

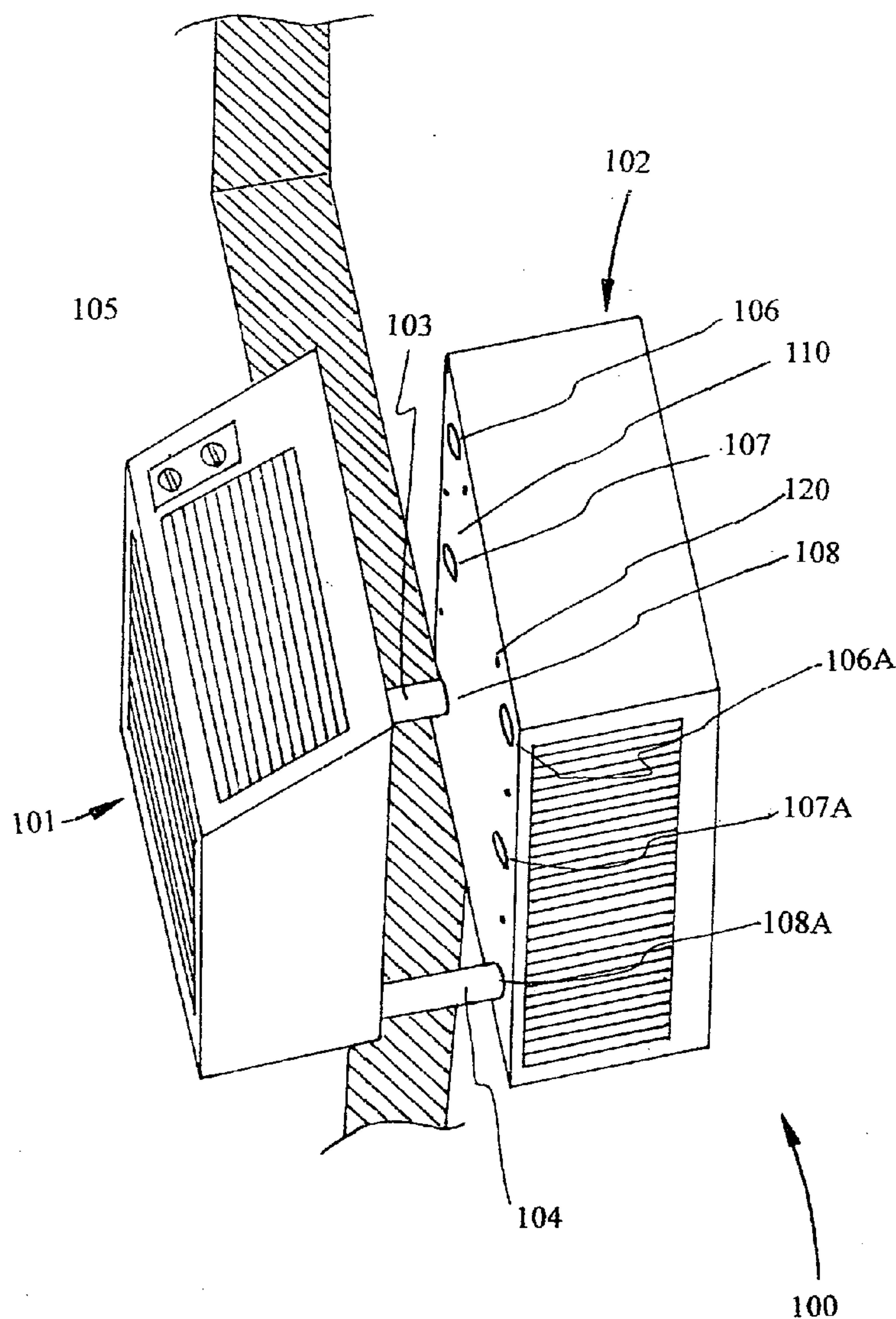
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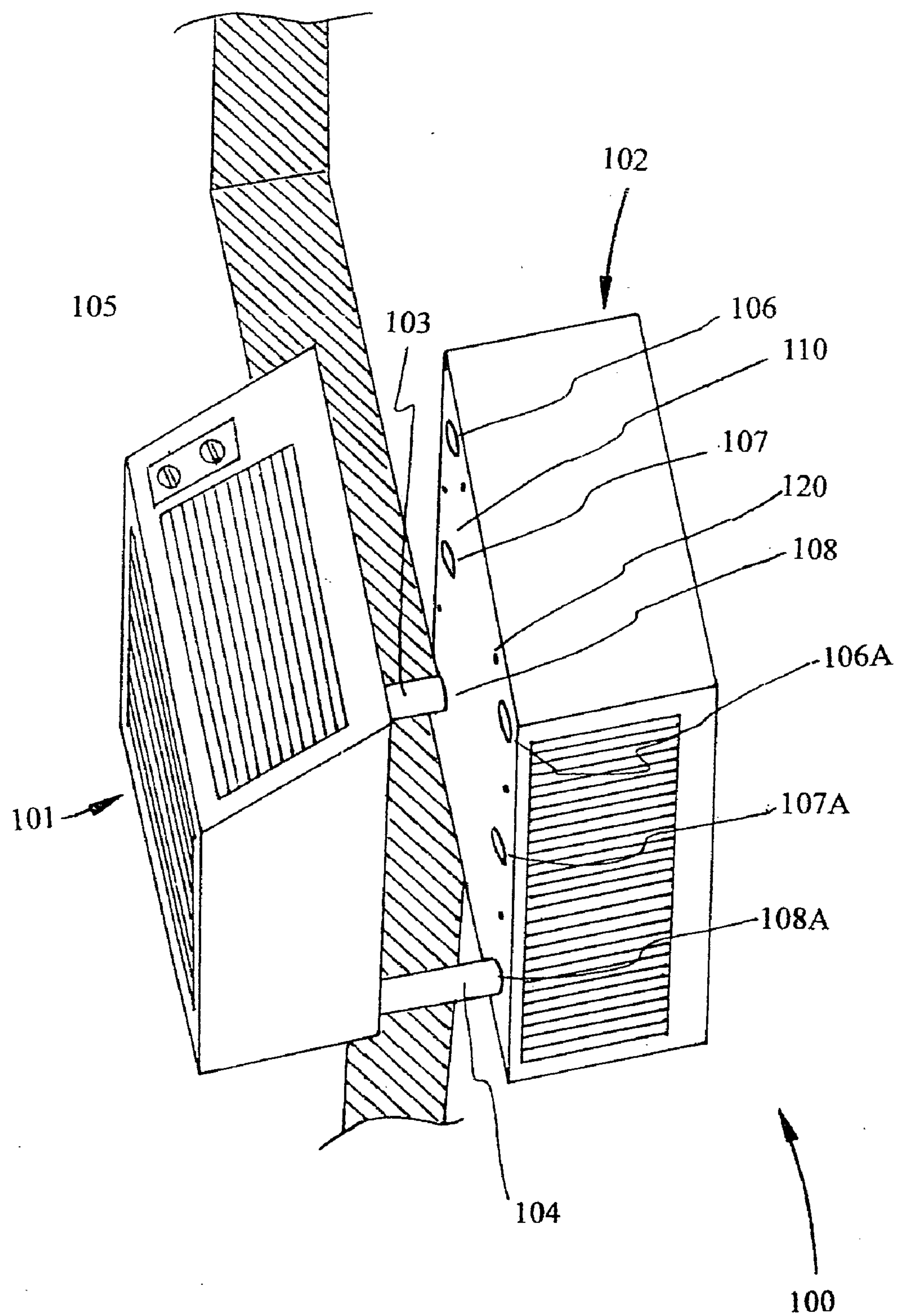
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Su et al.(10) **Pub. No.: US 2009/0107162 A1**(43) **Pub. Date: Apr. 30, 2009**(54) **WINDOW AIR CONDITIONER WITH EASY  
INSTALLATION METHOD****Publication Classification**(51) **Int. Cl.**  
*F25D 23/00* (2006.01)(52) **U.S. Cl.** ..... 62/263(57) **ABSTRACT**

An air conditioner includes an indoor unit, an outdoor unit, and a connection unit supportively coupled between the indoor and outdoor units at a position that an indoor housing is supported at an interior wall side of the wall while an outdoor housing is supported at an exterior wall side of the wall. The connection unit has a channel communicating between the indoor and outdoor housings that an indoor component of the indoor unit are operatively connected with an outdoor component of the outdoor unit through the channel, such that the connection unit not only forms a support to retain the indoor and outdoor units in position but also provides a communication to link the indoor component with the outdoor component.

