

Description

[0001] The present disclosure relates to a circuit for blocking an operation of a compressor, capable of cutting off the supply of power in hardware when the pressure of a refrigerant is increased.

[0002] In general, a compressor serves to convert mechanical energy into compressive energy of a compressive fluid. The compressor is used as a part of a freezer, such as a refrigerator or an air conditioner.

[0003] The air conditioner is an apparatus to cool down air through heat exchange occurring as a refrigerant is compressed by the compressor and the compressed refrigerant is evaporated.

[0004] The air conditioner may employ various refrigerants. Recently, an eco-friendly refrigerant has been introduced to minimize environment pollution.

[0005] Meanwhile, the required specification of the eco-friendly refrigerant with respect to safety has been strengthened since the eco-friendly refrigerant has explosion hazard due to the flammability thereof.

[0006] The technology to prevent the fire of the air conditioner has been disclosed in KR 10-1323135 B1.

[0007] However, in the above patent document, in which the temperature of a refrigerant is measured and the refrigerant is spurted when flames are formed, in order to prevent the fire in advance, only a manner of coping with fire in software by measuring the temperature is suggested and a manner of coping with the fire in hardware is not suggested. In addition, when inflammable refrigerant is spurted, the fire may occur on a much bigger scale.

SUMMARY

[0008] The present disclosure is to provide a circuit for blocking an operation of a compressor, capable of cutting off the supply of power in hardware when the pressure of a refrigerant is increased.

[0009] In addition, the present disclosure is to provide a circuit for blocking an operation of a compressor, capable of rapidly notifying abnormal pressure to the outside.

[0010] According to an embodiment of the present disclosure, a circuit for blocking an operation of a compressor includes a pressure switch which cuts off power applied to the relay and cuts off power supplied to the compressor as the pressure switch operates when the pressure of the refrigerant is equal to or greater than the reference value.

[0011] According to an embodiment of the present disclosure, a circuit for blocking an operation of a compressor connects a pressure switching state sensing unit with a path of a current flowing along a relay power supply unit and a pressure switch and transmits error information when the pressure switch is turned off.

[0012] As described above, according to the embodiment of the present disclosure, since the operation of the compressor may be stopped through a hardware con-

trolling manner of opening or closing the pressure switch based on pressure, the safety standard, which is required when the eco-friendly refrigerant such as R32 is used, is satisfied. In spite of the failure in the micro-computer, the pressure sensor, the temperature sensor, or the like, the operation of the compressor may be stopped with reliability.

[0013] In addition, according to an embodiment of the present disclosure, a message representing the erroneous state or the normal state is output based on whether the pressure switch is open or closed, thereby notifying a user of whether or not the stop in the operation of the air conditioner is not a failure but a normal operation performed to reduce the pressure of the refrigerant.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

FIG. 1 is a view illustrating the configuration of an air conditioner according to an embodiment of the present disclosure.

FIG. 2 is a schematic view illustrating an outdoor unit and an indoor unit of FIG. 1.

FIG. 3 is a block diagram illustrating a circuit for blocking an operation of a compressor according to an embodiment of the present disclosure.

FIG. 4 is a circuit diagram illustrating a circuit for blocking an operation of a compressor according to an embodiment of the present disclosure.

FIGS. 5A and 5B are views illustrating a pressure switch state sensing unit according to an embodiment of the present disclosure.

FIG. 6 is a view illustrating a circuit for blocking an operation of a compressor coupled to a pressure switch state sensing unit according to an embodiment of the present disclosure.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0015] Description will now be given in detail according to exemplary embodiments disclosed herein, with reference to the accompanying drawings. For the sake of brief description with reference to the drawings, the same or equivalent components may be provided with the same reference numbers, and description thereof will not be repeated. In general, a suffix such as "module" and "unit" may be used to refer to elements or components. Use of such a suffix herein is merely intended to facilitate description of the specification, and the suffix itself is not intended to give any special meaning or function. In the present disclosure, that which is well-known to one of ordinary skill in the relevant art has generally been omitted for the sake of brevity. The accompanying drawings are used to help easily understand various technical features and it should be understood that the embodiments presented herein are not limited by the accompanying drawings. As such, the present disclosure should be con-

strued to extend to any alterations, equivalents and substitutes in addition to those which are particularly set out in the accompanying drawings.

[0016] It will be understood that although the terms first, second, etc. may be used herein to describe various elements, these elements should not be limited by these terms. These terms are generally only used to distinguish one element from another.

[0017] It will be understood that when an element is referred to as being "connected with" another element, the element can be connected with the other element or intervening elements may also be present. In contrast, when an element is referred to as being "directly connected with" another element, there are no intervening elements present.

[0018] A singular representation may include a plural representation unless it represents a definitely different meaning from the context. Terms such as "include" or "has" are used herein and should be understood that they are intended to indicate an existence of several components, functions or steps, disclosed in the specification, and it is also understood that greater or fewer components, functions, or steps may likewise be utilized.

[0019] The circuit for blocking the operation of the compressor disclosed in the present disclosure may be applied to the air conditioner, but the present disclosure is not limited thereto. In detail, the circuit for blocking the operation of the compressor disclosed in the present disclosure may be applied to all apparatuses including a compressor to compress a refrigerant of a refrigerator.

[0020] Hereinafter, embodiments disclosed in the present disclosure will be described in detail with reference to accompanying drawings and the same elements or similar elements will be assigned with same reference numerals and the redundant description thereof will be omitted.

[0021] In the following description, detailed descriptions of well-known functions or constructions will be omitted because they would obscure the inventive concept in unnecessary detail. Also, the accompanying drawings are used to help easily understanding embodiments disclosed herein but the technical idea of the inventive concept is not limited thereto. It should be understood that all of variations, equivalents or substitutes contained in the concept and technical scope of the present invention are also included.

[0022] FIG. 1 is a view illustrating the configuration of an air conditioner according to an embodiment of the present disclosure.

[0023] Referring to FIG. 1, according to an embodiment of the present disclosure, an air conditioner 100 may include an indoor unit 10, at least one outdoor unit 20 connected with the indoor unit 10, a remote controller (not illustrated) connected with the indoor unit 10, and a controller (not illustrated) to control the indoor unit 10 and the outdoor unit 20.

[0024] The controller (not illustrated) may be connected with the indoor unit 10 and the outdoor unit 20 to mon-

itor the operations of the indoor unit 10 and the outdoor unit 20 and to control the indoor unit 10 and the outdoor unit 20. In this case, the controller (not illustrated) is connected with a plurality of indoor units to perform operation setting, locking setting, schedule control, or the like. The controller (not illustrated) may have a structure included in the indoor unit 10 or the outdoor unit 20.

[0025] The air conditioner 100 may include any one of stand-type air conditioners, wall-mounted air conditioners, ceiling-type air conditioners, and duct-type air conditioners. Hereinafter, the stand-type air conditioner will be described by way of example for the convenience of explanation.

[0026] The outdoor unit 20 may include a compressor to receive and compress a refrigerant, an outdoor heat exchanger to perform heat exchange between the refrigerant and outdoor air, an accumulator to extract a gas refrigerant from the supplied refrigerant and to supply the gas refrigerant to the compressor, and a 4-way valve to select the fluid passage of the refrigerant depending on a heating operation. In addition, the outdoor unit 20 may further include a plurality of sensors, a plurality of valves, and an oil recovering unit.

