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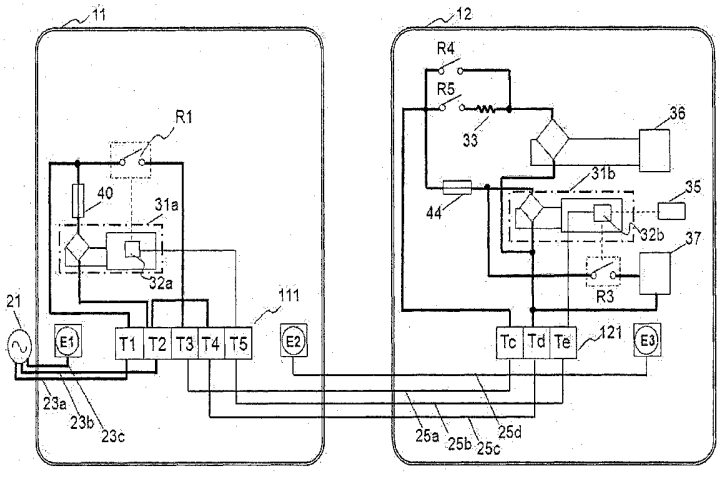
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(54) Title: AIR CONDITIONER



(57) Abstract: There is disclosed an air conditioner having feature that reduces standby power consumption and comprises of an indoor unit (11) having an indoor terminal board (111), a power supply means (21) adapted for powering the indoor unit (11) via terminal slots (Tl, T2), a relay (Rl) connected from a live line (23a) of the power supply means (21) to a second terminal (T3) via the terminal slot (Tl); and an outdoor unit (12) having an outdoor terminal board (121); characterized in that the. terminal slot (Tl) is a multifunctional terminal slot and the relay (Rl) is being connected from the terminal slot (Tl) to the second terminal slot (T3) of the indoor terminal board (111), wherein relay (Rl) is a power relay operates to switch on the outdoor unit (12) for operation and periodically determine the status of the outdoor unit (12). A second relay (R2) of the silent type is connected across the first relay (R2) and the relay (R2) is adapted to only operate during standby state to switch on the outdoor unit (12) for periodically determining its status.

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AIR CONDITIONER

1.0 TECHNICAL FIELD OF THE INVENTION

The present invention relates generally to an air conditioner. More particularly, this invention relates to an air conditioner which is capable of reducing its standby power consumption.

2.0 BACKGROUND OF THE INVENTION

An air conditioner involves three major components i.e., a compressor, an outdoor heat exchanger (also known as a condenser in cooling mode), an indoor heat exchanger (also known as an evaporator in cooling mode) and an expansionary device such as capillary tube to compose a refrigerating cycle.

In the field of air conditioning system, split-type air conditioner is the most typical air conditioning system installed in the residential and commercial applications. Split-type air conditioner comprises of at least an indoor unit and an outdoor unit. The outdoor unit is connected via refrigerant piping to one (typically known as single-split) or more (typically known as multi-split) indoor units. Split-type air conditioner requires electrical power to be supplied to both indoor and outdoor unit. The electrical power connections are typically made either via a terminal block of the indoor unit or via a terminal block of the outdoor unit.

A drawback of the split-type air conditioner is the higher consumption of standby energy. Split-type air

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conditioner endures higher consumption of standby power due to, for example the constant communication between the indoor and the outdoor unit. In this respect, standby power is defined as the energy consumed by appliances when they are not performing their main functions or when they are switched off by remote controller.

Application in some countries where the air conditioner is further equipped with a crankcase heater, it will impose even higher standby power consumption. The purpose of the crankcase heater is to prevent refrigerant migration and mixing with crankcase lubricant, when the unit is off, and to prevent too much condensation of refrigerant in the crankcase of a compressor. It is designed to keep the bottom part of the compressor where lubricant is accumulated at a temperature higher than the coldest part of the system. The reason that the crankcase heater imposing higher standby power consumption is that the crankcase heater is normally on even during the off cycle to warm the refrigerant, to reduce refrigerant migration, and to ensure proper compressor lubrication. If the air conditioner unit is started up without warming the crankcase, the lubricant and refrigerant will be pumped out of compressor which could damage or severely reduce the operational life of the compressor.

It is therefore desirable for the present invention to provide an air conditioner capable of minimizing standby power consumption where such air conditioner includes an indoor unit (11), and at least a relay (R1) to switch power supply from indoor unit to

outdoor unit; and an outdoor unit (12). The relay (R1), which preferably a normal relay typically known in the art. Besides being used for running the outdoor unit in normal operation, the relay (R1) is also controlled by the microprocessor (32a) which periodically determine the status of the outdoor unit throughout the operation such as determining the environment temperature of the of outdoor unit (12). Yet, it is also preferable that another relay (R2) is connected across the same node and preferably the relay (R2) is of a silent type, this silent relay (R2) will only be operated during standby state of the air conditioner to periodically switch and supply power to the outdoor unit (12) for certain operational check such as determining the operation of the crankcase heater. Further, the live line (23a) and the neutral line (23b) are provided with fuses (41, 42) to cut off power connection upon incorrect wiring arrangement. Advantageously, such design would be able to prevent damage to the components due to mismatched/incorrect wiring connection. The features just described are specifically preferred for an indoor power supply arrangement where the same power source is also used to provide power supply arrangement to the outdoor unit (12).

On the other hand, an outdoor power supply arrangement may also be arranged where the power source (22) is connected to the outdoor unit (12) through an outdoor terminal board (121) first and another connection is made from the outdoor terminal board (22) to the indoor terminal board (21) through a preferred connection arrangement. Similarly,

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relays and fuses are connected in the circuit that apart from providing the necessary system on and status check, prevent incorrect wiring connection from being allowed to energize the air conditioning system. Such outdoor power supply arrangement is generally preferred for the multi-split indoor units air conditioning arrangement.

The discussion of the background to the invention included herein including reference to documents, acts, materials, devices, articles and the like is included to explain the context of the present invention. This is not to be taken as an admission or a suggestion that any of the material referred to was published, known or part of the common general knowledge in Australia or in any other country as at the priority date of any of the claims.

3.0 SUMMARY OF THE INVENTION

It is an aspect of the present invention to provide an air conditioner capable of minimizing standby power consumption. It is another aspect of the present invention to provide an air conditioner capable of preventing damage of components due to mismatched load.