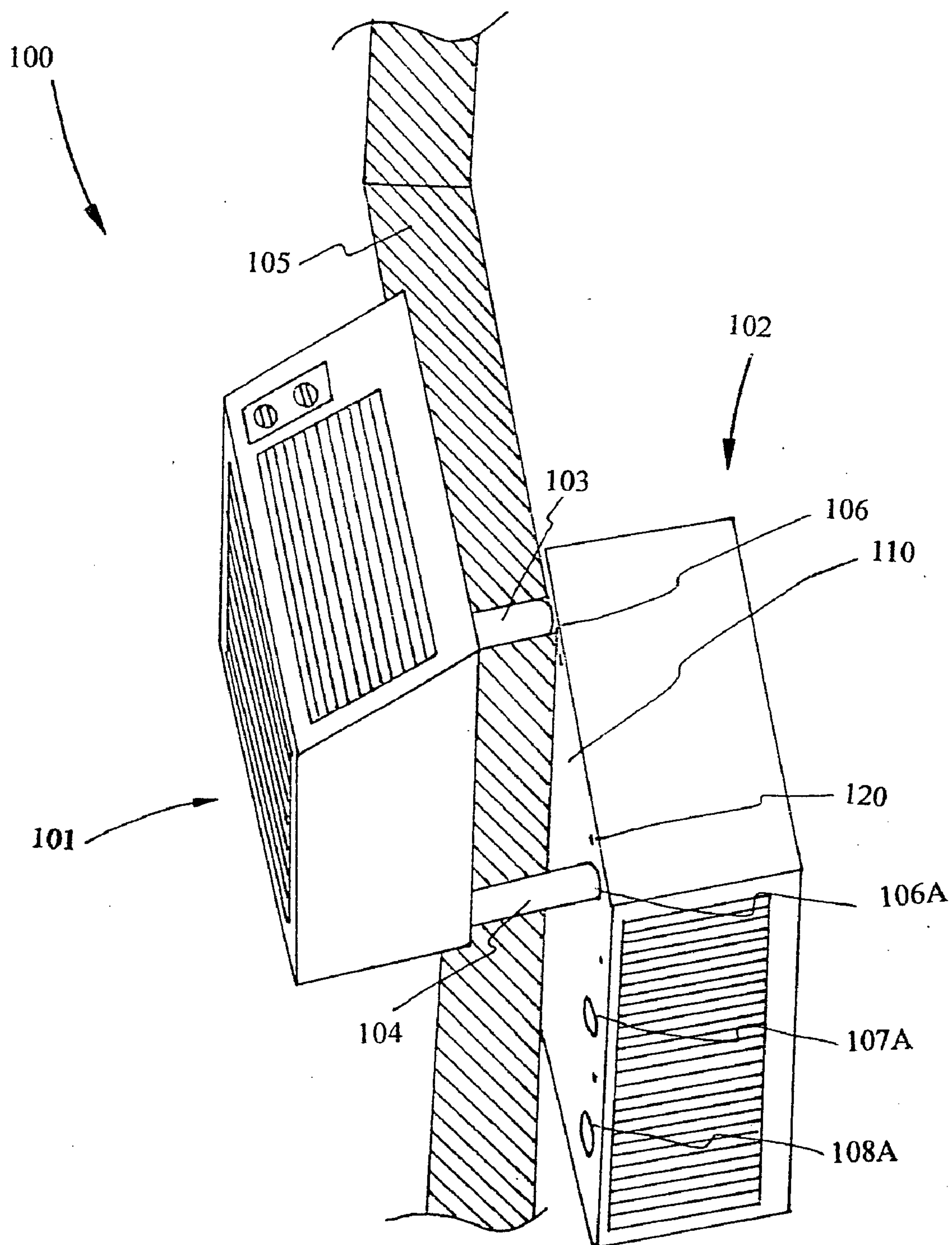
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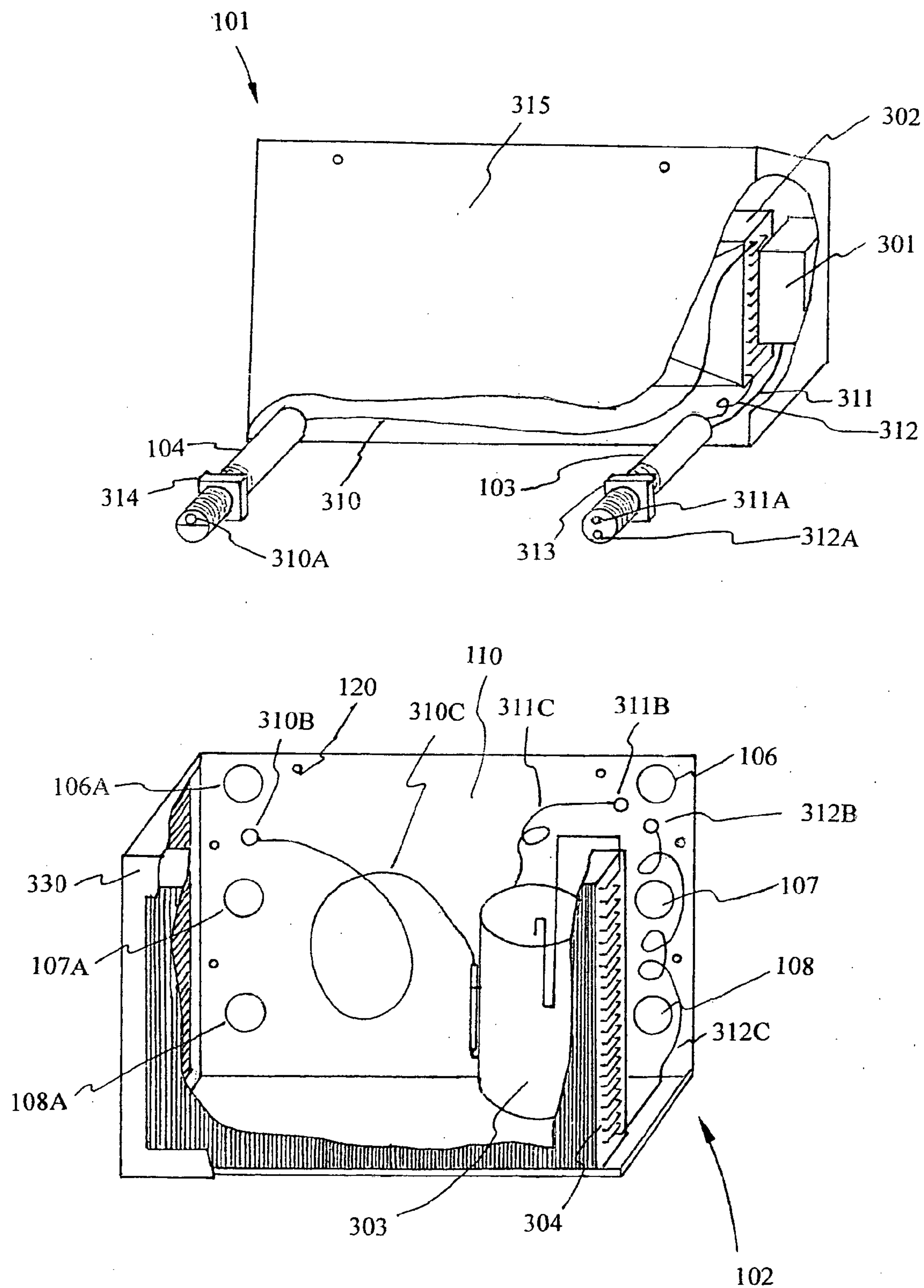