[0027] The outdoor unit 20 operates the compressor and the outdoor heat exchanger provided therein to compress the refrigerant and perform heat exchange depending on settings, and thereby to supply the refrigerant to the indoor unit 10. The outdoor unit 20 is driven depending on the demand of the controller (not illustrated) or the indoor unit 10 and the number of compressors to operate in the outdoor unit 20 is varied depending on the required cooling/heating capacity of the driven indoor unit 10.

[0028] The indoor unit 10 is connected with the outdoor unit 20 to receive the refrigerant and to discharge cold air or hot air to an air conditioning target. The indoor unit 10 may include an indoor heat exchanger, an indoor-unit fan, an expansion valve through which the received refrigerant is expanded, and a plurality of sensors.

[0029] The indoor unit 10 and the outdoor unit 20 may be connected with the controller (not illustrated) through additional communication lines to operate under the control of the controller (not illustrated).

[0030] The remote controller (not illustrated) may be connected with the indoor unit 10 to input a control command of a user into the indoor unit 10, to receive state information of the indoor unit 10, and to display the state information of the indoor unit 10. In this case, the remote controller (not illustrated) communicates with the indoor unit 10 in a wireless manner or a wired manner depending on the connection type of the indoor unit 10. To this end, the remote controller (not illustrated) may include a communication module to transmit or receive data.

[0031] For example, the user may input a target temperature through the remote controller (not illustrated). In this case, the remote controller (not illustrated) receives the user input for the target temperature and transmits the user input to the controller (not illustrated).

[0032] FIG. 2 is a schematic view illustrating the out-

door unit and the indoor unit of FIG. 1.

[0033] Referring to FIG. 2, the air conditioner 100 is mainly divided into the indoor unit 10 and the outdoor unit 20.

[0034] The outdoor unit 20 includes a compressor 102 which compresses a refrigerant and encloses a compressor motor 102b which drives the compressor 102; an outdoor-unit heat exchanger 104 which radiates heat from the compressed refrigerant; an outdoor-unit air blower 105 including an outdoor fan 105a which is provided at one side of the outdoor-unit heat exchanger 104 to promote the heat radiation from the refrigerant, and an electric motor 105b which rotates the outdoor fan 105a; an expansion mechanism 106 which expands the compressed refrigerant; a cooling/heating switch valve 110 which changes the fluid passage of the compressed refrigerant; and an accumulator 103 which temporarily stores an evaporated refrigerant, removes moisture and foreign matters from the refrigerant, and supplies a refrigerant having predetermined pressure to the compressor. The expansion mechanism 106 and the cooling/heating switch valve 110 may be included in the indoor unit 10 instead of the outdoor unit 20. The usage of the accumulator 103 is optionally used depending on the type of the compressor 102.

[0035] In addition, the outdoor unit 20 may include a circuit 300 for blocking an operation of a compressor, which is to be described below.

[0036] The indoor unit 10 includes an indoor heat exchanger 108 provided indoors to perform a cooling/heating function, and an indoor air blower 109 including an indoor fan 109a provided at one side of the indoor heat exchanger 108 to promote the heat radiation of the refrigerant and an electric motor 109b rotating the indoor fan 109a.

[0037] At least one indoor heat exchanger 108 may be installed.

[0038] The compressor 102 may employ at least one of an inverter compressor and a constant-speed type compressor.

[0039] In addition, the air conditioner 50 may be configured as a cooler for cooling the room or may be configured as a heat pump for cooling or heating the room.

[0040] Meanwhile, although FIG. 2 illustrates one indoor unit 10 and one outdoor unit 20, a driving device of the air conditioner according to an embodiment of the present disclosure is not limited thereto. In other words, the driving device of the air conditioner may be applied to a multi-type air conditioner including multiple indoor units and multiple outdoor units or an air conditioner including one indoor unit and multiple outdoor units.

[0041] Meanwhile, the circuit for blocking the operation of the compressor according to an embodiment of the present disclosure may be used for an air conditioner to which an R32 refrigerant is applied.

[0042] The R32 refrigerant, which is methylene fluoride (CH_2F_2), is an eco-friendly refrigerant. The R32 refrigerant has an advantage in that the energy efficiency is im-

proved by 5 to 10% and a cooling capacity is improved by 10% when compared with those of an existing refrigerant. However, the R32 has a disadvantage of flammability.

[0043] Accordingly, when the R32 refrigerant is used, caution is required for preventing combustion or explosion.

[0044] According to European Safety Standards, when the R32 refrigerant is used, the pressure switch has to be employed as a safety device depending on the capacity of the compressor. In addition, according to European Safety Standards, legal controls are imposed with respect to not only the operation of the pressure switch but also the compressor, such that the compressor is maintained in the safety state until the operation of the compressor is stopped in hardware, when the internal pressure of the air conditioner is increased to be in the abnormal state.

[0045] Accordingly, the compressor is not only stopped in software under the control of a micro-computer, but also stopped in hardware regardless of the control of the micro-computer.

[0046] FIG. 3 is a block diagram illustrating the circuit for blocking the operation of the compressor according to an embodiment of the present disclosure.

[0047] Referring to FIG. 3, according to an embodiment of the present disclosure, the circuit for blocking the operation of the compressor may include a power input unit 310, a compressor power supply unit 320, a relay power supply unit 330, a switching unit 340, a pressure switch status sensing unit 350, and a micro-computer 360.

[0048] The power input unit 310 may include a power circuit and may receive AC power from the outside to supply the AC power to the compressor power supply unit 320.

[0049] The compressor power supply unit 320 may supply power to the compressor. In this case, the supplying of the power to the compressor may refer to not only directly supplying power the compressor, but also supplying power to the compressor through another device.

[0050] For example, the compressor power supply unit 320 may supply power to a compressor driving unit. In this case, the compressor driving unit may include a converter and an inverter. In this case, the compressor power supply unit 320 may charge the converter with power, and the inverter may supply power to the compressor using the charged power.

[0051] Meanwhile, the compressor power supply unit 320 may include a relay 321. In addition, the compressor power supply unit 320 may supply power to the compressor when the relay 321 is turned on. In contrast, when the relay 321 is turned off, the compressor power supply unit 320 may stop supplying the power to the compressor.

[0052] The relay power supply unit 330 may apply power to the relay 321. In detail, when a current path is formed, the relay power supply unit 330 may supply power

er to a coil provided inside the relay 321. In this case, the relay power supply unit 330 may include a switching mode power supply (SMPS).

[0053] When the relay 321 is not supplied with power, the relay 321 may be maintained in an off state. As the relay power supply unit 330 applies power to the relay 321, the relay 321 may be turned on.

[0054] The switching unit 340 may cut off power to be applied to the relay 321.

[0055] In detail, the switching unit 340 may measure the pressure of the refrigerant and may include a pressure switch. In this case, based on the pressure of the refrigerant, the pressure switch may be turned on such that the power is applied to the relay 321 or may be turned off such that the power applied to the relay 321 is cut off.

[0056] In more detail, the switching unit 340 may measure the pressure of the refrigerant inside the compressor.

[0057] In addition, when the pressure of the refrigerant is less than a reference value, the switching unit 340 may be maintained in an 'on' state. In this case, the relay power supply unit 330 may supply power to the relay 321 as a current path is formed along the switching unit 340 and the relay 321.