Yet, it is another aspect of the present invention to provide an air conditioner that incorporated having a convenient terminal board arrangement for the indoor and outdoor unit where mismatched or incorrect wiring arrangement is conveniently prevented from operating the air conditioner thus eliminating damage possibility to the air conditioner system.

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According to an aspect of the present invention, there is provided an air conditioner comprising:

an indoor unit having an indoor terminal board, a power supply means adapted for powering said indoor unit via a plurality of terminal slots that are arranged on said indoor terminal board, a relay connected from a live line of said power supply means to a second terminal slot via a first terminal slot; and

an outdoor unit having an outdoor terminal board;

wherein said relay is connected from said first terminal slot to said second terminal slot of said indoor terminal board, wherein said relay being a power relay and operates to switch on said outdoor unit for operation and periodically switches on to determine the status of said outdoor unit during the entire operation of the air conditioner.

According to another aspect of the present invention, there is provided an air conditioner comprising:

an indoor unit having an indoor terminal board, and an outdoor unit having an outdoor terminal board; and

a power supply means adapted for powering said outdoor unit via terminal slots arranged on said outdoor terminal board and for providing power supply to said indoor unit via said indoor terminal board, a relay connected between a first terminal

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slot to a second terminal slot of said indoor terminal board;

wherein said terminal slot is a multifunctional terminal slot and said relay is connected from said first terminal slot to said second terminal slot of said indoor terminal board, wherein said relay being a power relay operates to switch on said outdoor unit for operation and periodically determine the status of said outdoor unit during the entire operation of the air conditioner.

Preferably, the live line and the neutral line from the indoor terminal board slot being provided with fuses adapted to cut off power supply connection upon incorrect wiring arrangement made in the circuit.

Preferably, relay is connected in parallel with the relay and relay being a silent type relay.

Also preferable, relay being connected from the terminal slot to the terminal slot and the terminal slot is connected to the terminal slot, relay adapted to only operate during a standby state to switch on the outdoor unit for periodically determining the status of the aid outdoor unit.

Also preferable, relay being provided with a thermistor as inrush-current protection.

4.0 BRIEF DESCRIPTION OF THE DRAWINGS

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Other aspect of the present invention and their advantages will be discerned after studying the Detailed Description in conjunction with the accompanying drawings in which:

Figure 1 shows a circuit diagram representation of an indoor power supply arrangement of an air conditioner according to the first embodiment of the present invention.

Figure 2 shows flow chart representation of control for an air conditioner in standby mode.

Figure 3 shows a circuit diagram representation of an indoor power supply air conditioner according to the second preferred embodiment of the present invention.

Figure 4 shows flow chart representation of control for air conditioner in standby mode having at least a power relay and silent relay according to the second preferred embodiment of the present invention.

Figure 5 shows a circuit diagram representation of an indoor power supply air conditioner according to

the third preferred embodiment of the present invention.

Figure 6, shows yet another preferred embodiment of the present invention.

Figure 7 shows an example of incorrect wiring arrangement for which the embodiments of the present invention are expected to mitigate.

5.0 DETAILED DESCRIPTION OF THE DRAWINGS

In the broadest aspect of the invention, the air conditioner is capable of reducing standby power consumption and comprises of an indoor unit (11) having an indoor terminal board (111), a fuse (40) which protects rectifier circuit (31a) from over current connected between a live line (23a) to a neutral line (23b) through a rectifier circuit (31a) and preferably, as in one of the preferred embodiments, a relay (R1) and a silent relay (R2) connected through the live line (23a) to a terminal slot (Tc) of the outdoor terminal board (121) of an outdoor unit (12) through the terminal T3 on the indoor terminal board (111) . The relay (R1) and the silent relay (R2) are made connected from a terminal slot (T1) to terminal slot (Tc) of the outdoor terminal board. Besides being used for running the outdoor unit for normal operation, the relay (R1) is also use to periodically determine the status of the outdoor unit throughout the operation. On the other hand, the silent relay (R2) only operates during standby state to periodically switching on the outdoor unit for certain operation check such as

determining the operation of the crankcase heater, beside the power relay to run the whole outdoor unit. Further, earth line is provided for the purpose of grounding or earthing of the air conditioner system.

Referring first to Figure 1 where a circuit diagram representation of an indoor power supply air conditioner system according to one embodiment of the present invention is shown. The air conditioner includes an indoor unit (11), an outdoor unit (12) and an indoor power supply (21). The indoor unit (11) is provided with an indoor terminal board (111), fuse (40), a live line (23a), a neutral line (23b), earth line (23c) to be connected to the indoor earth terminal (E1), a rectifier circuit (31a) and a relay (R1) while the outdoor unit (12) is provided with an outdoor terminal board (121). The fuse (40) is connected between the live line (23a) to the neutral line (23b) through the rectifier circuit (31a).

The indoor terminal board (111) consists of indoor terminal slot (T1) through (T5) meanwhile the outdoor terminal board (121) consists of terminal slots (Tc), (Td) and (Te). The indoor unit (11) and the outdoor unit (12) are connected through the terminal slot (T3), (T4) and (T5) of the indoor terminal board (111) and outdoor terminal slot (Tc) , (Td) , (Te) of the outdoor terminal board (121) using the connecting wire (25a) to supply power source from indoor unit (11) to outdoor unit (12), (25b) as the neutral line and (25c) to be connected to communicate between the indoor

microprocessor (32a) and outdoor microprocessor (32b) accordingly. Indoor earth terminal (E2) and outdoor earth terminal (E3) are also connected using the connecting wire (25d) each other.

Outdoor unit (12) also includes the electric circuit shown in Figure 1 and further includes a fuse (44) which protects rectifier circuit (31b) from over current ,compressor (36) , crank case heater (37) to be installed on the compressor , relay (R3) to switch power supply to the crank case heater (37) , microprocessor (32b) to control the devices in the outdoor unit (12) , outdoor temperature sensor (35) to detect outdoor temperature around the outdoor unit connected to the outdoor microprocessor (32b) and relay (R4 and R5) which are also controlled by outdoor microprocessor (32b) to regulate to supply source power.

