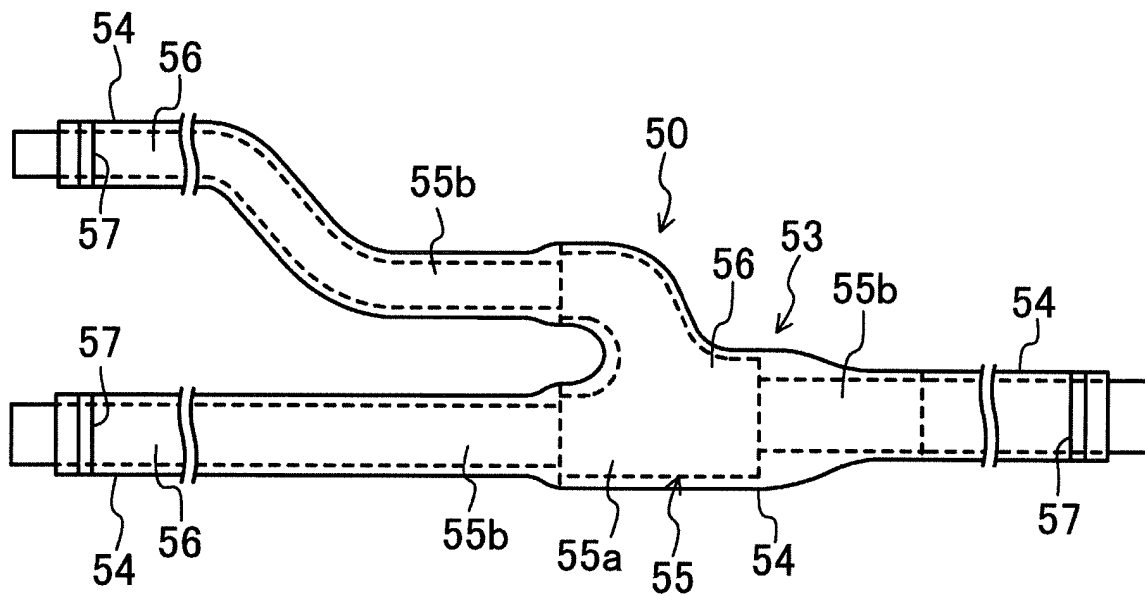


FIG.5

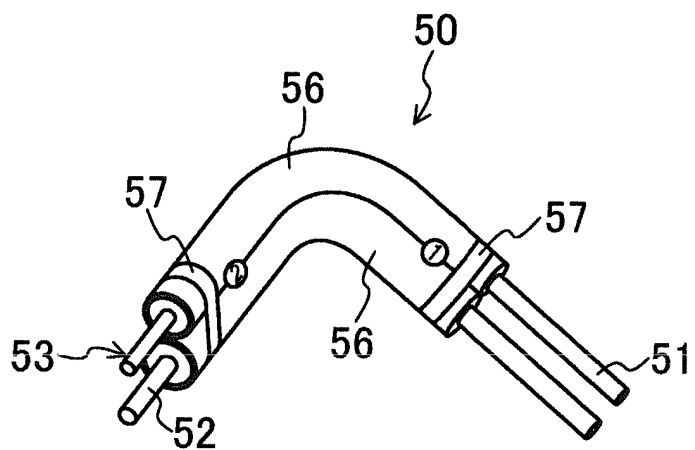


FIG.6