[0058] In addition, when the pressure of the refrigerant is greater than the reference value, the switching unit 340 may be turned off. When the switching unit 340 is turned off, the current path is disconnected as the switching unit 340 is turned off. Accordingly, the supply of power to the relay 321 may be stopped.

[0059] The pressure switch state sensing unit 350 is connected through the current path to output a signal for determining the on/off state of the pressure switch.

[0060] In detail, when the current path is formed, the pressure switch state sensing unit 350 may output a first signal to the micro-computer. In addition, when the current path is disconnected, the pressure switch state sensing unit 350 may output a second signal to the micro-computer.

[0061] Meanwhile, the pressure switch state sensing unit 350 may be a photo-coupler including a light emitting element connected with the current path and a light receiving element connected with the micro-computer 360.

[0062] The micro-computer 360 may control the overall operation of the circuit for blocking the operation of the compressor.

[0063] The micro-computer 360 may control the on/off state of the relay 321.

[0064] In detail, the micro-computer 360 may form the path of a current flowing along the relay power supply unit 330, the switching unit 340, and the relay 321, by outputting a signal for turning on the relay.

[0065] In addition, the micro-computer 360 may determine the on/off state of the pressure switch, based on a signal received from the pressure switch state sensing unit 350.

[0066] Meanwhile, the micro-computer 360 may include a communication unit (not illustrated) and may transmit/ receive data together with the outside.

[0067] Meanwhile, when the pressure switch is determined to be turned off, the micro-computer 360 may transmit an error report to the outside.

[0068] FIG. 4 is a circuit diagram illustrating the circuit for blocking the operation of the compressor according to an embodiment of the present disclosure.

[0069] The power input unit 310 may be configured with a power circuit, may receive AC power from the outside, and may supply the AC power to the compressor power supply unit 320

[0070] The compressor power supply unit 320 may include the relay 321, a second relay 322, and a buffer IC 323.

[0071] In this case, the relay 321 may be a power relay, and the second relay 322 may be a start relay.

[0072] The start relay may be a relay used for the initial charging when the compressor initially operates. The power relay may be a relay used to supply power to the compressor when the compressor operates.

[0073] In detail, when the compressor initially operates, the start relay may be turned on. In this case, an inrush current may be limited due to a resistor connected with the start relay in series and thus the parts may be prevented from being burned.

[0074] Meanwhile, as the power is supplied through the start relay, a direct current (DC) link voltage of the compressor driving unit may be raised

[0075] Meanwhile, when the difference between the voltage applied to the compressor power supply unit 320 and the DC link voltage is reduced, the power relay may be turned on.

[0076] In this case, the DC link voltage may be more increased and the inverter may drive the compressor by using the charged DC link voltage.

[0077] Meanwhile, the switching unit 340 may include a pressure switch connector 341 and a pressure switch 342.

[0078] The switching unit 340 may be connected with the relay power supply unit 330 and the relay 321 in series.

[0079] In detail, one end of the power switch 342 may be connected with the relay power supply unit 330 and an opposite end of the pressure switch 342 may be connected with the relay 321.

[0080] The pressure switch connector 341 may be connected with a point for pressure measurement to measure the pressure of the refrigerant and may open/close the pressure switch 342 based on the pressure of the refrigerant.

[0081] In detail, when the pressure of the refrigerant is less than a reference value, the pressure switch 342 is turned on. When the pressure of the refrigerant is greater than the reference value, the pressure switch 342 is turned off.

[0082] Hereinafter, an operation in a normal state and an operation in an abnormal state (erroneous state) will be described.

[0083] In this case, the normal state refers to the state

that the pressure of the refrigerant is less than the reference value, that is, the state that there is no problem in safety. The abnormal state (the erroneous state) may refer to the state that the pressure of the refrigerant is greater than the reference value and thus the operation of the compressor has to be stopped.

[0084] In this case, the pressure of the refrigerant may be measured in a manner of measuring the internal pressure of the compressor. However, the present disclosure is not limited, but the pressure of the refrigerant may be measured at various points allowing the measurement of the pressure of the refrigerant inside the air conditioner. The reference value may be varied depending on the measurement points.

[0085] Hereinafter, the description will be made regarding the operation of the circuit for blocking the operation of the compressor in the normal state.

[0086] Since the present state is the normal state in which the pressure of the refrigerant is less than the reference value, the pressure switch 342 may be maintained in a switching-on state. Accordingly, the pressure switch 342 may be shorted and thus the relay 321 may be connected with the relay power supply unit 330.

[0087] Meanwhile, the micro-computer 360 may control the on/off state of the relay 321. In detail, the micro-computer 360 may output a signal for turning on the relay 321.

[0088] In addition, when the signal for turning on the relay 321 is output, a current path for supplying power to the relay 321 from the relay power supply unit 330 may be formed.

[0089] In detail, when the signal for turning on the relay 321 is output, the path of the relay power supply unit 330, the switching unit 340, and the relay 321 may be connected with the ground. Accordingly, the path of current flowing along the relay power supply unit 330, the switching unit 340, and the relay 321 may be formed.

[0090] In this case, the current may flow through the current path depending on the potential difference between the relay power supply unit 330 and the ground. Accordingly, the power is supplied to the relay 321 and thus the relay 321 may be turned on.

[0091] For example, when the high signal for turning on the relay 321 is output to the micro-computer 360, the current path may be formed and the 15-V power of the relay power supply unit 330 may be applied to the relay coil.

[0092] Accordingly, when the relay 321 is turned on, the AC power may be supplied to the compressor through the compressor power supply unit 320.

[0093] Meanwhile, the forming of the path of the current flowing along the relay power supply unit 330, the switching unit 340, and the relay 321 may refer to that a current may flow as the power supply unit 330, the switching unit 340, and the relay 321 are electrically connected with each other to make the potential difference.

[0094] Accordingly, although description has been made with reference to FIG. 4 in that the switching unit

340 is interposed between the relay power supply unit 330 and the relay 321, the present disclosure is not limited thereto.

[0095] For example, the switching unit 340 may be connected between the relay 321 and the ground, and the connection position is not important.

[0096] In other word, as long as the switching unit 340 is connected with the relay power supply unit 330 and the relay 321 in series, the various positions may be employed for the connection among the switching unit 340, the relay power supply unit 330 and the relay 321.

[0097] Hereinafter, description will be made regarding the operation of the circuit for blocking the operation of the compressor when the compressor is switched to the abnormal state as the pressure of the refrigerant is increased after the operation of the compressor in the normal state.

[0098] In the normal state, the path of the current flowing along the relay power supply unit 330, the switching unit 340, and the relay 321 is formed and thus power is supplied to the relay 321.

[0099] Meanwhile, in the case of the abnormal state (=erroneous state) that the pressure of the refrigerant is greater than the reference value, the pressure switch 342 may be turned off.

[0100] In this case, the pressure switch 342 is open, and thus the current path may be disconnected. In other words, the connection between the relay 321 and the relay power supply unit 330 may be disconnected.

[0101] In this case, the power supplied to the relay coil from the relay power supply unit 330 may be cut off. For example, the voltage of 15 V, which is supplied to the relay coil from the relay power supply unit 330, may be cut off

[0102] Accordingly, the relay 321 may be turned off and thus the supply of the power through the compressor power supply unit 320 may be cut off.

[0103] In this case, the charging of converter power is stopped and thus the driving of the compressor may be stopped.

[0104] Meanwhile, according to the present disclosure, the driving of the compressor may be not stopped in software, but may be stopped in hardware.