In this system when air conditioner is operated to exercise its function , according to the operation indoor relay (R1) is closed and power source is supplied to the outdoor unit and outdoor microprocessor (32b) controls every devices such as fan , compressor (not shown) ,and so on.
On the other hand when the air conditioner is in standby mode , power supply for outdoor unit (12) is cut off by indoor relay (R1) under the control of indoor microprocessor (32a) in order to save energy consumption in outdoor unit. Then, while in standby mode, indoor microprocessor (32a) periodically detect the necessity to activate the function of crank case heater (37).

Control during standby mode is described using Figure 2.

Referring now to Figure 2 where the figure is to be read together with Figure 1. In this respect, indoor relay (R1) will be turn on to supply power to the outdoor microprocessor (32b) to check the outdoor air temperature (t-out) during air conditioner in standby mode (S101). Upon relay (R1) turn on, the system will check whether outdoor air temperature (t-out) is less than t1 (S102) and if t-out > t1, then relay (R1) will be turned off and wait for a period set by timer 1 to lapse before relay (R1) is turned on to check the outdoor temperature again. If t-out < t1 and t-out< t2 at (S103) relay (R1) will be turned off and wait for a period set by timer 2 to lapse before turning on R1 to check the outdoor temperature again.

If t2 > t-out > t3 as in (S104), relay (R1) will be turned off and wait for a period of time set by timer 3 to lapse before tuning on R1 to check the outside temperature again. If t-out < t3 as in (S105), relay R1 will be continuously turned on. Relay (R3) and crankcase heater (37) of the outdoor unit (12) will be on and heater will be functioning. Relay (R3) and crankcase heater (37) will be turned off if t-out > t4 at (S106). At this stage, relay (R1) will turned off and waiting for a period as set by timer 3 to lapse before it is turned on again to check the outdoor air temperature as in (S101). The process will be repeated again according to the system setting. In this respect, t1>t2>t4>t3 and timer 1>timer 2>timer 3.

Next the second example of the invention is shown using Figure 3 and 4. Here the relay (R1) is a normal or power relay type whereas the second relay (R2) is a silent relay type and are made connected from the terminal slot (T1) to terminal slot (T3) of the indoor terminal board. In normal operation, the silent relay (R2) is turned off. In contrast, the relay (R1) is used to connect between the terminal slot (T1) and terminal slot (T3) of the indoor terminal board (111) in order to supply power to whole outdoor unit (12) for operation. Besides, the relay (R1) is also adapted for periodically determining the status of the outdoor unit (12) during the entire operation. On the other hand, when the air conditioner is put in the standby state, the silent relay (R2) would overtake the function of the relay (R1) to periodically switch on the outdoor unit (12) for determining the status of the outdoor unit (12). Such silent relay (R2) would advantageously eliminates the somewhat louder sound of using relay (R1) when they operate. Besides, the use of the silent relay (R2) to overtake the function of the relay (R1) in standby state would also provide a measure to increase the lifespan of the relay (R1). Furthermore, power supply to the outdoor unit is cut off completely when the silent relay (R2) is not in operation thereby resulting in reduction of standby power consumption. The execution of the silent relay (R2) operation is regulated by a control means or microprocessor (32a). Further, the silent relay (R2) is provided with a connection to a thermistor (34) to reduce inrush current that can damage the silent relay (R2). The thermistor (34) is preferably a negative

temperature coefficient (NTC) thermistor.

Referring now to Figure 4 where a flow chart representation of control for air conditioner in standby mode having at least relay (R1) and silent relay (R2) configured according to the second preferred embodiment of the present invention as shown in Figure 3 and Figure 5. In this respect, the operation flow chart is generally the same as in Figure 2 except that the relay (R2) is of the silent type. There will be 4 scenarios where the process in Figure 4 takes place.

Scenario 1.

If t-out > t1, relay (R2) will be turned off and it will wait a period of time to lapse as set by timer 1 before R2 is turned on to check the outdoor temperature again.

Scenario 2.

If t1 > t-out > t2 at (S202) relay (R2) will be turned off and wait for a period set by timer 2 to lapse before turning on R2 to check the outdoor temperature again.

Scenario 3.

If t2 > t-out > t3 as in (S203), relay (R2) will be turned off and wait for a period set by timer 3 to lapse before turning on relay (R2) again to check the outside temperature.

Scenario 4.

If t-out < t3 as in (S205), relay (R2) will be continuously turned on. Relay (R3) and crankcase heater (37) of the outdoor unit (12) will be on and heater will be functioning. Relay (R3) and crankcase heater (37) will be turned off if t-out > t4 at (S206). At this stage, relay (R2) will turned off and waiting for a period as set by timer 3 to lapse before it is turned on again to check the outdoor air temperature as in (S101). The process will be repeated again according to the system setting. In this respect, t1>t2>t4>t3 and timer 1>timer 2>timer 3.

Figure 5 show another preferred embodiments of the present where the pair of relays (R1 and R2) are incorporated in the circuit. The operation of the particular circuit is as earlier described. For further protection, the live line (23a) and the neutral line (23b) may be further provided with another fuses (41, 42) for cutting off connection upon incorrect wiring arrangement. Although the above discloses a complete arrangement of a circuit for an air conditioner, the above can also be implemented independently. In this regard, the relay (R1) can also be operated and used for periodically checking the status of the outdoor unit (12) without the presence of the silent relay (R2) as mentioned in Figure 1 above.

Furthermore, the above configuration can also be implemented to reduce standby power consumption of an air conditioner without the presence of the fuses

(41, 42). On the other hand, in the absence of the relay (R1, R2), the fuses (41, 42) could still be used for protecting the air conditioner from damages resulting from incorrect wiring arrangement.

The terminal slot (T1) of the indoor terminal board (111) is also used to provide power supply arrangement as an outdoor power supply arrangement as shown in Figure 6. Referring back to Figure 1, the indoor power supply (13) is use to supply power to both indoor unit (11) and outdoor unit (12) through the indoor terminal board (111) and outdoor terminal board (121). The indoor power supply (21) is connected from the terminal slot (T1) of the indoor terminal board (111) to the terminal slot (T3) then to terminal slot (Tc) of the outdoor terminal board (121). Thereby, power from the indoor power supply (21) is supplied to both indoor unit (11) and outdoor unit (12) of the air conditioner system. In the case when indoor power supply (21) is utilized, the terminal slot (T1) of the indoor terminal board (111) serve the purpose of supplying power from the indoor power supply (21) to both indoor unit (11) and outdoor unit (12).