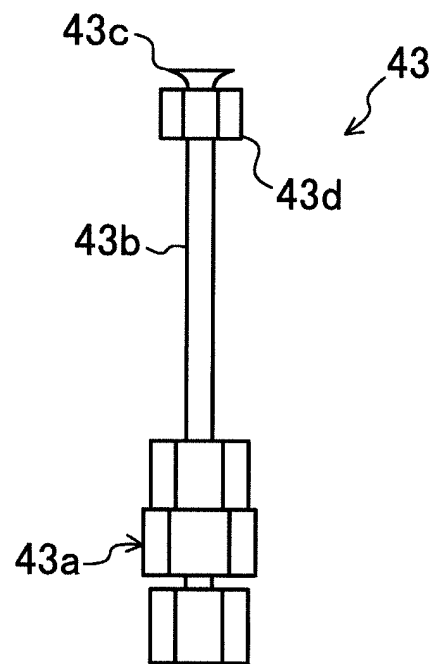


FIG.7

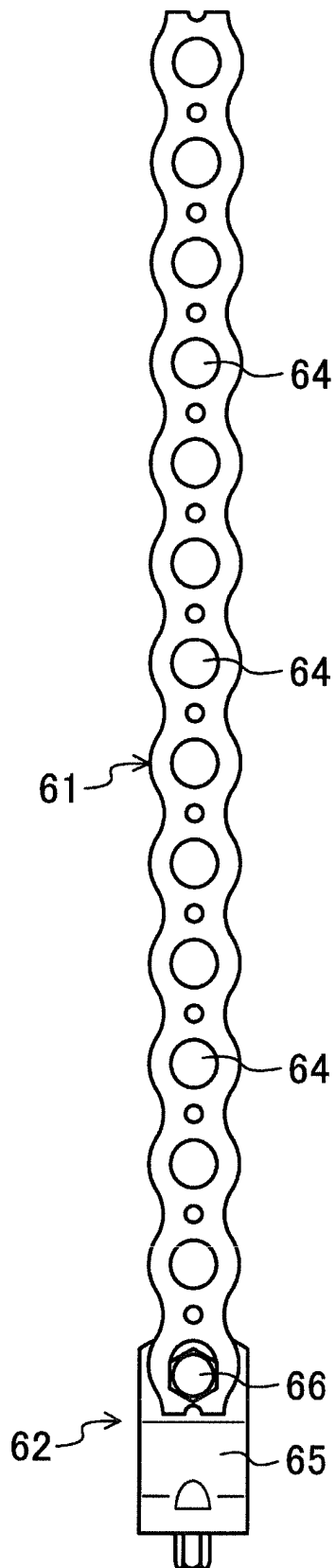