[0105] In detail, when the initial charging of the compressor driving unit is completed, the micro-computer 360 may output a signal for turning on the relay 321 and may continuously maintain the outputting of the signal. In addition, the micro-computer 360 may not receive information or data on the pressure of the refrigerant.

[0106] In other words, the micro-computer 360 may output the signal for turning on the relay 321 and may maintain the outputting of the signal, regardless of the pressure of the refrigerant.

[0107] Meanwhile, while the micro-computer 360 outputs the signal for turning on the relay 321, the pressure switch 342 is turned off to disconnect the current path, when the pressure of the refrigerant is equal to or greater than the reference value.

[0108] In other words, even though the micro-computer 360 outputs the signal for turning on the relay 321, the power supplied to the compressor may be cut off through the operation of the power switch 342.

[0109] Conventionally, the internal temperature of the compressor is measured and the operation of the compressor is controlled depending on the measured temperature. However, in this manner, the pressure of the refrigerant directly causing the explosion of the refrigerant may not be measured. Accordingly, the calculation procedure of converting the temperature to the pressure is necessary.

[0110] However, according to the present disclosure, the pressure of the refrigerant is directly measured and the operation of the compressor is blocked based on the pressure. Accordingly, the operation of the compressor may be rapidly and exactly stopped within time points sufficient for avoiding the explosion hazard.

[0111] In addition, conventionally, in the manner for blocking the operation of the compressor in software, data is acquired through the sensor and the micro-computer controls signal output based on the data value, thereby stopping the operation of the compressor.

[0112] However, such a software control does not satisfy the safety standard of nations to require the installation of a safety device operating mechanically at least in a part thereof and may not cope with the failure in the micro-computer, the pressure sensor, the temperature sensor, or the like.

[0113] However, according to the present disclosure, since the operation of the compressor is stopped through a hardware control manner of opening or closing the pressure switch based on pressure, the safety standard required when using an eco-friendly refrigerant, such as R32, may be satisfied and the operation of the compressor may be stopped in spite of the failure in the micro-computer, the pressure sensor, the temperature sensor, or the like.

[0114] FIGS. 5A and 5B are views illustrating a pressure switch state sensing unit according to an embodiment of the present disclosure.

[0115] The circuit 300 for blocking the operation of the compressor may include the pressure switch state sensing unit 350 to determine the on/off state of the pressure switch.

[0116] The pressure switch state sensing unit 350 may include a light emitting element connected with the primary side, that is, the pressure switch 342. In this case, the light emitting element may include a light emitting diode LED.

[0117] In addition, the pressure switch state sensing unit 350 may include a light receiving element connected with the secondary side, that is, the micro-computer 370. In this case, the light receiving element may be at least one of a photo-diode, a photo-transistor, an optical thyristor, and an optoelectronic integrated circuit (OEIC).

[0118] Hereinafter, the operation of the pressure switch state switching unit in the normal state will be de-

scribed.

[0119] Since the present state is the normal state that the pressure of the refrigerant is less than a reference value, the pressure switch 342 may be maintained in a switching-on state. Accordingly, the pressure switch 342 may be shorted and thus the relay power supply unit 330 may be connected with the light emitting element.

[0120] Meanwhile, when the pressure switch 342 is in the switching-on state, a current path for supplying power to the light emitting element from the relay power supply unit 330 may be formed.

[0121] In detail, the path of a current flowing along the relay power supply unit 330, the switching unit 340, and the light emitting element may be formed.

[0122] In this case, the current may flow through the current path due to the potential difference between the relay power supply unit 330 and the ground. Accordingly, as power is supplied to the light emitting element, the light emitting device may emit light.

[0123] Meanwhile, as the current path is formed, the light emitting element emits light. When the emitted light is received by the light receiving element, a pressure switch state sensing unit 350 may output a first signal to the micro-computer 370. In this case, the first signal may be a high signal.

[0124] Meanwhile, the micro-computer 370, which has detected the first signal, may determine that the present pressure switch is in the switching-on state, that is, the normal state.

[0125] Hereinafter, the operation of the pressure switch state sensing unit in the abnormal state will be described.

[0126] When the pressure switch 342 is in a switching-off state, the current path for supplying the power to the light emitting element from the relay power supply unit 330 may be disconnected.

[0127] Therefore, as the supply of the power to the light emitting element is cut off, the light emitting element may not emit light.

[0128] Meanwhile, when light is not received in the light receiving element as the current path is disconnected, the pressure switch state sensing unit 350 may output a second signal to the micro-computer 370. In this case, the second signal may be a low signal.

[0129] Meanwhile, the micro-computer 370, which has detected the second signal, may determine that the pressure switch is currently in the off state, that is, the abnormal state.

[0130] When the abnormal state is sensed, the micro-computer 370 may transmit error information to the outside.

[0131] For example, when the abnormal state is sensed, the micro-computer 370 may transmit the error information to the indoor unit. In this case, the indoor unit may output a message representing the abnormal state based on the received error information.

[0132] For another example, when the abnormal state is sensed, the micro-computer 370 may transmit the error

information to a server at the side of a service company. In this case, the service company may notify the abnormal state to a customer or may determine whether to repair the air conditioner, based on the error information.

[0133] As described above, according to the present disclosure, the message representing the erroneous state or the normal state is output based on the opening/closing of the pressure switch, thereby notifying a user of whether or not the stop in the operation of the air conditioner is a normal operation performed to reduce the pressure of the refrigerant and does not mean a failure.

[0134] In addition, according to the present disclosure, the error information may be transmitted to the service company based on whether the pressure switch is open or closed, which allows the service company to detect the state of the air conditioner and to properly manage the air conditioner.

[0135] FIG. 6 is a view illustrating the circuit for blocking the operation of the compressor coupled to the pressure switch state sensing unit according to an embodiment of the present disclosure.

[0136] All descriptions made with reference to FIGS. 4, 5A, and 5B may be applied to the circuit for blocking the operation of the compressor illustrated in FIG. 6.

[0137] In addition, although FIG. 6 illustrates that the micro-computer 360 and a second micro-computer 370 are provided separately from each other, the present disclosure is not limited thereto.

[0138] In detail, according to the present disclosure, one micro-computer 360 may be provided. In this case, one micro-computer 360 may perform functions of the second micro-computer 370.

[0139] For example, the pressure switch state sensing unit 350 is connected with the micro-computer 360 to output the first signal and the second signal to the micro-computer 360. In addition, the micro-computer 360 may transmit the error information to the outside.

[0140] Meanwhile, the pressure switch state sensing unit 350 may be connected with the path of a current flowing along the relay power supply unit 330, the switching unit 340, and the relay 321.

[0141] In detail, the light emitting element of the pressure switch state sensing unit 350 may be parallel-connected with the path of the current flowing along the relay power supply unit 330, the switching unit 340, and the relay 321, but the present disclosure is not limited thereto. Alternatively, the light emitting element of the pressure switch state sensing unit 350 may be connected with the current path in series.

[0142] Hereinafter, the operation of the circuit for blocking the operation of the compressor in the normal state will be described.

[0143] Since the present state is the normal state where the pressure of the refrigerant is less than the reference value, the pressure switch state sensing unit 350 may be maintained in the switching-on state. Accordingly, the pressure switch 342 may be shorted and thus the

relay 321 may be connected with the relay power supply unit 330.