**Fig. 1**

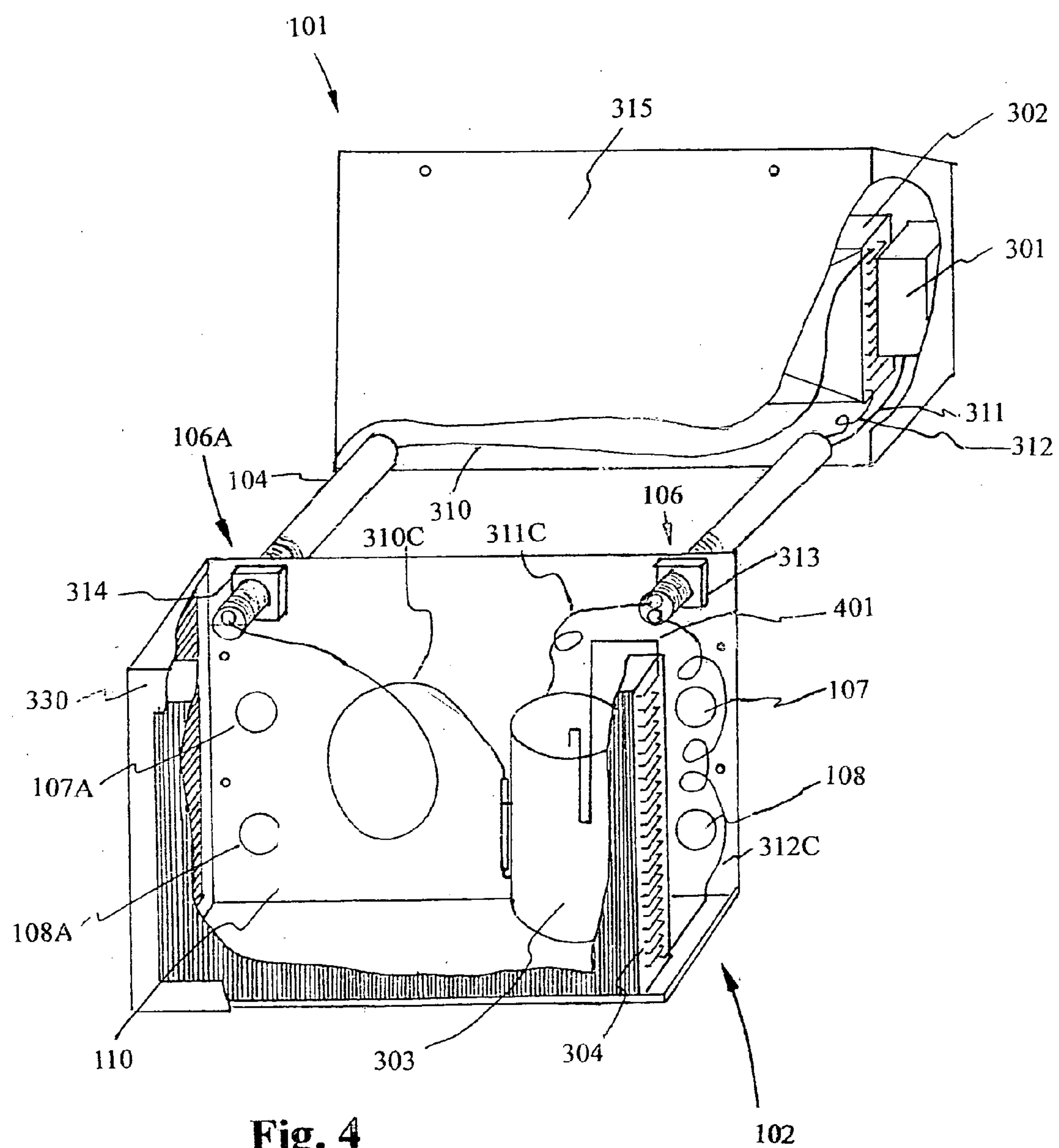


**Fig. 2**

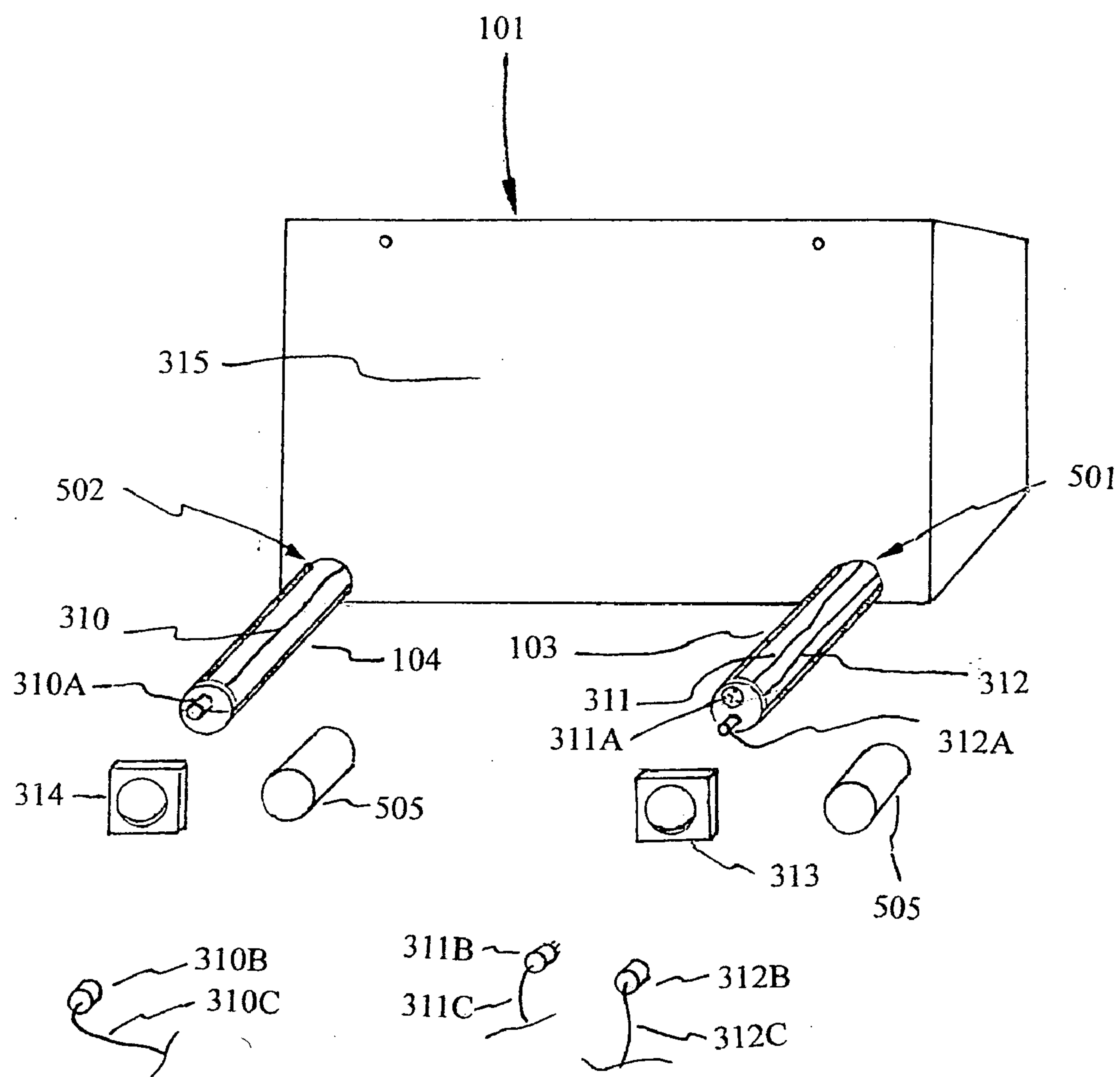




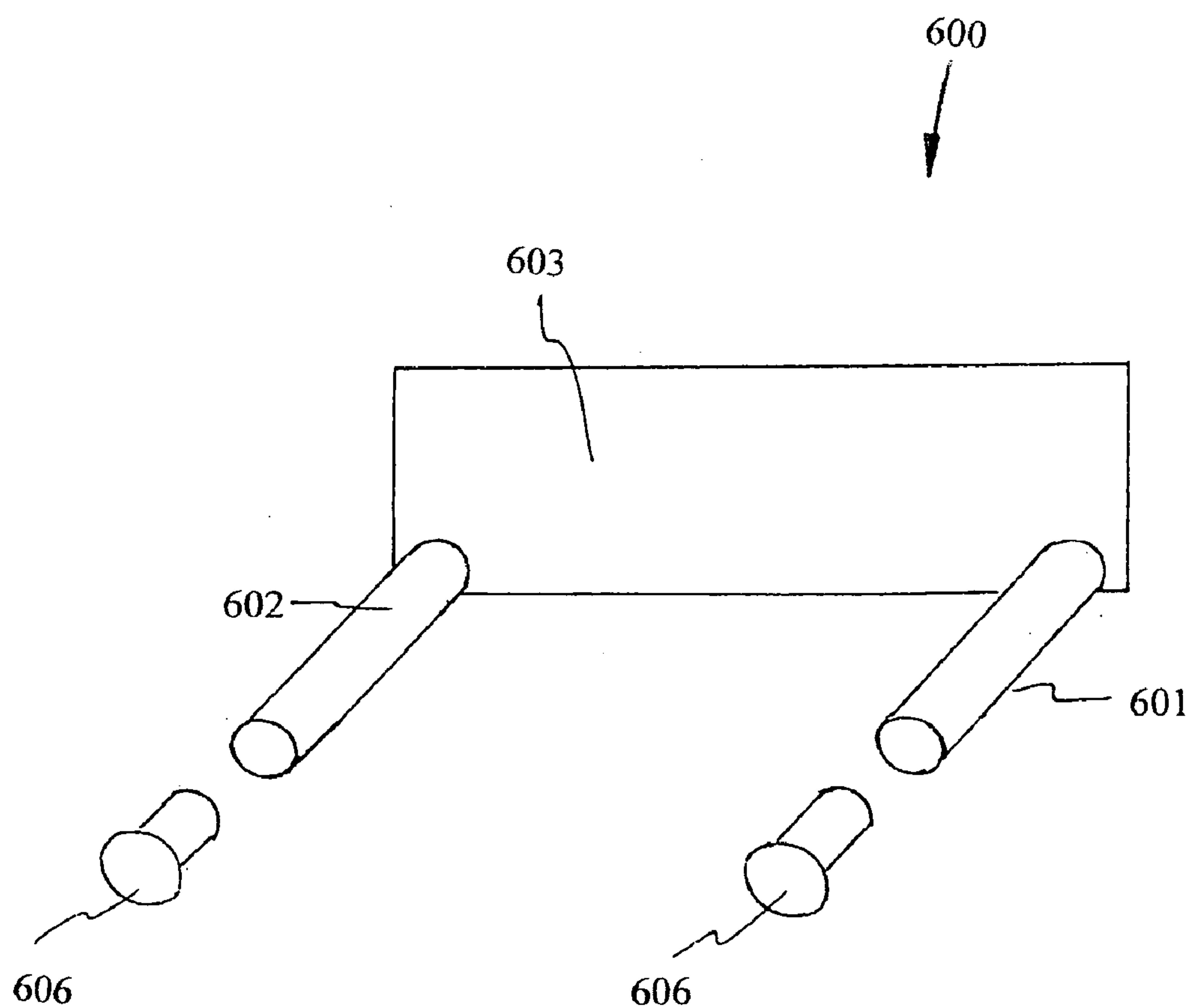
**Fig. 3**



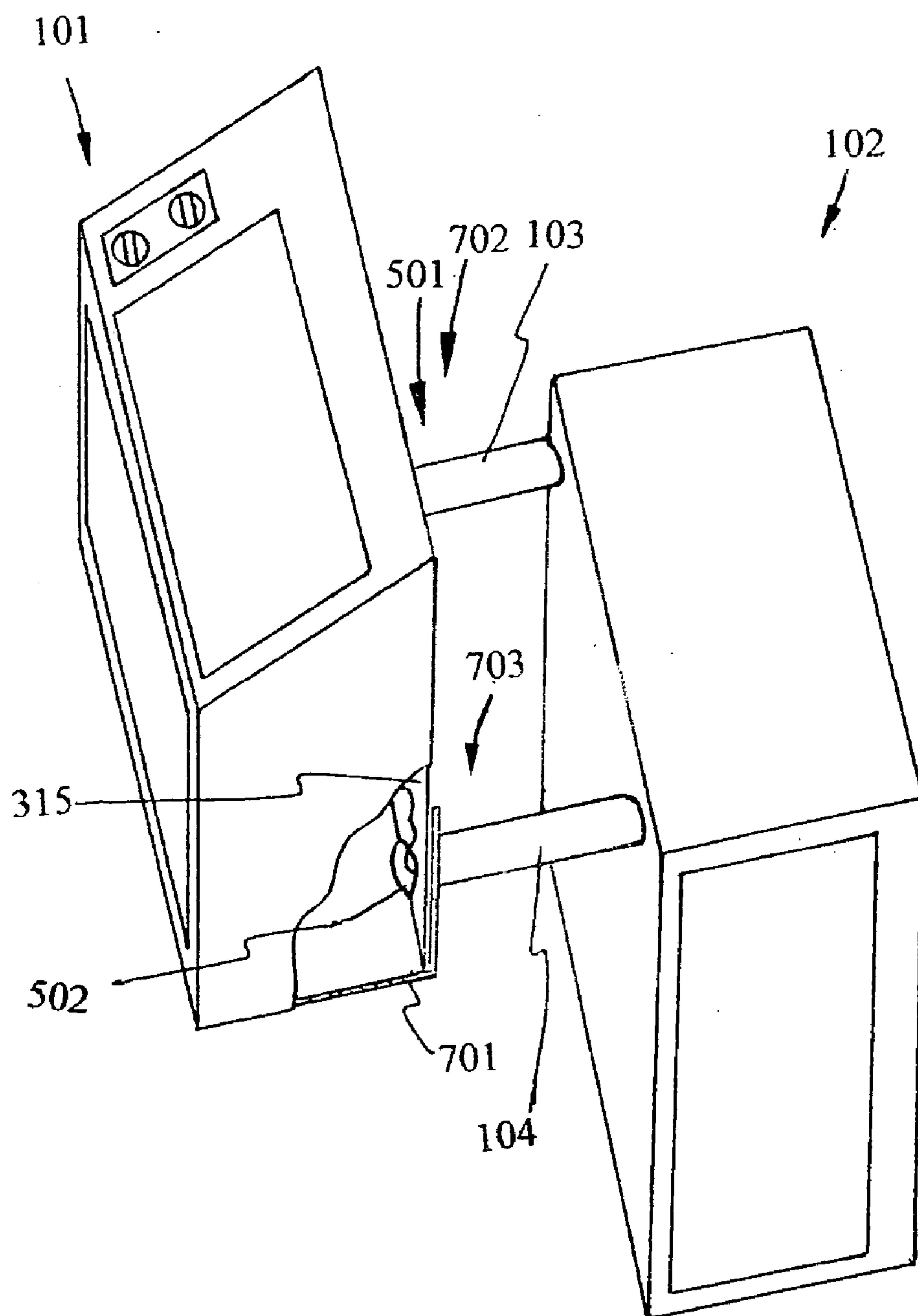
**Fig. 4**



**Fig. 5**



**Fig. 6**



**Fig. 7**



## WINDOW AIR CONDITIONER WITH EASY INSTALLATION METHOD

### CROSS REFERENCE OF RELATED APPLICATION

**[0001]** This is a non-provisional application of a provisional application having an application Ser. No. 61/001,398 and a filing date of Oct. 31, 2007.

### BACKGROUND OF THE PRESENT INVENTION

**[0002]** 1. Field of Invention

**[0003]** The present invention relates to an air conditioner, and more particularly to a window type of room air conditioner with unique features allowing for easy installation and better noise reduction.

**[0004]** 2. Description of Related Arts

**[0005]** Room air conditioners are typically classified into window type, split type and central system. The window type of air conditioner comprises an electricity panel, an evaporator module (a refrigerant coil and a cooling fan), a condenser module (a refrigerant coil and a cooling fan), and a compressor, which are encased in a housing as a package unit. The advantage of the window air conditioner is that it's easy to install it and thus allows purchasers to install the unit themselves if they choose to. The disadvantage is that much of the noise generated by the compressor and the condenser module of the air conditioner travels into the room. The split type air conditioner consists of an indoor unit and an outdoor unit. The indoor unit, which is installed inside the room, comprises an electricity panel and evaporator module. The outdoor unit, which is installed outside the room, comprises a condenser module and compressor. One advantage of the split type of air conditioner is the achievement in noise reduction by placing the noisy compressor and condenser module in a separate housing unit and placing the housing unit outdoor. As a result, the noise level is greatly reduced in the air conditioned room. The disadvantage of the split type air conditioner is that it's more expensive and costs more to install it than the window type air conditioner. In places where labor cost is high the popularity of the split type air conditioner is low. The high cost in installation results from the need to hire a professional technician for connecting the refrigerant lines and power lines from the separate housing units together. Another type of air conditioner, the central air conditioning system, is quiet inside the conditioned room. The disadvantages are that that it's expensive and the energy consumption is high.

**[0006]** The present invention addresses the noise issue associated with window air conditioners and the cost concerning the split type and central air conditioners by designing a new type room air conditioner. The new type air conditioner will be low price, easy to install and quiet in the conditioned room.