FIG.8

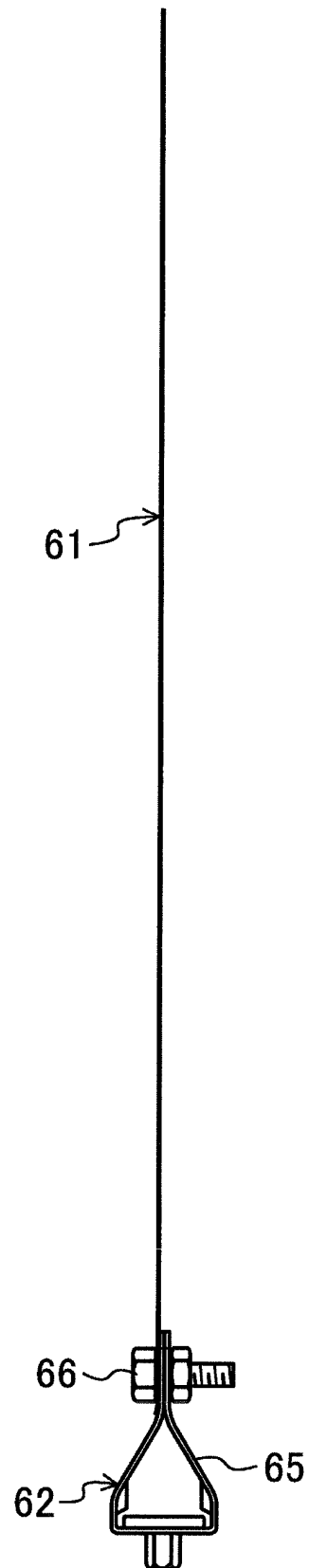


FIG.9

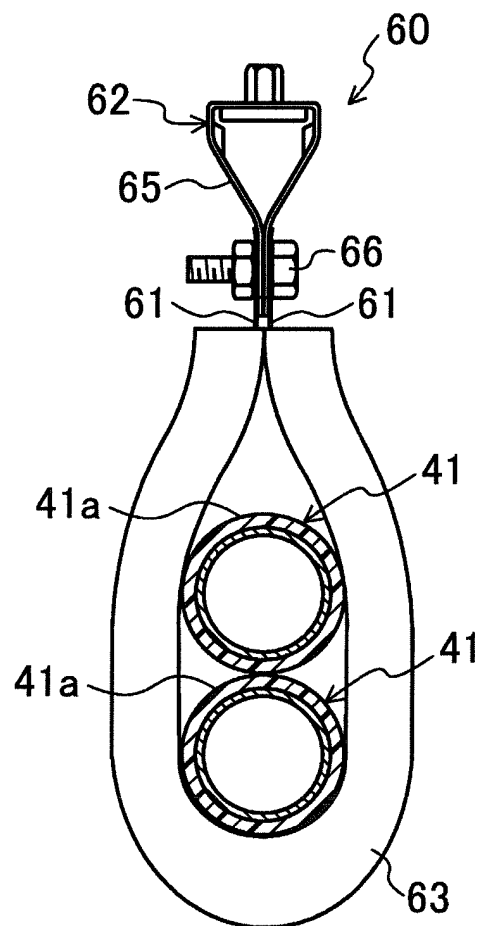