Referring again to Figure 6 where an outdoor power supply arrangement for an air conditioner configured according to the embodiment of the present invention is shown. When an outdoor power supply (22) is implemented, the power is supplied to both indoor unit (11) and outdoor unit (12) through the respective terminal board. The outdoor power supply (22) is connected from the terminal slot (Ta) of the outdoor power terminal board (121) to the terminal

slot (T1) of the indoor terminal board (111) through the terminal slot (Tc) of the outdoor terminal board (121). The power from the outdoor power supply (22) is thereby supplied to both indoor unit (11) and outdoor unit (12). In contrast to its purpose when an indoor power supply (21) described in Figures 1, 3 and 5 is used; when an outdoor power supply (22) is utilized, the terminal slot (T1) of the indoor terminal board (111) serve the purpose of receiving power from the outdoor power supply (22) and conveying the power to the whole components of indoor unit (11). In this case, power consumption during standby is advantageously reduced as well as the silent relay (R2) will only be in operation when the system needs to periodically switching on the outdoor unit for operational check as mentioned earlier.

The indoor terminal board (111) may also be provided with a pair of thermal fuses (not shown) for overcurrent protection to the indoor terminal board (111). The thermal fuse (not shown) may be located in between the terminal slot (T1) and terminal slot (T2) while thermal fuse (also not shown) may be located in between of the terminal slot (T3) and terminal slot (Td).

Now referring to Figure 7 where the figure shows an example of incorrect wiring arrangement for which the embodiments of the present invention are expected to mitigate. In the correct multi split air conditioner unit connection, power supply source (22) is supplied from the outdoor unit (12). However, in this figure, two power supply sources

(21, 22) are connected to the same air conditioner unit where power supply source (21) is connected to the indoor unit (11) and another power supply source (22) is connected to the outdoor unit (12). From power supply source (22), live connection (24a) is made to terminal slot (Ta), neutral connection (24b) is made to terminal slot (Tb). From power supply source (21), live connection (23a) is connected to terminal slot (T2) an neutral connection (23b) is made to terminal slot (T1). When both power supply sources (21, 22) are powered on, neutral line (24b) will short circuit to live line (23a) through Tb, Td, T4 and fuse (42) then to T2. Fuse (42) will be triggered and burned off thus disconnecting the neural line (24b) and live line (23a) connection. As a result, the air conditioner integrity will be preserved as desired.

Apart form the above, the relay in the indoor terminal board as described above would provide a highly dependable component for minimizing standby power consumption of an air conditioner and would be conveniently used to connect the air conditioner to both indoor and outdoor supply system. In use, it is desirable to have such air conditioner that is convenient to use and able to reduce standby power consumption thereby minimizing electricity and cost. In addition, utilization of such relay and indoor terminal board is also applicable not only to the split system air conditioner but is also applicable to the air conditioner having hot/cold water producing system.

While the preferred embodiments of the present

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invention have been described, it should be understood that various changes, adaptations and modifications may be made thereto. It should be understood, therefore, that the invention is not limited to details of the illustrated invention shown in the figures and that variations in such minor details will be apparent to one skilled in the art.

Where the terms "comprise", "comprises", "comprised" or "comprising" are used in this specification (including the claims) they are to be interpreted as specifying the presence of the stated features, integers, steps or components, but not precluding the presence of one or more other features, integers, steps or components, or group thereof.

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The claims defining the invention are as follows:

1. An air conditioner comprising:

an indoor unit having an indoor terminal board, a power supply means adapted for powering said indoor unit via a plurality of terminal slots that are arranged on said indoor terminal board, a relay connected from a live line of said power supply means to a second terminal slot via a first terminal slot; and an outdoor unit having an outdoor terminal board;

wherein said relay is connected from said first terminal slot to said second terminal slot of said indoor terminal board, wherein said relay is a power relay and operates to switch on said outdoor unit for operation and periodically switches on to determine the status of said outdoor unit during the entire operation of the air conditioner.

2. An air conditioner as claimed in Claim 1, wherein another relay is connected in parallel with said relay and said relay is a silent relay type and said relay is controlled to switch on said outdoor unit for operation and periodically switches on to determine the status of said outdoor unit during the entire operation of the air conditioner instead of said relay.

3. An air conditioner as claimed in Claim 1 or 2, wherein said outdoor terminal board has terminal

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slots for connection to the terminal slots of said indoor terminal board.

4. An air conditioner as claimed in Claim 3, wherein said relay is connected from the first terminal slot to said second terminal slot and said terminal slot of said outdoor terminal board is connected to said second terminal slot, said relay adapted to only operate during a standby state to switch on said outdoor unit for periodically determining the status of said outdoor unit.

5. An air conditioner as claimed in Claim 4, wherein said relay is provided with a thermistor to provide inrush-current protection before connection to said second terminal slot.

6. An air conditioner as claimed in Claim 1 or 2, wherein said live line and a neutral line of said power supply means being provided with fuses for cutting off connection upon incorrect wiring arrangement.

7. An air conditioner as claimed in Claim 1 or 2, wherein a thermal fuse is connected from said terminal slot to a rectifier circuit and provided therein as overcurrent protection of the rectifier circuit of said air conditioner indoor power supply system.

8. An air conditioner comprising:

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an indoor unit having an indoor terminal board, and an outdoor unit having an outdoor terminal board; and

a power supply means adapted for powering said outdoor unit via terminal slots arranged on said outdoor terminal board and for providing power supply to said indoor unit via said indoor terminal board, a relay connected between a first terminal slot to a second terminal slot of said indoor terminal board;

wherein said first terminal slot is a multifunctional terminal slot and said relay is connected from said first terminal slot to said second terminal slot of said indoor terminal board, wherein said relay is a power relay operates to switch on said outdoor unit for operation and periodically determine the status of said outdoor unit during the entire operation of the air conditioner.

9. An air conditioner as claimed in Claim 8, wherein a another relay is connected in parallel with said relay and said relay being a silent relay type and adapted to only operate during a standby state to switch on said outdoor unit for periodically determining the status of said outdoor unit.

10. An air conditioner as claimed in any one of the preceding claims, wherein said air conditioner being equipped with hot/cold water producing system.