[0144] Meanwhile, when the signal for turning on the relay 321 is output from the micro-computer 360, the path of the current flowing along the relay power supply unit 330, the switching unit 340, and the relay 321 may be formed.

[0145] In this case, the relay 321 may be turned on and the AC power may be supplied to the compressor through the compressor power supply unit 320.

[0146] As the pressure switch state sensing unit 350 is connected with the current path, the path of the current flowing along the relay power supply unit 330, the switching unit 340, and the light emitting element may be formed.

[0147] In this case, as power is supplied to the light emitting element, the light emitting element may emit light. The second micro-computer 370 may determine the pressure switch to be currently in the switching-on state, that is, the normal state, based on the signal output the pressure switch state sensing unit 350.

[0148] Hereinafter, description will be made regarding the operation of the circuit for blocking the operation of the compressor when the compressor is switched to the abnormal state as the pressure of the refrigerant is increased after the operation of the compressor in a normal state.

[0149] When the abnormal state (erroneous state) happens in which the pressure of the refrigerant is greater than the reference value, the pressure switch 342 may be switched off.

[0150] In this case, the pressure switch 342 is switched off and the preset current path may be disconnected.

[0151] In detail, the connection between the relay 321 and the relay power supply unit 330 may be disconnected. In addition, the connection between the pressure switch state sensing unit 350 and the relay power supply unit 330 may be disconnected.

[0152] In this case, the power supplied to the relay coil from the relay power supply unit 330 is cut off, the relay 321 is turned off, and the supply of the power from the compressor power supply unit 320 is also cut off.

[0153] In addition, the power, which is supplied from the relay power supply unit 330 to the light emitting element provided inside the pressure switch state sensing unit 350, may be cut off and thus the pressure switch state sensing unit 350 may output the second signal to the second micro-computer 370. In this case, the second micro-computer 370 may transmit error information to the outside.

[0154] Meanwhile, when the pressure of the refrigerant becomes less than the reference value again, the pressure switch may return to be switched on.

[0155] In this case, the path of current flowing along the relay power supply unit 330, the switching unit 340, and the light emitting element may be formed again. In this case, the pressure switch state sensing unit 350 may transmit the first signal to the micro-computer 360.

[0156] Meanwhile, when receiving the first signal, the micro-computer 360 may stop transmitting the error information. In this case, the indoor unit may stop outputting the message representing the abnormal state.

[0157] In addition, when the first signal is received, the micro-computer 360 may restart the compressor and thus power may be supplied to the compressor, again.

[0158] As described above, according to the present disclosure, when the pressure state is abnormal, the operation of the compressor may be blocked through only the simple structure of connecting the pressure switch to the path of the current flowing the relay power supply and the relay. Accordingly, costs may be saved.

[0159] In addition, according to the present disclosure, the pressure switch state sensing unit is connected to the path of a current flowing along the relay power supply unit, the switch, and the relay, thereby transmitting the error information to the outside without an additional circuit configuration. Accordingly, costs may be saved.

[0160] Meanwhile, hereinafter, the operation method of the circuit 300 for blocking the operation of the compressor will be described.

[0161] According to an embodiment of the present disclosure, the operation method of the circuit 300 for blocking the operation of the compressor may include the steps of outputting a signal for turning on the relay 321 by the micro-computer 360, applying power to the relay 321 to turn on the relay 321 by the relay power supply unit 330, supplying power to the compressor by the compressor power supply unit 320 when the relay is turned on, and blocking power applied to the relay 321 by the switching unit 340, based on the pressure of the refrigerant.

[0162] In this case, the outputting of the signal for turning on the relay 321 may include forming the path of a current flowing along the relay power supply unit 330, the switching unit 340, and the relay 321 by outputting the signal for turning on the relay 321.

[0163] In this case, the pressure switch 342 may disconnect the current path as the pressure switch 342 is turned off when the pressure of the refrigerant is equal to or greater than the reference value while the signal for turning on the relay 321 is being output.

[0164] Meanwhile, the operation method of the circuit 300 for blocking the operation of the compressor may include determining the on/off state of the pressure switch 342 based on the signal output by the pressure switch state sensing unit 350 which is connected with the pressure switch 342.

[0165] Meanwhile, the operation method of the circuit 300 for blocking the operation of the compressor may include outputting the first signal to the micro-computer 360 by the pressure switch state sensing unit 350 when the current path is formed, outputting the second signal to the micro-computer 360 by the pressure switch state sensing unit 350 when the current path is disconnected, and transmitting error information to the outside by the microcomputer 360 when the second signal is received.

[0166] The present disclosure mentioned in the fore-

going description may be implemented with computer-readable codes on a recording medium having a program. A computer-readable medium includes all types of recording apparatuses having data readable by a computer system. Examples of computer-readable media include a hard disk drive (HDD), a solid state disk (SSD), a silicon disk drive (SDD), a ROM, a RAM, a CD-ROM, a magnetic tape, a floppy disk, an optical data storage device, or the like. In addition, the computer may include a controller of a terminal. Accordingly, the above description should not be limitedly understood, but is provided only for the illustrative purpose. The scope of the present disclosure is determined by reasonably interpreting the attached claims and all equivalents and all modifications are possible falling within the scope of the present disclosure.

Claims

1. A circuit for blocking an operation of a compressor configured to compress a refrigerant, the circuit comprising:

a compressor power supply unit (320) including a relay (321) to supply power to the compressor when the relay (321) is turned on;

a micro-computer (360) to control an on/off state of the relay (321);

a relay power supply unit (330) to apply power to the relay (321); and

characterized in that:

a switching unit (340) to cut off the power applied to the relay (321), based on pressure of the refrigerant.

2. The circuit of claim 1, wherein the switching unit (340) includes a pressure switch (342) which is switched off when the pressure of the refrigerant is equal to or greater than a reference value.

3. The circuit of claim 2, wherein the micro-computer (360) outputs a signal for turning on the relay (321), which allows to form a path of a current flowing along the relay power supply unit (330), the switching unit (340) and the relay (321).

4. The circuit of claim 3, wherein the pressure switch (342) is switched off to disconnect the path of the current when the pressure of the refrigerant is equal to or greater than the reference value, while the micro-computer (360) outputs the signal for turning on the relay (321).

5. The circuit of claim 3 or 4, further comprising: a pressure switch state sensing unit (350) connected with the path of the current to determine an on/off state of the pressure switch (342).

6. The circuit of claim 5, wherein the pressure switch state sensing unit (350) includes:

a light emitting element connected with the path of the current; and
a light receiving element connected with the micro-computer (360).

7. The circuit of claim 5 or 6, wherein the pressure switch state sensing unit (350):

outputs a first signal to the micro-computer (360) when the path of the current is formed; and
outputs a second signal to the micro-computer (360) when the path of the current is disconnected, and
wherein the micro-computer (360) transmits error information to an outside when the second signal is received.

8. An air conditioner (100) including an outdoor unit (20) which comprises:

a compressor (102) compressing a refrigerant;
an outdoor-unit heat exchanger (104) which radiates heat from compressed refrigerant;
an outdoor-unit air blower (105) including an outdoor fan (105a) which is provided at one side of the outdoor-unit heat exchanger (104) to promote the heat radiation from the refrigerant, and
an electric motor (105b) which rotates the outdoor fan (105a); and
the circuit according to any one of claims 1 to 7.