FIG.10

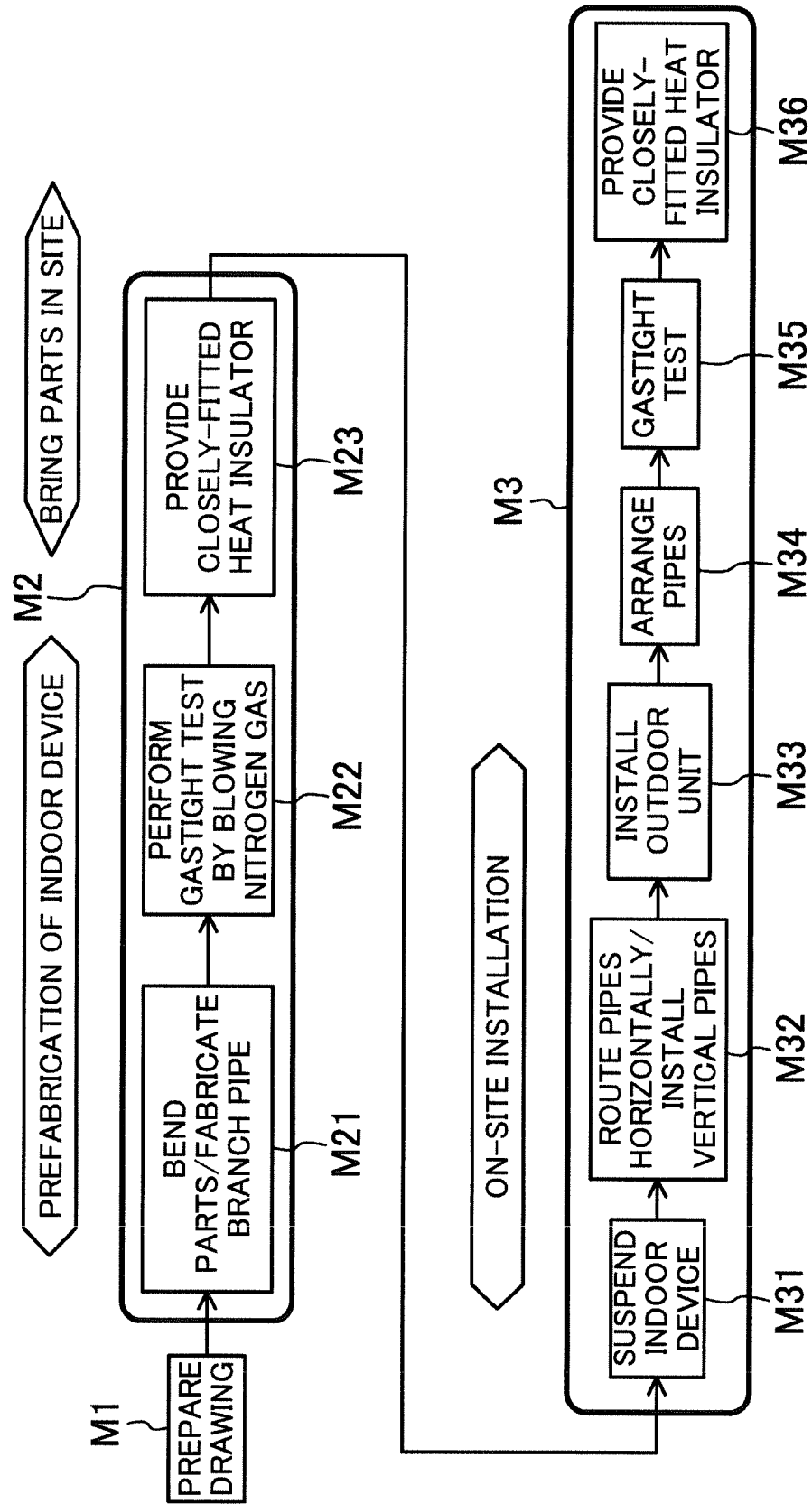


FIG.11

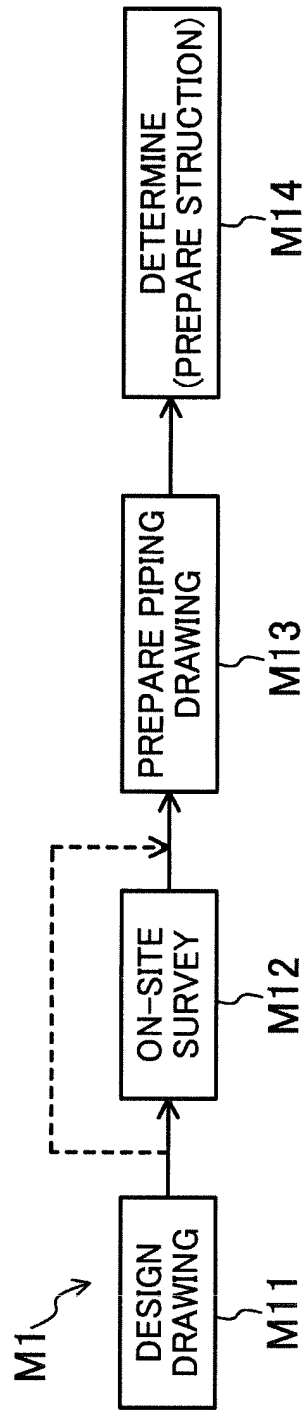