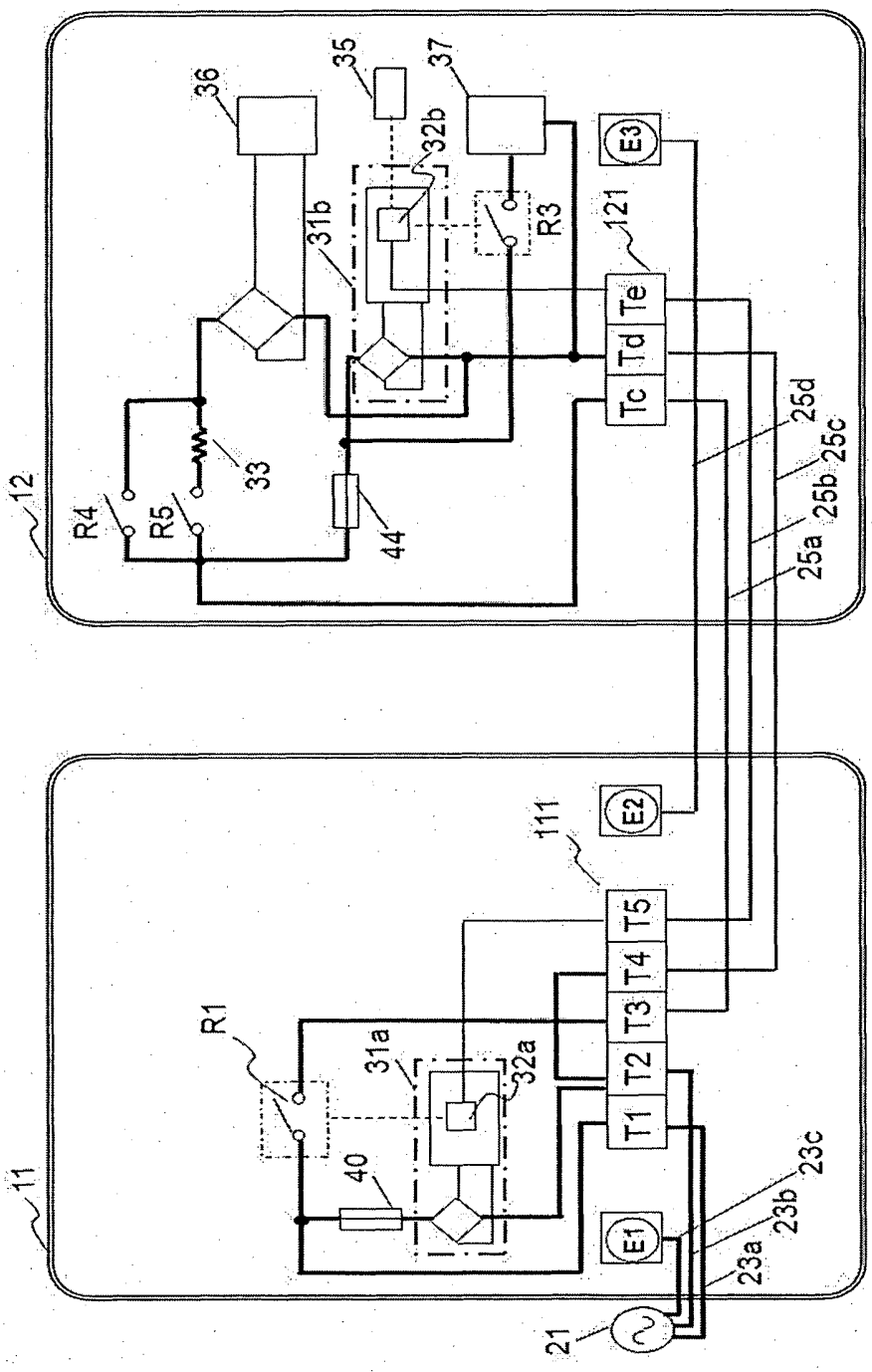

12
11
36
35
37
32b
31b
R3
121
E3
Te
Td
Tc
25d
25c
25b
25a
R4
R5
33
44
R1
31a
32a
40
111
E2
T5
T4
T3
T2
T1
E1
23c
23b
23a
21