9. An operation method of a circuit for blocking an operation of a compressor configured to compress a refrigerant, the operation method comprising:

Outputting, by a micro-computer (360), a signal for turning on a relay;
Applying, by a relay power supply unit (330), power to the relay (321) to turn on the relay (321);
Supplying, by a compressor power supply unit (320), power to the compressor when the relay (321) is turned on; and
characterized in that:
cutting off, by a switching unit (340), the power applied to the relay (321) based on pressure of the refrigerant.

10. The operation method of claim 9, wherein the cutting off of the switching unit (340) is performed by switching off a pressure switch (342) included in the switching unit (340), when the pressure of the refrigerant is equal to or greater than a reference value.

11. The operation method of claim 10, wherein the out-

putting of the signal for turning on the relay (321) comprises:

forming a path of a current flowing along the relay power supply unit (330), the switching unit (340) and the relay (321) by outputting a signal for the turning on the relay (321).

12. The operation method of claim 11, wherein the pressure switch (342) is switched off to disconnect the path of the current when the pressure of the refrigerant is equal to or greater than the reference value, while the micro-computer (360) outputs the signal for turning on the relay (321).

13. The operation method of claim 11 or 12, wherein the circuit includes a pressure switch state sensing unit (350) connected with the path of the current, and wherein the operation method further comprises: determining an on/off state of the pressure switch (342) based on a signal output from the pressure switch state sensing unit (350).

14. The operation method of claim 13, wherein the pressure switch state sensing unit (350) includes:

a light emitting element connected with the path of the current; and
a light receiving element connected with the micro-computer (360).

15. The operation method of claim 13 or 14, further comprising:

outputting, by the pressure switch state sensing unit (350), a first signal to the micro-computer (360) when the path of the current is formed, and outputting, by the pressure switch state sensing unit (350), a second signal to the micro-computer (360) when the path of the current is disconnected; and
transmitting, by the micro-computer (360), error information to an outside when the second signal is received.