### SUMMARY OF THE PRESENT INVENTION

**[0007]** A main object of the present invention is to provide a room air conditioner, wherein the consumers will want to purchase for its great qualities and economic reasons.

**[0008]** The merits of the new invention include good noise insulation, easy installation, low purchasing and installation costs.

**[0009]** The present invention provides a room air conditioner with unique features allowing for easy installation and reduction of noise level in an air conditioned room. The

invention includes an indoor unit and an outdoor unit. The two units are connected to each other by the use of two connecting rods to form a complete air conditioner.

**[0010]** The indoor unit contains an electricity panel and an evaporator module (evaporator refrigerant coil and fan); the outdoor unit contains a compressor and a condenser module (condenser refrigerant coil and fan). The two connecting rods are fixed on the back panel of the indoor housing and are threaded through the wall to connect with the outdoor unit. The connecting rods have hollow inner parts that function as channels through which run the refrigerant lines, power lines and condensate from the indoor unit to the outdoor unit. The two connecting rods also serve as the weight supporter of the air conditioner to support the indoor unit at the first ends (the ends fixed on the indoor housing) of the connecting rods and to support the outdoor unit at the second ends (the ends facing the outdoor unit) of the connecting rods.

**[0011]** When installing the air conditioner, drill two small holes in the wall first. Thread the two connecting rods, which are fixed on the back of the indoor housing, through the two holes until their second ends protrude out of the exterior wall and the indoor unit is leaning closely against the wall. On the protruding ends of the connecting rod, hang the outdoor unit.

**[0012]** Both the indoor and the outdoor units are factory assembled and refrigerant charged. The refrigerant lines and power lines coming from the indoor unit are pre-threaded through the two connecting rods and are connected, at the second ends of the two connecting rods, to quick-connect fittings, power adaptor. The refrigerant lines and power lines coming from the outdoor unit are also connected to quick-connect fittings and power plug so as to connect to the corresponding lines coming from the indoor unit. Besides the easy installation feature, the present invention also reduces the noise level in the air conditioned room by the fact that the compressor and the condenser module are mounted in the outdoor housing, keeping the noise of the compressor and the condenser module outside of the air conditioned room.