FIG.12

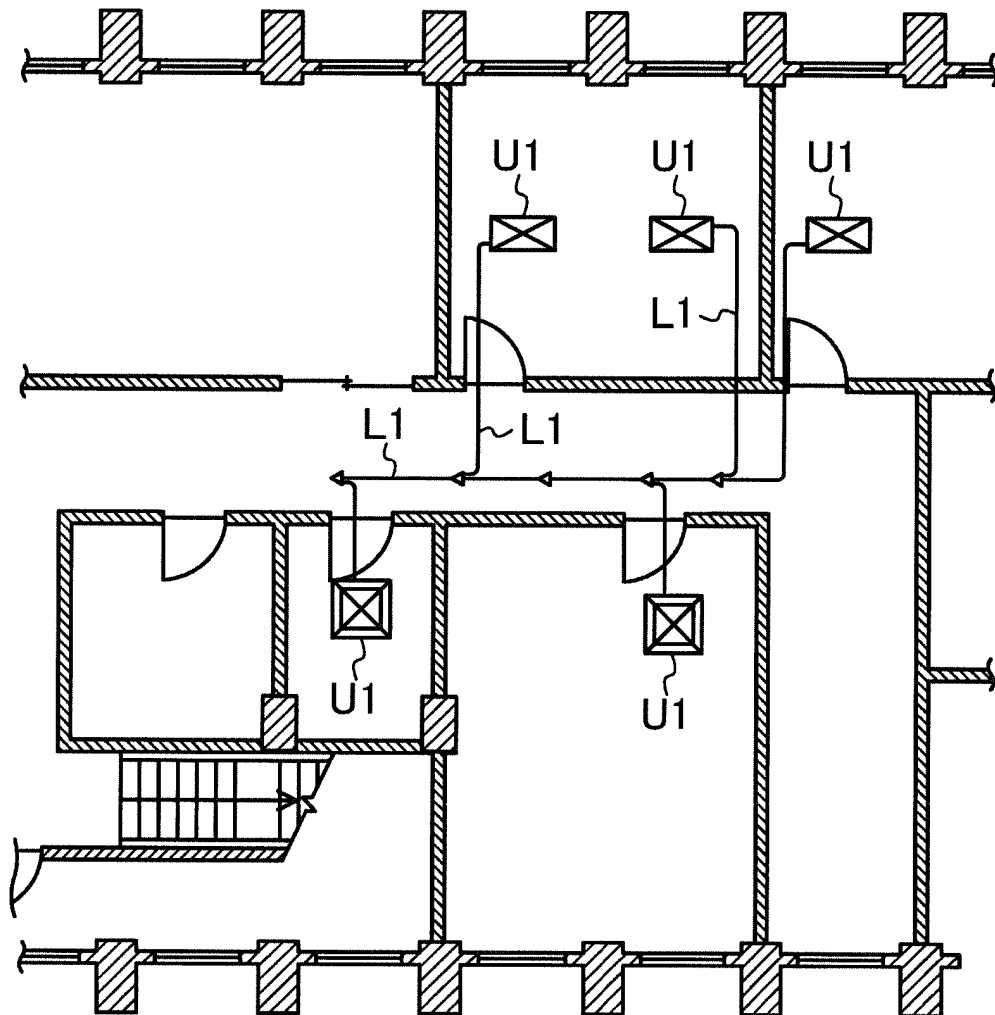
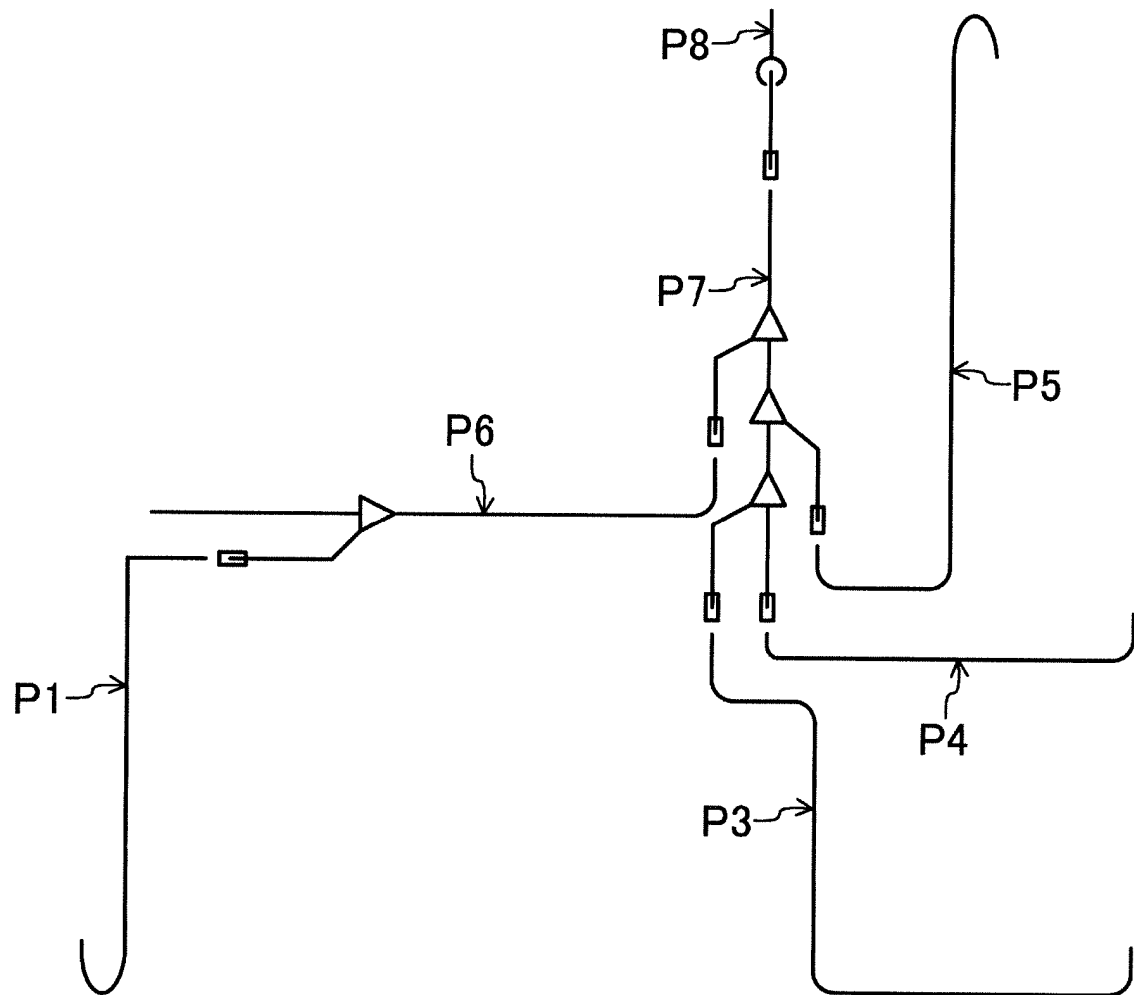