FIG. 1

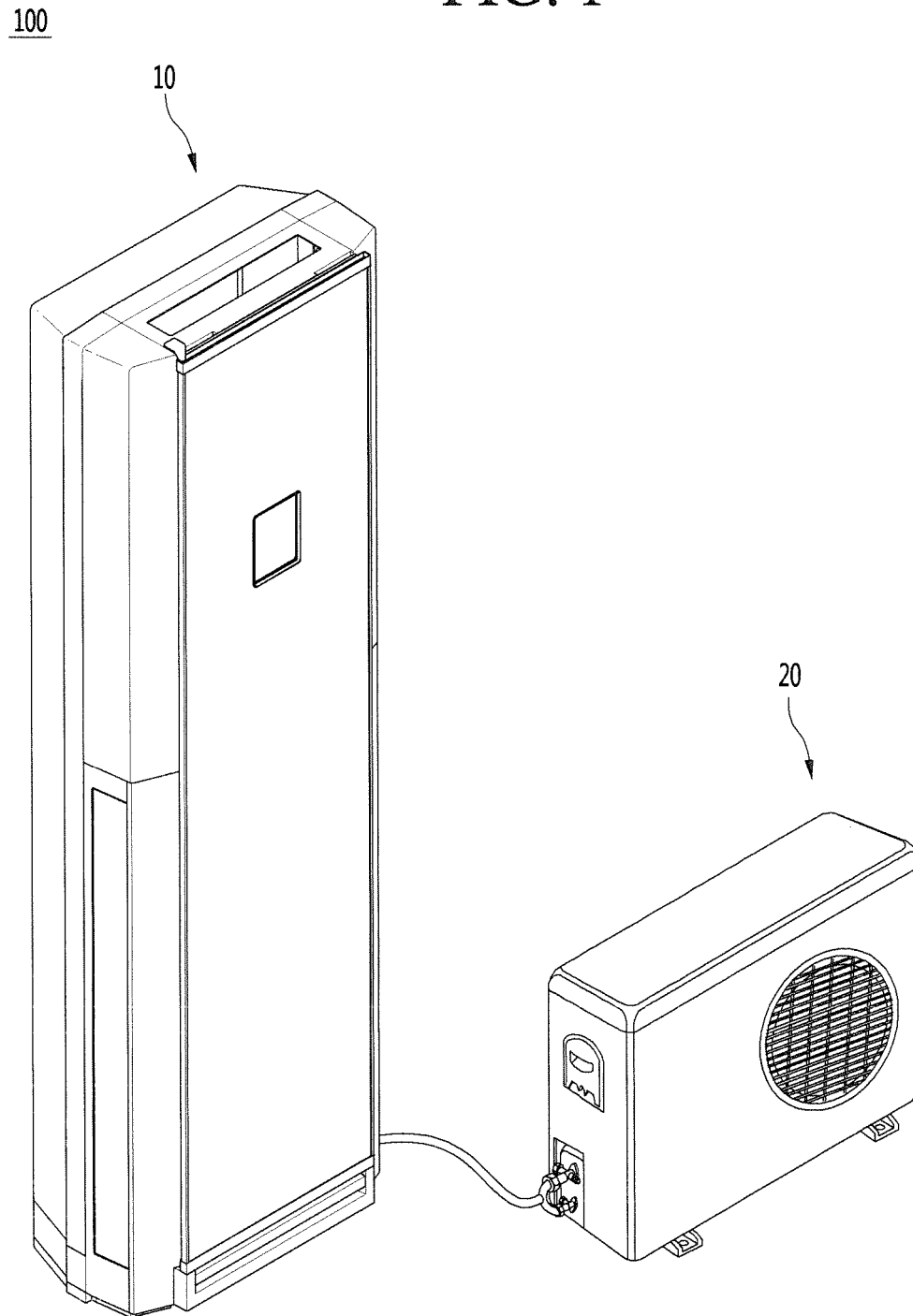


FIG. 2

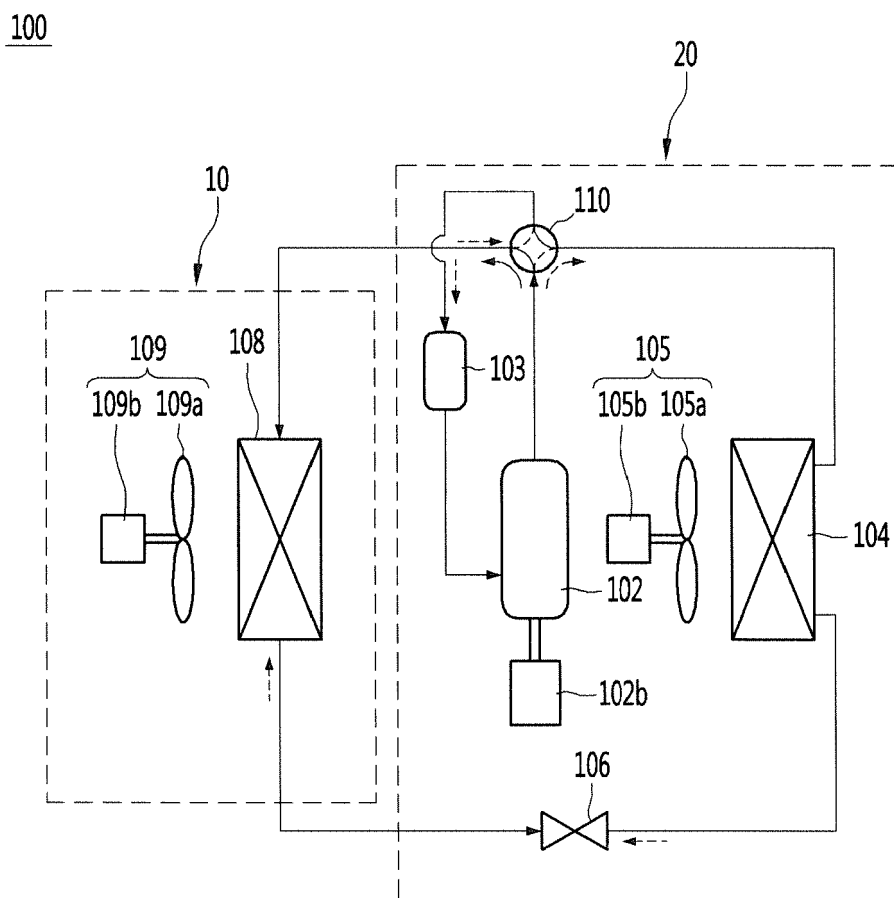


FIG. 3

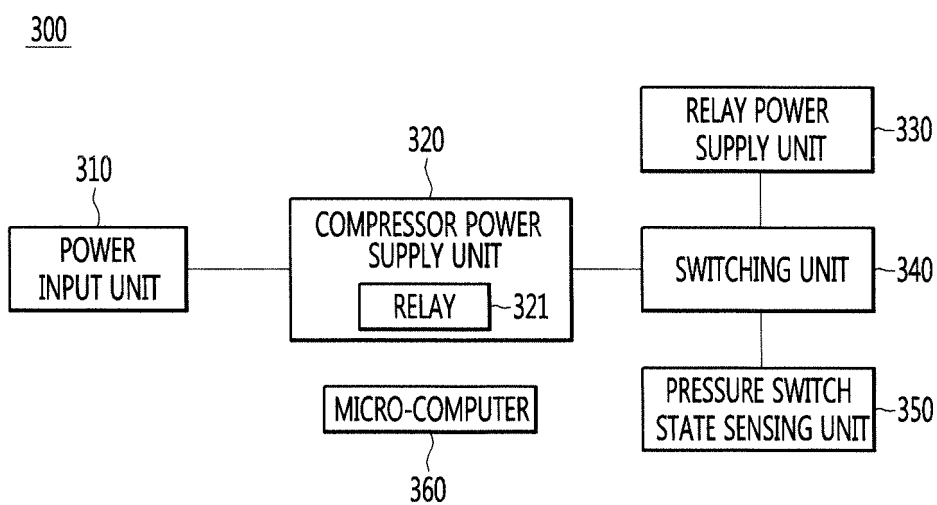


FIG. 4

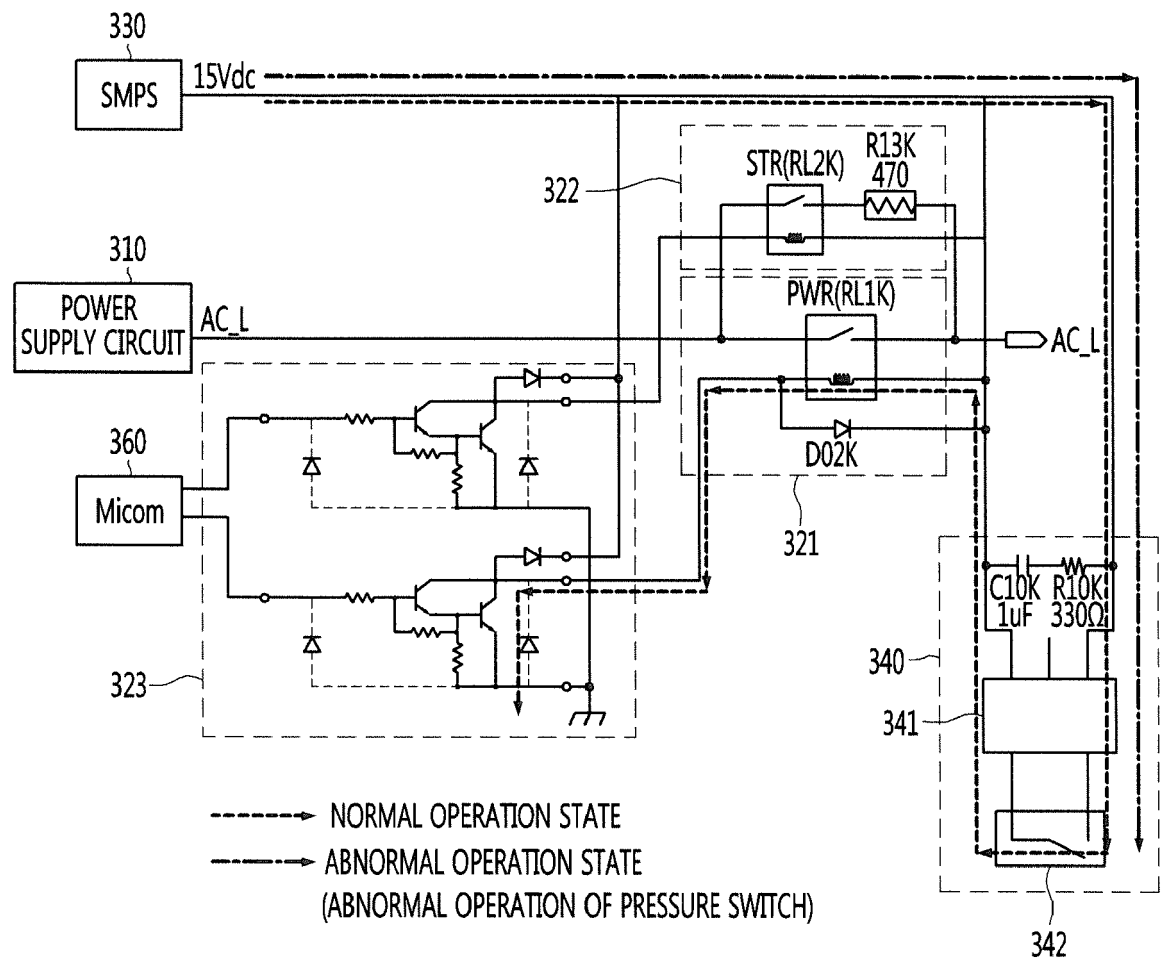


FIG. 5A

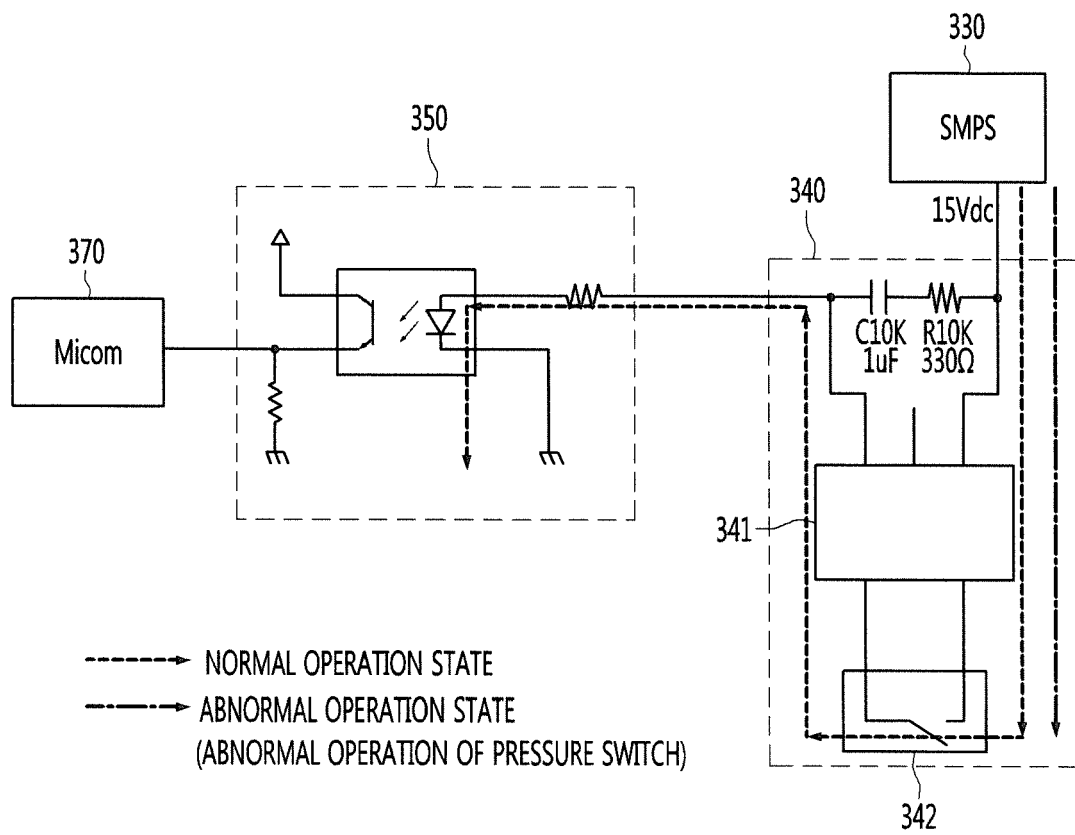


FIG. 5B