**[0013]** The procedure of installing the new invention is as follows:

**[0014]** First, create two small holes in the wall in preparation for threading the two connecting rods, which are fixed on the indoor housing, through the wall.

**[0015]** Second, install a rod sleeves set (FIG. 6) in the wall. The rod sleeves set functions as a device for guiding the connecting rods through the hole.

**[0016]** Third, thread the two connecting rods, which are fixed on back of the indoor housing, from the air conditioned room through the rod sleeves and push the indoor housing towards the wall so that it leans against the wall closely.

**[0017]** Fourth, from the exterior side of the wall, hang the outdoor housing onto the connecting rods which protrude from the wall a few inches out.

**[0018]** Fifth, connect the corresponding refrigerant suction lines, capillary tubes and power lines from the outdoor and indoor units to form a complete air conditioner unit.

**[0019]** The above mentioned installation method is simple enough for purchasers of the invention to install the unit themselves or pay less for labor to hire a technician to do it.

**[0020]** These and other objectives, features, and advantages of the present invention will become apparent from the following detailed description, the accompanying drawings, and the appended claims.

### BRIEF DESCRIPTION OF THE DRAWINGS

**[0021]** FIG. 1 illustrates a room air conditioner according to the present invention, illustrating the indoor unit and the outdoor unit installed on the wall as a complete air conditioner.



[0022] FIG. 2 illustrates a room air conditioner according to the present invention, illustrating the indoor unit and the outdoor housing installed on the wall as a complete air conditioner, wherein the outdoor housing is hung on the two connecting rods by inserting the connecting rods into the hanging holes on the back of the outdoor housing.

[0023] FIG. 3 illustrates a perspective view of the invention with parts removed to reveal details of the air conditioner, illustrating an exploded view of the indoor unit and the outdoor before the two units are combined to form a complete air conditioner.

[0024] FIG. 4 illustrates a perspective view of the invention with parts removed to reveal details of the air conditioner unit, illustrating the indoor and outdoor units being combined to form a complete air conditioner with the second ends of the two connecting rods being inserted into the hanging holes on the back of the outdoor unit.

[0025] FIG. 5 illustrates the two connecting rods in the configuration.

[0026] FIG. 6 illustrates the rod sleeves set in the configuration.

[0027] FIG. 7 illustrates the two connecting rods fixed on the indoor housing in the configuration.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0028] Referring to FIGS. 1 to 4 of the drawings, a room air conditioner according to the present invention is illustrated. As shown in FIG. 1, the room air conditioner 100 comprises an indoor unit and an outdoor unit installed on the wall 105 to form a complete air conditioner. The following is a brief introduction of the present invention in production and installation.

[0029] The indoor unit comprises an indoor housing 101 and an indoor component housed in the indoor housing 101, wherein the indoor component comprises an electricity panel 301 and an evaporator module 302.

[0030] The outdoor unit comprises an outdoor housing 102 and an outdoor component housed in the outdoor housing 102, wherein the outdoor component comprises a compressor 303 and a condenser module 304.

[0031] Accordingly, the indoor housing 101 is mounted at an interior wall side of the wall 105 while the outdoor housing 102 is mounted at an exterior wall side of the wall 105 to connect with the indoor housing 101 through the wall 105. The air conditioner further comprises a connection unit, which is extended through the wall 105, supportively coupled between the indoor and outdoor units at a position that the indoor housing 101 is supported at the interior wall side of the wall 105 while the outdoor housing 102 is supported at the exterior wall side of the wall 105.

[0032] The connection unit has a channel communicating between the indoor and outdoor housings 101, 102 that the electricity panel 301 and the evaporator module 302 of the indoor unit are operatively connected with the compressor 303 and the condenser module 304 of the outdoor unit through the channel, such that the connection unit not only forms a support to retain the indoor and outdoor units in position but also provides a communication to link the electricity panel 301 and the evaporator module 302 with the compressor 303 and the condenser module 304.

[0033] The connection unit comprises two spaced apart connecting rods 103, 104 extending from the indoor housing 101 to the outdoor housing 102 through the wall 105 to keep

the indoor and outdoor housings 101, 102 in stably manner, wherein each of the connecting rods 103, 104 has a hollow structure to define the channel at each of the connecting rods 103, 104 for communicating the indoor housing 101 with the outdoor housing 102.

[0034] The indoor housing 101 is fixed firmly on its back panel 315 with two strong, hollow connecting rods 103, 104. The two connecting rods 103, 104, which stay in the wall 105, holds the indoor housing 101 on their first ends (the ends fixed on the indoor housing 101) and holds the outdoor housing 102 on their second ends (facing the outdoor housing 102). The connecting rods 103, 104 also function as channels for the refrigerant lines, power lines, and condensate to run through between the indoor housing 101 and the outdoor housing 102. The two connecting rods 103, 104 are fixed to the back of the indoor housing 101 are threaded through two sleeves of the rod sleeves set (FIG. 6) installed in the wall 105 to serve as a guiding frame for positioning the two connecting rods 103, 104 in the wall 105. The outdoor housing 102 is hung on the two connecting rods 103, 104 on the exterior wall. In effect, while the connecting rods 103, 104 support the weight of the indoor housing 101 by upholding it on the first ends of the connecting rods 103, 104, they support the weight of the outdoor housing 102 by hanging it on the second end of the connecting rods 103, 104. In this illustration, when the two units are set in place to form one complete unit, the indoor housing 101 stays at a higher level than the outdoor housing 102 with respect to the ground level. In other words, the indoor housing 101 is supported at a wall position higher than the outdoor housing 102. One advantage of such configuration is that the condensate from the indoor housing 101 can run from the indoor housing 101 through the connecting rods 103, 104 to the outdoor housing 102 to be evaporated by the condenser or simply drain out. In such design, no condensate pump is necessary. There are several sets of hanging holes 106, 106A, 107, 107A, 108, 108A in the back panel 110 of the outdoor housing 102 for the two connecting rods 103, 104 to support the outdoor housing 102. One can select the set of the hanging holes to hang the outdoor housing 102 at the level of height they desire. The outdoor housing 102 is locked onto the connecting rods 103, 104 by way of the screw nuts threading over the two connecting rods 103, 104, which are covered with screw surfaces, against the back panel of the outdoor housing 102 until they are tightly fixed in place. While threading the screw nuts, push the outdoor housing 102 towards the wall to ensure it will stay firmly against the wall. A few screws are drilled into the holes 120 in the back panel 110 of the outdoor housing 102 against the wall to further secure the stability of the outdoor housing 102. If the outdoor housing 102 is a large capacity unit and very heavy, the prefer method for hanging the unit is using the higher hanging holes to obtain more stability (FIG. 2).

[0035] FIG. 2 illustrates the room air conditioner 100, according to the present invention. The indoor housing 101 and the outdoor housing 102 are installed on the wall 105 to form a complete air conditioner. In this illustration, the outdoor housing 102 is hung on the two connecting rods 103, 104 by inserting the connecting rods 103, 104 into the hanging holes 106, 106A on the back of the outdoor housing 102. The indoor housing 101 is fixed firmly with two strong hollow connecting rods 103, 104 on the back its back panel. The two connecting rods 103, 104, which stay in the wall 105, hold the indoor housing 101 on their first ends (the ends fixed on the indoor housing 101) and hold the outdoor housing 102 on



their second ends (the ends facing the outdoor housing 102). The connecting rods 103, 104 also function as channels for the refrigerant lines, power lines, and condensate to run through between the indoor housing 101 and the outdoor housing 102. The two connecting rods 103, 104 fixed at the back of the indoor housing 101 are threaded through the rod-sleeves set (FIG. 6) installed in the wall 105 to serve as a guiding frame for positioning the two connecting rods in the wall. The outdoor housing 102 is hung on the second ends of the two connecting rods 103, 104 that protrude a few inches out of the exterior wall side. In effect, while the connecting rods 103, 104 support the weight of the indoor housing 101 by upholding it on the first ends of the connecting rods 103, 104, they support the weight of the outdoor housing 102 by hanging it on the second end of the connecting rods 103, 104. In this illustration, when the two units are set in place to form one complete unit, the indoor housing 101 stays at a higher level than the outdoor housing 102. One advantage of such configuration is that the condensate formed in the evaporator can run from the indoor housing 101 through the connecting rods 103, 104 to the outdoor housing 102 to be evaporated by the condenser or simply drain out. In such design, no condensate pump is necessary. There are several sets of hanging holes 106 & 106A, 107 & 107A, 108 & 108A in the back panel 110 of the outdoor housing 102 for hanging the outdoor housing 102 on the connecting rods 103, 104. This illustration shows the outdoor housing 102 hangs on the two connecting rods 103, 104 by inserting the connecting rods 103, 104 into the hanging holes 106 & 106A. The outdoor housing 102 is locked onto the connecting rods 103, 104 by way of the screw nuts threading over the two connecting rods 103, 104, which are covered with screw surface, against the back panel of the outdoor housing 102 until the back panel leans the wall closely. A few screws are drilled into the holes 120 in the back panel 110 of the outdoor housing 102 against the wall to further secure the stability of the outdoor housing 102. The indoor housing 102, which houses the evaporator module and electricity panel, is lighter than the outdoor housing 102, which houses the heavier components such as the compressor and condenser module. In the installation of the present invention, hang the outdoor housing 102 on the two connecting rods 103, 104 by inserting the connecting rods 103, 104 into the top set of the hanging holes 106 & 106A in the back panel of the outdoor housing 102. By using the top set of the hanging holes, the outdoor housing 102 is stabilized more. The invention is applicable to both large and small capacity air conditioners to be installed on the wall. In effect, with large capacity units available, the new invention can substitute for the central air conditioning system to provide consumers with high quality of air conditioner and save energy. In the United State, people who live in houses often have the option of using the central AC (air conditioning) system. One problem with the use of the central AC system is that it takes much more energy than a regular window air conditioner because it's designed to cover wider areas. Once the central AC is turned on it works to cool down every corner of the house, even the unoccupied parts of the house, which can be a waste of energy and electricity. With the present invention installed in selected rooms, one has the option to just turn on the air conditioner where needed, which will help save energy and reduce electricity bill.