FIG.13



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2013/007168

A. CLASSIFICATION OF SUBJECT MATTER

F24F1/32(2011.01)i, F25B41/00(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F24F1/32, F25B41/00, F17D1/00-1/20, G06F17/50

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2014

Kokai Jitsuyo Shinan Koho 1971-2014 Toroku Jitsuyo Shinan Koho 1994-2014

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 7-280376 A (Daikin Industries, Ltd.), 27 October 1995 (27.10.1995), entire text; all drawings (Family: none)	1-6
Y	JP 11-237000 A (Chiyoda Corp.), 31 August 1999 (31.08.1999), entire text; all drawings (Family: none)	1-6
Y	JP 8-235235 A (Daikin Industries, Ltd.), 13 September 1996 (13.09.1996), entire text; all drawings (Family: none)	1-6

☒ Further documents are listed in the continuation of Box C.☐ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search
20 February, 2014 (20.02.14)Date of mailing of the international search report
04 March, 2014 (04.03.14)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2013/007168

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 8-94128 A (Daikin Industries, Ltd.), 12 April 1996 (12.04.1996), paragraphs [0058] to [0089], [0101] to [0111]; fig. 1, 16 & US 6230747 B1 & EP 730125 A1 & WO 1996/009498 A1 & AU 3533895 A & AU 685004 B2 & CN 1135791 A	6
A	JP 2001-235062 A (Hitachi Metals, Ltd.), 31 August 2001 (31.08.2001), entire text; all drawings (Family: none)	1-6
A	JP 2001-188809 A (Hitachi Metals, Ltd.), 10 July 2001 (10.07.2001), entire text; all drawings (Family: none)	1-6
A	JP 2002-7485 A (Hitachi, Ltd.), 11 January 2002 (11.01.2002), entire text; all drawings (Family: none)	1-6
A	JP 2005-337524 A (Daikin Industries, Ltd.), 08 December 2005 (08.12.2005), entire text; all drawings & US 2007/0113582 A1 & EP 1750072 A1 & WO 2005/114067 A1 & KR 10-0813762 B1 & CN 1910413 A & AU 2005246151 A1	1-6

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP H07280376 B [0003]