Figure 1

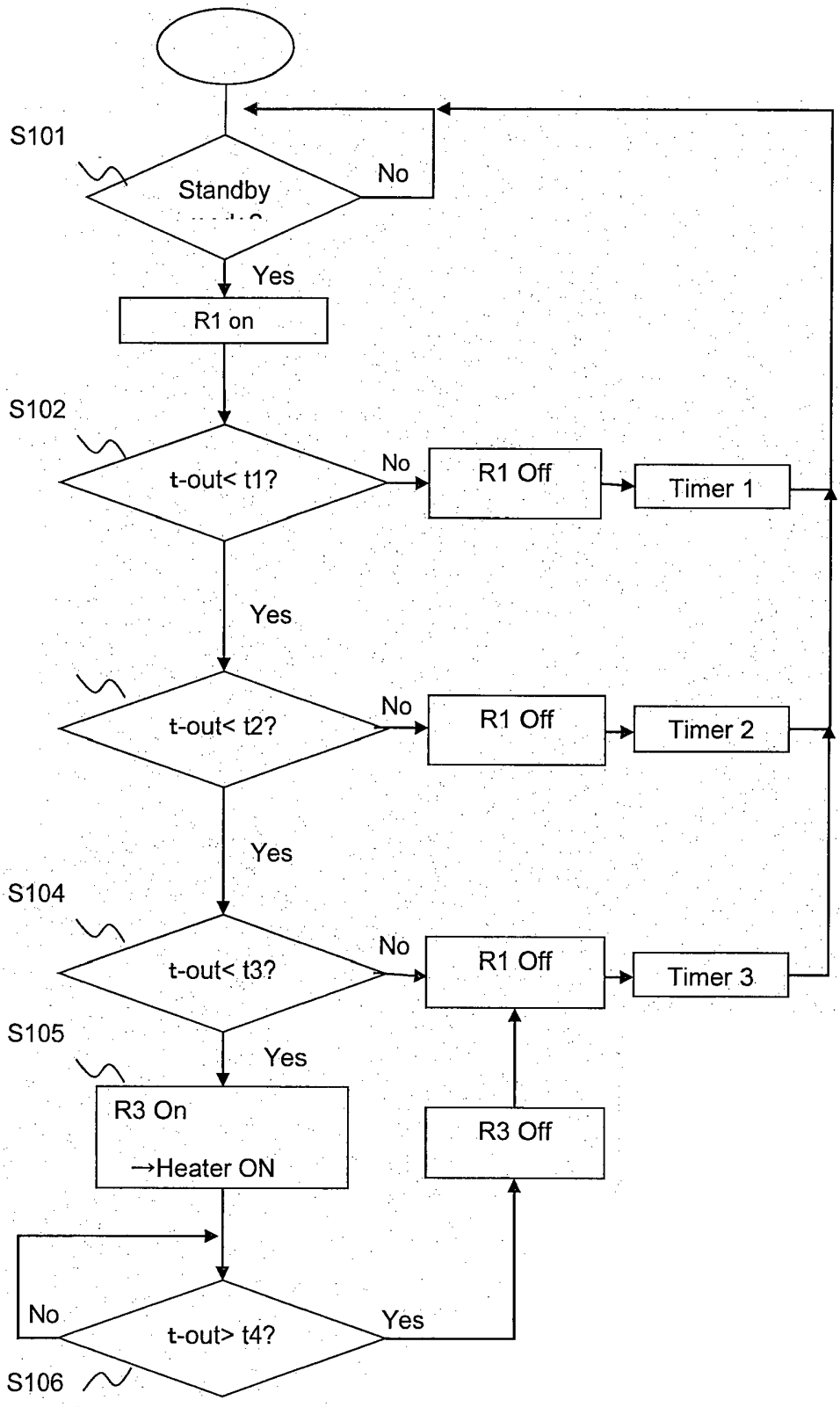

S101
Standby
No
Yes
R1 on
S102
t-out< t1?
No
R1 Off
Timer 1
Yes
t-out< t2?
No
R1 Off
Timer 2
Yes
S104
t-out< t3?
No
R1 Off
Timer 3
S105
Yes
R3 On
→Heater ON
R3 Off
No
t-out> t4?
Yes
S106

Figure 2

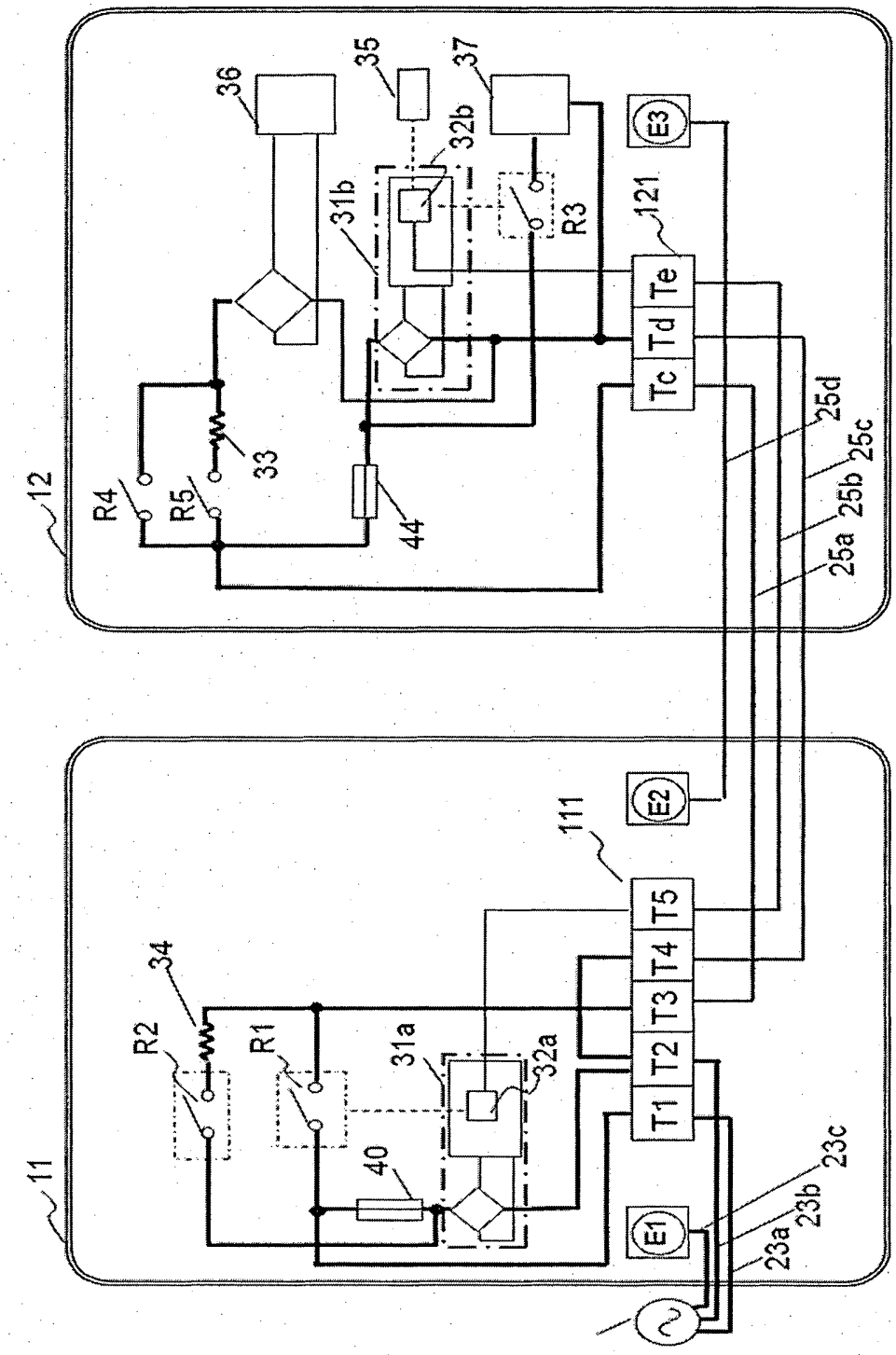

11
12
111
121
T1
T2
T3
T4
T5
Tc
Td
Te
E1
E2
E3
R1
R2
R3
R4
R5
31a
31b
32a
32b
33
34
35
36
37
40
44
23a
23b
23c
25a
25b
25c
25d