[0036] FIG. 3 illustrates a perspective view of the invention with parts removed to reveal details of the air conditioner unit. This view shows the present invention before the two indoor

and outdoor housings 101, 102 are combined to form a complete unit. A refrigerant pre-charged indoor unit and a refrigerant pre-charged outdoor unit are separate at this point. The indoor housing 101 houses the electricity panel 301 and the evaporator module 302 (evaporator refrigerant coil and fan). Accordingly, the power plug (not shown in the Figures) is electrically extended from the electricity panel 301 of the indoor unit to electrically couple with a power socket at indoors. Therefore, the air conditioner of the present invention does not require to alter any electrical wiring system of the room to install the air conditioner. The two connecting rods fixed on the lower back panel 315 of the indoor housing 101. The outdoor housing 102 houses the compressor 303 and the condenser module 304 (condenser refrigerant coil and fan). The outdoor unit's back panel 10 contains several sets of hanging holes 106 & 106A, 107 & 107A, 108 & 108A that correspond to the connecting rods 103, 104 extending from the back panel 315 of the indoor housing 101. The two connecting rods 103, 104, once placed in the wall 105, support the weight of the indoor unit on the first ends (fixed on the indoor housing 101) by upholding it from the lower back of the indoor unit. The same connecting rods 103, 104 support the weight of the outdoor unit on the second ends (facing the outdoor housing 102) by inserting into the hanging holes on the back panel 110 of the outdoor housing 102 so that the unit hangs on the connecting rods. The second end of the connecting rod 104 is affixed with a quick-connect fitting 310A which is attached to the refrigerant suction line 310 that extends from the evaporator module 302 in the indoor unit. The second end of the connecting rod 103 is affixed with a quick-connect fitting 312A which is attached to the capillary tube 312 that extends from the evaporator module 302 in the indoor unit. Also affixed with the same second end of the connecting rod is the power adaptor 311A which is extended from the power lines 311 that extend from the electricity panel 301 in the indoor unit. The quick-connect fittings and the adaptor at the second ends of the connecting rods 103, 104 are used to connect with the quick-connect fitting 310B, which is extended from the refrigerant suction line 310C, and to connect with the quick-connect fitting 312B, which is attached to the capillary tube 312C, and to plug into the power plug 311B, which is attached to the power lines 311C that extends from compressor and condenser module. The connecting rods 103, 104 once threaded through any set of the hanging holes 106 & 106A, or 107 & 107A, or 108 & 108A in the back panel 110 of the outdoor unit, screw the screw nuts 313 & 314 onto the connecting rods 103, 104, which are covered with screw surface, against the back panel 110 of the outdoor unit until the back panel leans against the wall. A movable cover 330 is used to cover the outdoor housing 102. This cover can be easily taken off to make it convenient to connect the lines and tubes inside the air conditioner unit during installation or to perform maintenance work. In other words, the movable cover 330 can be removed from the outdoor housing 102 to operatively connect the indoor component with the outdoor component via the connection unit. Once the connection is formed, the movable cover 330 can be mounted to the outdoor housing 102 for protecting the outdoor component. Inside the outdoor unit, the capillary tube 312C and the power lines 311 C are soft, the refrigerant suction line 310C, by comparison, is harder. The suction line 310C and is coiled up to extend its length so that it can be stretched easily when needed. The suction line 310C, which is connected with the compressor 303, extends to another side



of the housing to be next to the second end of connecting rod **104**. The extra length of the suction lines is coiled up so that it can be stretched easily for its quick-connect fitting **310B** to reach and connect with the corresponding quick-connect fitting fixed at the second end of the connecting rod **104**. To prevent the refrigerant line **310C** and capillary **312C** tube from getting kinked during the connecting working, they are cover with soft metal hoses which are similar to a soft metal gas hose. These soft metal hoses with plastic surface also function as a heat insulator.

[0037] FIG. 4 illustrates a perspective view of the invention with parts removed to reveal details of the air conditioner unit. This view is the present invention in the complete configuration with the second ends of the two connecting rods supporting the weight of the outdoor unit by inserting into the hanging holes **106** & **106A** in the back panel **110** of the outdoor housing **102** so that the outdoor unit hangs on the connecting rods **103**, **104**. The power lines **311** from the indoor unit run through the connecting rod **103** to connect with power lines **311 C** of the outdoor unit for the power supply of the compressor **303** and condenser fan in the outdoor housing **102**. In the outdoor unit, the compressor **303** compresses the gas refrigerant through the refrigerant discharge line **401** to the condenser inlet on the top of the condenser **304**. The hot refrigerant gas goes through the condenser tube to reject the heat and to be condensed in the process. The condensed liquid refrigerant travels through the condenser refrigerant coil and passes from the condenser outlet on the bottom of the condenser to the capillary tube **312C**, then the liquid refrigerant travels on through the connecting rod **103** to the capillary tube **312** situated in the indoor housing **101** into the evaporator **302** by way of the inlet on the bottom of the evaporator. The liquid refrigerant goes through the evaporator tube to absorb the heat from the room and as the liquid refrigerant evaporates it transforms into gas. The evaporated refrigerant gas exits from the evaporator outlet on the top of evaporator and enters into the refrigerant suction line **310** through the connecting rod **104** to the refrigerant suction line **310C** situated in the outdoor housing and then travels on in the compressor **303** to be compressed for the next cycle. Inside the indoor unit, as the air from the air conditioned room gets in contact with the evaporator, the condensate forms and drops onto the bottom of the indoor housing. The condensate collected on the bottom then runs through the connecting rod **104** and enters into the outdoor housing **102** to be evaporated by the condenser or to drain out. In this illustration, the connecting rod **104** also works as a condensate tube. No special condensate tube is needed. Also in the present invention, it is not necessary to have a condensate pump. The refrigeration system in the invention is the same as that of a regular air conditioner. The design of the invention focuses on the use and functions of the two connecting rods and how to best connect the internal components of the separate housing units together to form one complete, functional unit.

[0038] FIG. 5 illustrates the two connecting rods **103**, **104** with the top portions removed to reveal the details inside. The connecting rods **103**, **104** are similar to a water pipe. They are made of either metal or other suitable materials. The two connecting rods **103**, **104**, which are parallel to each other and placed apart at a predetermined distance, are fixed to the indoor housing **101** at the lower back of the unit. Two holes **501**, **502** in the back panel of the indoor housing **101** allow the refrigerant lines, condensate, and power lines from the indoor unit to thread through the inner parts of the two connecting

rods **103**, **104**. Fixed firmly at the second end (facing the outdoor unit) of the connecting rod **104** is a quick-connect fitting **310A** which is attached to the suction line running from the indoor unit. In addition to serving as the channel through which the suction line runs from the indoor housing to the outdoor housing, the connecting rod **104** also serves as a condensate tube through which the condensate travel from the indoor housing **101** to the outdoor housing **102**. Inside, running through the other connecting rod **103** is the capillary tube **312** extending from the evaporator situated in the indoor housing **101**. The capillary tube **312** is attached to the quick-connect **312A** which is firmly fixed at the second end of the connecting rod **103**. The power lines **311** coming from the electricity panel **301** situated in the indoor housing **101** also thread through the connecting rod **103**, along with the capillary tube **312**, and is attached to a power adaptor **311A**. The adaptor **311A** is also fixed firmly at the second end of the connecting rod **103**. To complete connecting all of the tubes and lines one simply connect the quick-connect fitting **310B** attached to the refrigerant suction line **310C** of the outdoor unit to the quick-connect fitting **310A** fixed at the second end of the connecting rod **104**, and connect the quick-connect fitting **312B** attached to the capillary tube **312C** of the outdoor unit to the quick-connect fitting **312A** fixed at the second end of the connecting rod **103**. Finally, plug in the power plug **311B** of the outdoor unit to the adaptor **311A** fixed at the second end of the connecting rod **103**. Both rods **103**, **104** are covered with screw surface so that the screw nuts **313**, **314** can be screwed on and help tighten the outdoor unit against the exterior wall. Also the screw surface on the two connecting rods allows for the screw caps **505** to cover the ends of the two connecting rods **103**, **104** for protecting the quick-connect fitting during delivery.