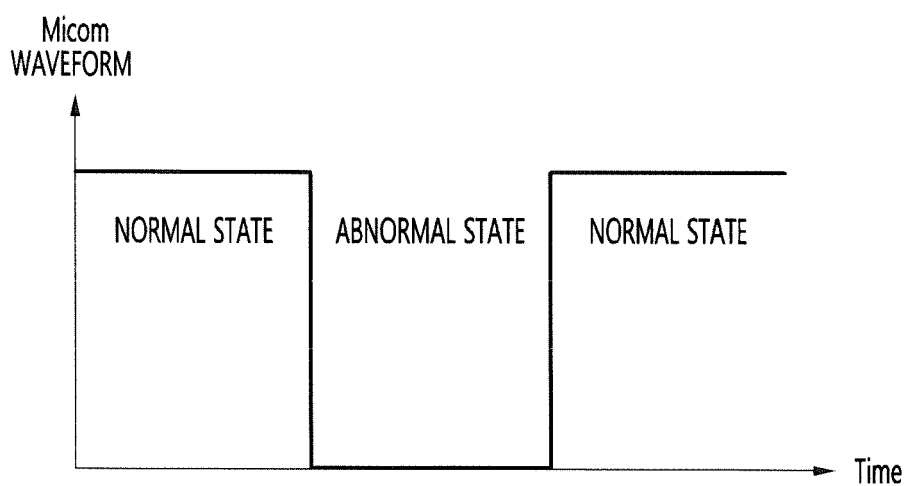
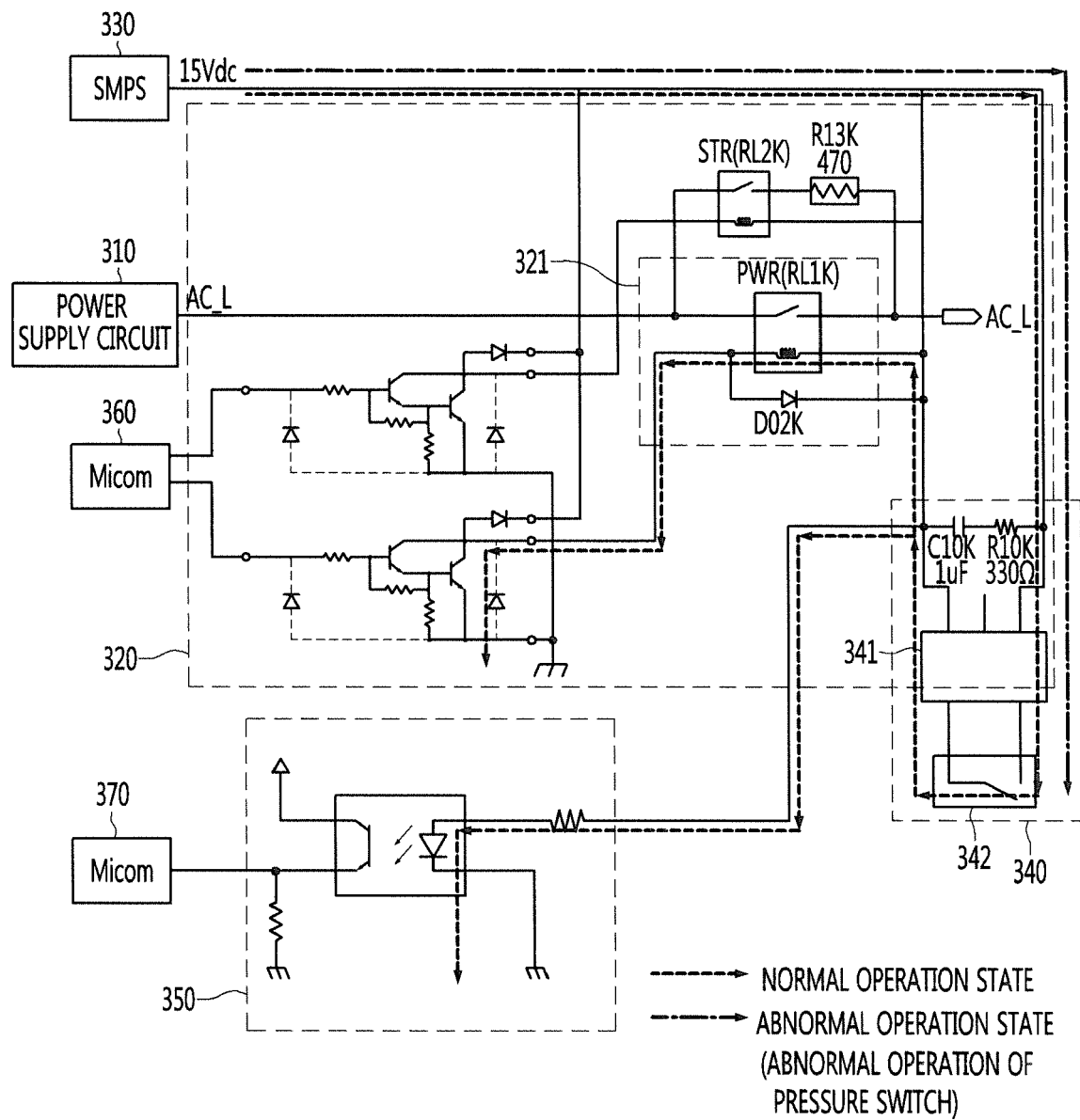


FIG. 6





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Place of search Munich		Date of completion of the search 18 July 2018	Examiner Weisser, Meinrad
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