Figure 3

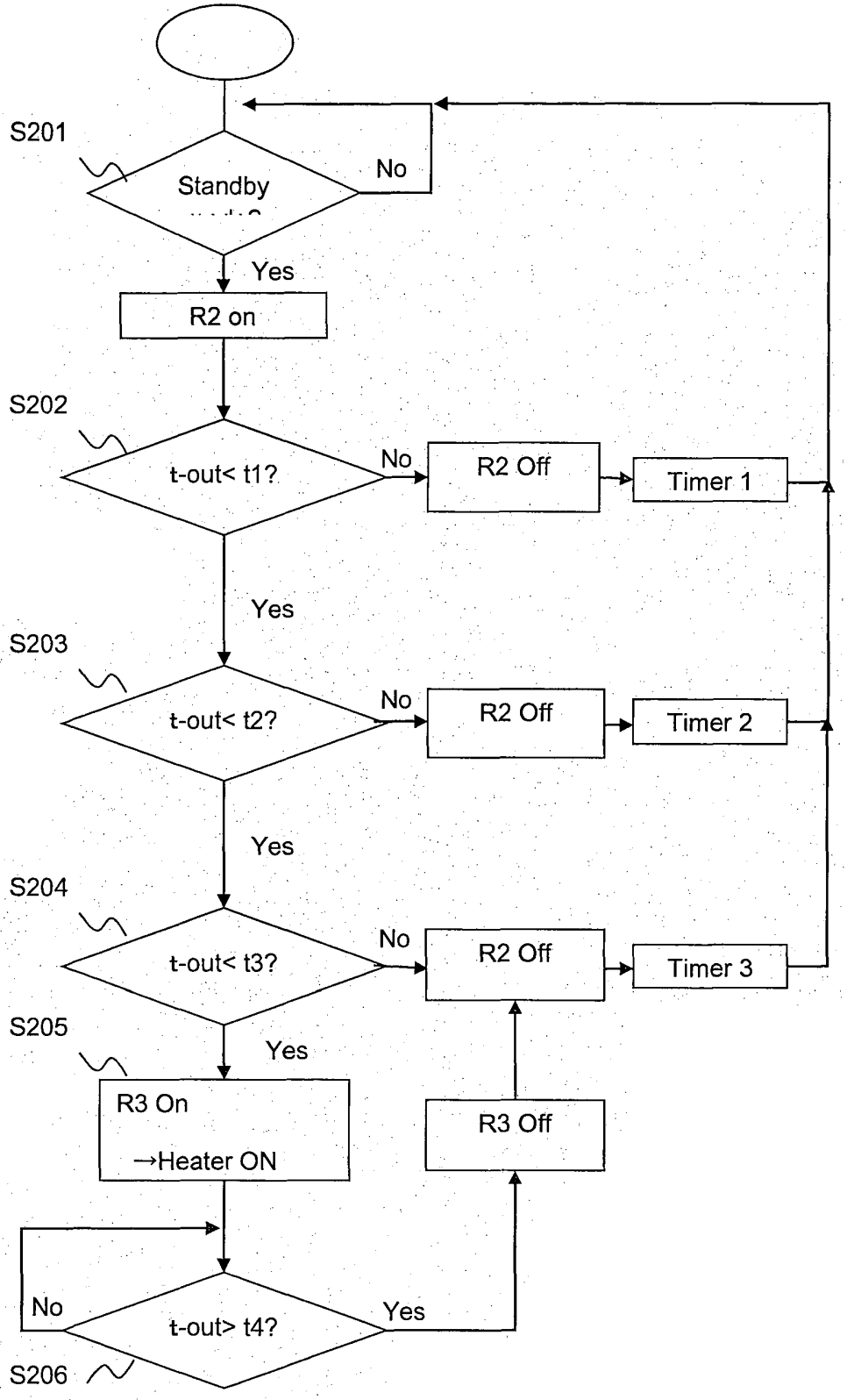

S201
Standby
No
Yes
R2 on
S202
t-out< t1?
No
R2 Off
Timer 1
Yes
S203
t-out< t2?
No
R2 Off
Timer 2
Yes
S204
t-out< t3?
No
R2 Off
Timer 3
S205
Yes
R3 On
→Heater ON
R3 Off
No
t-out> t4?
Yes
S206