[0039] FIG. 6 illustrates the rod sleeves set **600** in the configuration. The rod sleeves set is made of plastic or other suitable materials and is used for guiding the two connecting rods **103**, **104** when they are threaded through the wall. The rod sleeves set **600** is composed of a piece of plate **603** and two sleeves **601**, **602**. The two sleeves **601**, **602** are connected perpendicularly to the plate **603** and are set apart at a distance corresponding to the same distance the two connecting rods **103**, **104** are set part. The holes of the sleeves are just large enough for the connecting rods **103**, **104** to thread through. The lengths of the sleeves are longer than the thickness of the wall. To install the rod sleeves set, one first drills two holes in the wall large enough to insert the sleeves. Once the holes are created in the wall, insert the sleeves **601**, **602** from the interior side of the wall and press the sleeve plate **603** closely against the wall. Once the rod sleeves set **600** is placed in the wall, patch and fill any gaps in the wall surrounding the sleeves **601**, **602**. The sleeves **601**, **602** are designed to be longer than the thickness of the wall, and as such, there will most likely be extra inches of sleeves **601**, **602** protruding out of the exterior wall. Trim the extra lengths off the sleeves **601**, **602** to make the sleeves **601**, **602** even with the exterior wall as to prevent from affecting the installation of the air conditioner. With the rod sleeves set **600** in place, the air conditioner is now ready for installation, starting with threading the two connecting rods **103**, **104** through the sleeves **601**, **602** of the rod sleeves set. In the present invention, the diameter of the connecting rods **103**, **104** and the distance they are set apart will be standardized. Therefore the rod sleeves set **600** will also be standardized. The standard rod sleeves set **600** will be suitable for builders to pre-install in the walls of any



new buildings to provide convenience for installation of the present invention when desired. The rod sleeves set **600** comes with rod caps **606** for covering the holes of the sleeves **601**, **602** when the sleeves **601**, **602** installed in the wall are not being used. Comparing to the preparation one needs to perform by creating a large hole to install the conventional box type of window air conditioner, the installation of the present invention requires only two tiny holes in the wall which requires much less work. With the use of the rod sleeves set **600**, the installation of the air conditioner becomes easier. It's possible for the use of the rod sleeves set to be accepted as a part of the standard installation system in the future. For simplifying the system, the connecting rods can be classified into two sizes; living room size connecting rods and bedroom size connecting rods. Two sizes of rod sleeves set **600** will also be created to correspond to the sizes of the connecting rods **103**, **104** they are used for.

[0040] FIG. 7 illustrates the configuration of the two connecting rods **103**, **104** fixed on the back panel **315** of the indoor housing **101**. When the back panel of the indoor housing **101** is strong enough to be fixed with the two connecting rods **103**, **104** to carry the weight of the indoor unit, the two connecting rods **103**, **104** can be connected to the back panel **315** directly. Otherwise (the back panel is too thin or not made of metal), the two connecting rods **103**, **104** are fixed on housing seat **701** first (the housing seat is added to provide reinforcement to the support, then the indoor housing **101** sits on the housing seat **701** (the indoor housing fixed firmly with the housing seat as same indoor unit) with its back panel **315** attached to the first ends of two connecting rods **103**, **104**. There are holes **501**, **502**, **702**, **703** in the back panel of the indoor housing **101** and the housing seat to allow passage of the refrigerant lines, power lines and condensate lines from the indoor unit to the hollow inner parts of the two connecting rods **103**, **104**. In this figure, it shows that the two connecting rods **103**, **104** are fixed on the housing seat **701** as a body. This housing seat **701** is designed to be strong enough to hold the indoor unit by the two connecting rods **103**, **104**. In this illustration, the two connecting rods **103**, **104** connect to the bottom of the back panel **315** of the indoor housing **101**, such that the condensate can run through the connecting rod **104** from the indoor housing **101**. This is the better location for the connecting rod **103**, **104** when a condensate pump is not required, but is not the only choice. If the indoor housing **101** has a condensate pump, then the connecting rods can locate higher on the back panel of the indoor housing **101**. Any method used for connecting of the two connecting rods **103**, **104** to the back panel **315** of the indoor housing **101** doesn't affect the two connecting rods' functions, which include being a supporter of the air conditioner and acting as the channels for the refrigerant lines, power lines and the condensate line to go through. Thus the invention is without limitation on the method of connecting the two connecting rods **103**, **104** to the back panel **315** of the indoor housing **101**.

[0041] The two connecting rods **103**, **104** are made of metal material or other suitable materials that are strong enough to hold the whole air conditioner unit on the wall **105**. The bottom of the indoor housing **101**, which functions as a condensate pan, collects the condensate. The condensate runs through the connecting rod **103**, **104** into the outdoor housing **102** to be evaporated or drain out. The two connecting rods **103**, **104** are rust free. Each connecting rod **103**, **104** has a diameter large enough to accommodate the quick-connect fittings of the suction line and capillary tube, and the power

adaptor at the second ends (the ends facing to outdoor housing **102**) of the rods **103**, **104**. The quick-connect fittings of the suction line and the capillary tube from the indoor unit are fixed firmly at the second ends of the two connecting rods **103**, **104**. The length of the rods **103**, **104** can be about nine inches long (or longer if required) to ensure they will be long enough to thread through walls **105**. The stretching capability of the refrigerant lines in the outdoor unit is required such that their quick-connect fittings can reach the quick-connect fittings fixed at the second ends of the two connecting rods **103**, **104** during installation. The indoor and outdoor units of the present invention are refrigerant pre-charged, and all the quick-connect fittings are covered at the factory with protecting caps for preventing the fitting from being damaged or refrigerant leakage. To install the air conditioner, first drill in the wall **105** to form two holes slightly larger than the diameter of the sleeves of the rod sleeves set. Then insert the sleeves **601**, **602** of the rod sleeves set **600** into the holes. Once the rod sleeves set **600** is in place, patch up any gaps in the wall surrounding the sleeves **601**, **602**. Trim off the extra portion of the sleeves **601**, **602** sticking out of the wall. When the patch work is dried, the next installation step is to thread the two connecting rods **103**, **104**, which are fixed on the indoor housing **101**, from the air conditioned room through the holes of the sleeves to the exterior of the wall. Push the indoor housing **101** towards the wall **105** until the indoor housing **101** is closely leaning against the wall **105**. There will be about few inches of the connecting rods **103**, **104** sticking out of the exterior wall. The next step is to hang the outdoor unit on the two connecting rods **103**, **104**. On the back panel **110** of the outdoor housing **102** there are several sets of hanging holes. Hang the outdoor housing **102** by inserting the connecting rods **103**, **104** into the selected set of hanging holes. Then thread a screw nut on each connecting rod **103**, **104** until it tightens the back panel **110** of the outdoor housing **102** against the wall **105** closely. To further stabilize the outdoor housing **102**, screw on several screws on the back panel of the outdoor housing **102** to hold firmly the outdoor unit against the wall **105**. Next, connect the corresponding refrigerant lines from the indoor and outdoor units to form a complete air conditioner. Connect the quick connect fittings of the outdoor unit to the corresponding quick-connect fittings fixed at the second ends of the two connecting rods **103**, **104**, and plug in the power plug of the outdoor unit into the adaptor at fixed at the second end of one of the two connecting rods **103**, **104**. The method of connecting the quick-connect fittings is by hand to get hand tight of the fitting for making sure no thread cross, then tighten by the wrench. When connecting the quick-connect fittings, some hissing noise will occur indicating that the refrigerant is leaking. The hissing noise will stop after the connecting fittings are completely tightened. The refrigerant connecting work can be done by most people following the instruction manual provided by the manufacture. The main purposes of this invention are to provide consumers with a good quality air conditioner and save installation costs.

[0042] The window type air conditioner has been used for centuries. The new window air conditioner has a better design and, when build with the right materials, is lighter, cheaper and has higher efficiency. Unfortunately, many people use window as a location for installing their air conditioner and carelessly patch up any existing gaps in the window with materials that do not harmonize with the appearance of the building of which the window is a part. The split type air



conditioner is attractive for consumers for its quietness. However, the high installation cost associated with the split type air conditioner discourages people from purchasing it. In the United States, central air conditioning system is popular with people who live in houses. However the system is wasteful in energy. All of the above mentioned types of air conditioner have room for improvement. The new invention addresses the concerns with the air conditioners mentioned above in new structural designs. The merits of the invention include easy installation, lower purchasing price, and noise reduction inside the air conditioned room. The new invention uses two hollow connecting rods to connect the indoor and outdoor housing units together to form one complete air conditioner unit. It's easy to install the present invention; one only needs to drill two tiny holes in the wall, thread the connecting rods through the holes and unite the two units by connecting the connecting rods. The noise generated by the compressor and the condenser module inside the outdoor unit is insulated by the wall. It is important to note that the new invention is functional in either single rod design or multiple rods design. The new invention adopts the two rods design over the single or other multiple rods designs for consideration of getting the best stability in the most economic way. The use of two rods in the design is a matter of preference, not the limit. The number of rod(s) being used is not the core of the matter but rather how the rod(s) is configured to be utilized to serve its purpose is the focus of the present invention.

[0043] The following is the conclusion of the merits of the present invention;

[0044] (1) Easy installation.

[0045] (2) Reduction in noise in the air conditioned room.

[0046] (3) Low purchasing and installation costs.

[0047] (4) suitability for making large capacity units.

[0048] (5) Suitability for substituting the central air conditioning system to save energy, containing removable covers of the indoor and outdoor housings for convenience of installation and maintenance.

[0049] One skilled in the art will understand that the embodiment of the present invention as shown in the drawings and described above is exemplary only and not intended to be limiting.

[0050] It will thus be seen that the objects of the present invention have been fully and effectively accomplished. The embodiments have been shown and described for the purposes of illustrating the functional and structural principles of the present invention and is subject to change without departure from such principles. Therefore, this invention includes all modifications encompassed within the spirit and scope of the following claims.

What is claimed is:

1. An air conditioner for installing into a wall, comprising: an indoor unit which comprises an indoor housing, an electricity panel housed in said indoor housing, and an evaporator module received in said indoor housing; an outdoor unit which comprises an outdoor housing, a compressor housed in said outdoor housing, and a condenser module received in said outdoor housing; and a connection unit, which is extended through said wall, supportively coupled between said indoor and outdoor units at a position that said indoor housing is supported at an interior wall side of said wall while said outdoor housing is supported at an exterior wall side of said wall, wherein said connection unit has a channel communicating between said indoor and outdoor housings that

said electricity panel and said evaporator module of said indoor unit are operatively connected with said compressor and said condenser module of said outdoor unit through said channel, such that said connection unit not only forms a support to retain said indoor and outdoor units in position but also provides a communication to link said electricity panel and said evaporator module with said compressor and said condenser module.

2. The air conditioner, as recited in claim 1, wherein said connection unit comprises two spaced apart connecting rods extending from said indoor housing to said outdoor housing through said wall to keep said indoor and outdoor housings in stably manner, wherein each of said connecting rods has a hollow structure to define said channel at each of said connecting rods for communicating said indoor housing with said outdoor housing.

3. The air conditioner, as recited in claim 1, wherein said indoor housing is supported at a wall position higher than said outdoor housing.

4. The air conditioner, as recited in claim 2, wherein said indoor housing is supported at a wall position higher than said outdoor housing.

5. The air conditioner, as recited in claim 2, wherein a refrigerant suction line runs through said channel of one of said connecting rods to communicatively connect said evaporator module with said compressor, wherein a capillary tube and a power line run through said channel of another said connecting rod that said capillary tube is communicatively connected between said evaporator module and said condenser module while said power line is electrically connected among said electricity panel, said compressor, and said condenser module.

6. The air conditioner, as recited in claim 4, wherein a refrigerant suction line runs through said channel of one of said connecting rods to communicatively connect said evaporator module with said compressor, wherein a capillary tube and a power line run through said channel of another said connecting rod that said capillary tube is communicatively connected between said evaporator module and said condenser module while said power line is electrically connected among said electricity panel, said compressor, and said condenser module.

7. The air conditioner, as recited in claim 5, wherein each of said connecting rods has an end detachably coupled with said outdoor housing, a power adaptor provided at said end of said corresponding connecting rod to detachably couple with said power line, and first and second quick-connect fittings provided at said ends of said connecting rods to detachably couple with said capillary tube and said refrigerant suction line respectively.

8. The air conditioner, as recited in claim 6, wherein each of said connecting rods has an end detachably coupled with said outdoor housing, a power adaptor provided at said end of said corresponding connecting rod to detachably couple with said power line, and first and second quick-connect fittings provided at said ends of said connecting rods to detachably couple with said capillary tube and said refrigerant suction line respectively.

9. The air conditioner, as recited in claim 8, further comprising a rod sleeves set for guiding said connecting rods through said wall, wherein said rod sleeves set comprises a plate and two sleeves spacedly extended from said plate for extending through said wall, wherein said connecting rods are passing through said sleeves respectively to support said



indoor and outdoor units at said interior and exterior wall sides of said wall respectively.

**10.** The air conditioner, as recited in claim **9**, wherein said outdoor unit further comprises a movable cover detachably enclosing said outdoor housing such that when said movable cover is detached from said outdoor housing, said electricity panel and said evaporator module of said indoor unit are easily connected with said compressor and said condenser module of said outdoor unit through said connection unit, and when said movable cover is detached from said outdoor housing, said outdoor housing is enclosed to protect said compressor and said condenser module.

**11.** A method of installing an air conditioner at a wall, comprising the steps of:

- (a) forming two spaced apart holes on said wall;
- (b) passing two connecting rods through said holes, wherein each of said connecting rods has a tubular structure to define a channel therewithin, wherein said connecting rods are spacedly extended from a back panel of an indoor housing of an indoor unit,
- (c) supporting said indoor housing of said indoor unit and an outdoor housing of an outdoor unit via said connecting rods at a position that said indoor unit is supported at an interior wall side of said wall while said outdoor unit is supported at an exterior wall side of said wall, wherein said connecting rods form a support to retain said indoor and outdoor units in a stably manner; and
- (d) operatively connecting an electricity panel and an evaporator module of said indoor unit with a compressor and a condenser module of said outdoor unit through channels, wherein said connecting rods also provides a communication link to operatively connect said indoor unit with said outdoor unit.

**12.** The method, as recited in claim **11**, wherein said indoor housing is supported at a wall position higher than said outdoor housing.

**13.** The method, as recited in claim **11**, wherein the step (d) further comprises the steps of:

- (d.1) running a refrigerant suction line through said channel of one of said connecting rods to communicatively connect said evaporator module with said compressor;
- (d.2) running a capillary tube through said channel of one of said connecting rods to communicatively connect between said evaporator module and said condenser module; and
- (d.3) running a power line through said channel of one of said connecting rods to electrically connect between said electricity panel and said compressor.

**14.** The method, as recited in claim **12**, wherein the step (d) further comprises the steps of:

- (d.1) running a refrigerant suction line through said channel of one of said connecting rods to communicatively connect said evaporator module with said compressor;
- (d.2) running a capillary tube through said channel of one of said connecting rods to communicatively connect between said evaporator module and said condenser module; and
- (d.3) running a power line through said channel of one of said connecting rods to electrically connect between said electricity panel and said compressor.

**15.** The method, as recited in claim **13**, wherein each of said connecting rods has an end detachably coupled with said outdoor housing, a power adaptor provided at said end of said corresponding connecting rod to detachably couple with said power line, and first and second quick-connect fittings provided at said ends of said connecting rods to detachably couple with said capillary tube and said refrigerant suction line respectively.

**16.** The method, as recited in claim **14**, wherein each of said connecting rods has an end detachably coupled with said outdoor housing, a power adaptor provided at said end of said corresponding connecting rod to detachably couple with said power line, and first and second quick-connect fittings provided at said ends of said connecting rods to detachably couple with said capillary tube and said refrigerant suction line respectively.

**17.** The method, as recited in claim **11**, between the steps (a) and (b), further comprising a step of mounting a rod sleeves set on said wall, wherein said rod sleeves set comprises a plate and two sleeves spacedly extended from said plate for extending through said holes of said wall, wherein said connecting rods are passing through said sleeves respectively to support said indoor and outdoor units at said interior and exterior wall sides of said wall respectively.

**18.** The method, as recited in claim **16**, between the steps (a) and (b), further comprising a step of mounting a rod sleeves set on said wall, wherein said rod sleeves set comprises a plate and two sleeves spacedly extended from said plate for extending through said holes of said wall, wherein said connecting rods are passing through said sleeves respectively to support said indoor and outdoor units at said interior and exterior wall sides of said wall respectively.

**19.** The method, as recited in claim **11**, wherein the step (d) further comprises the steps of:

detaching a movable cover from said outdoor unit to operatively connect said electricity panel and said evaporator module of said indoor unit with said compressor and said condenser module of said outdoor unit through said channels; and

attaching said movable cover to said outdoor unit to enclose said outdoor housing so as to protect said compressor and said condenser module of said outdoor unit.

**20.** The method, as recited in claim **18**, wherein the step (d) further comprises the steps of:

detaching a movable cover from said outdoor unit to operatively connect said electricity panel and said evaporator module of said indoor unit with said compressor and said condenser module of said outdoor unit through said channels; and

attaching said movable cover to said outdoor unit to enclose said outdoor housing so as to protect said compressor and said condenser module of said outdoor unit.

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