Figure 4

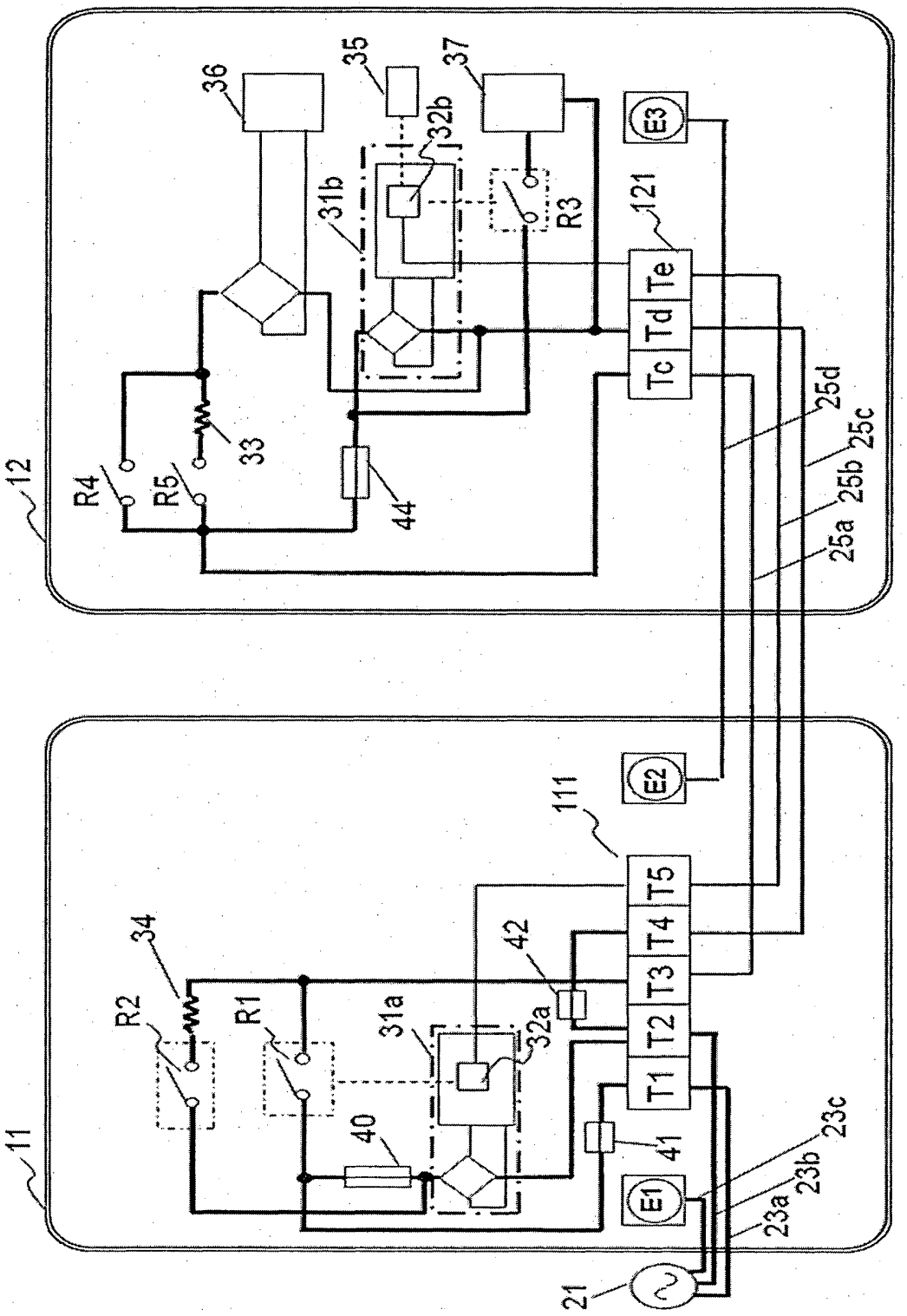

11
12
21
23a
23b
23c
25a
25b
25c
25d
31a
31b
32a
32b
33
34
35
36
37
40
41
42
44
111
121
R1
R2
R3
R4
R5
T1
T2
T3
T4
T5
Tc
Td
Te
E1
E2
E3

Figure 5

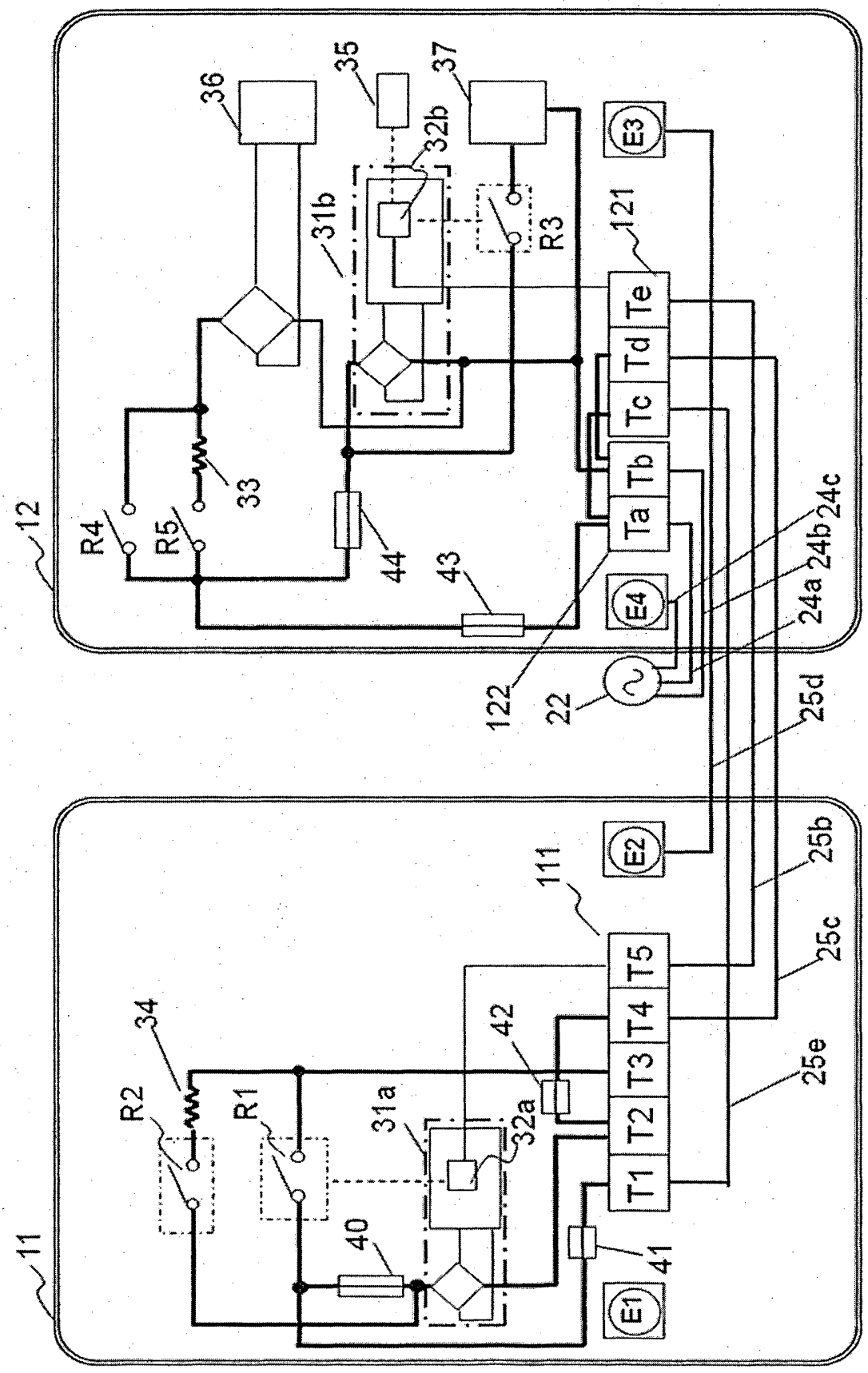

11
12
111
121
122
22
31a
31b
32a
32b
33
34
35
36
37
40
41
42
43
44
R1
R2
R3
R4
R5
T1
T2
T3
T4
T5
Ta
Tb
Tc
Td
Te
E1
E2
E3
E4
24a
24b
24c
25b
25c
25d
25e

Figure 6

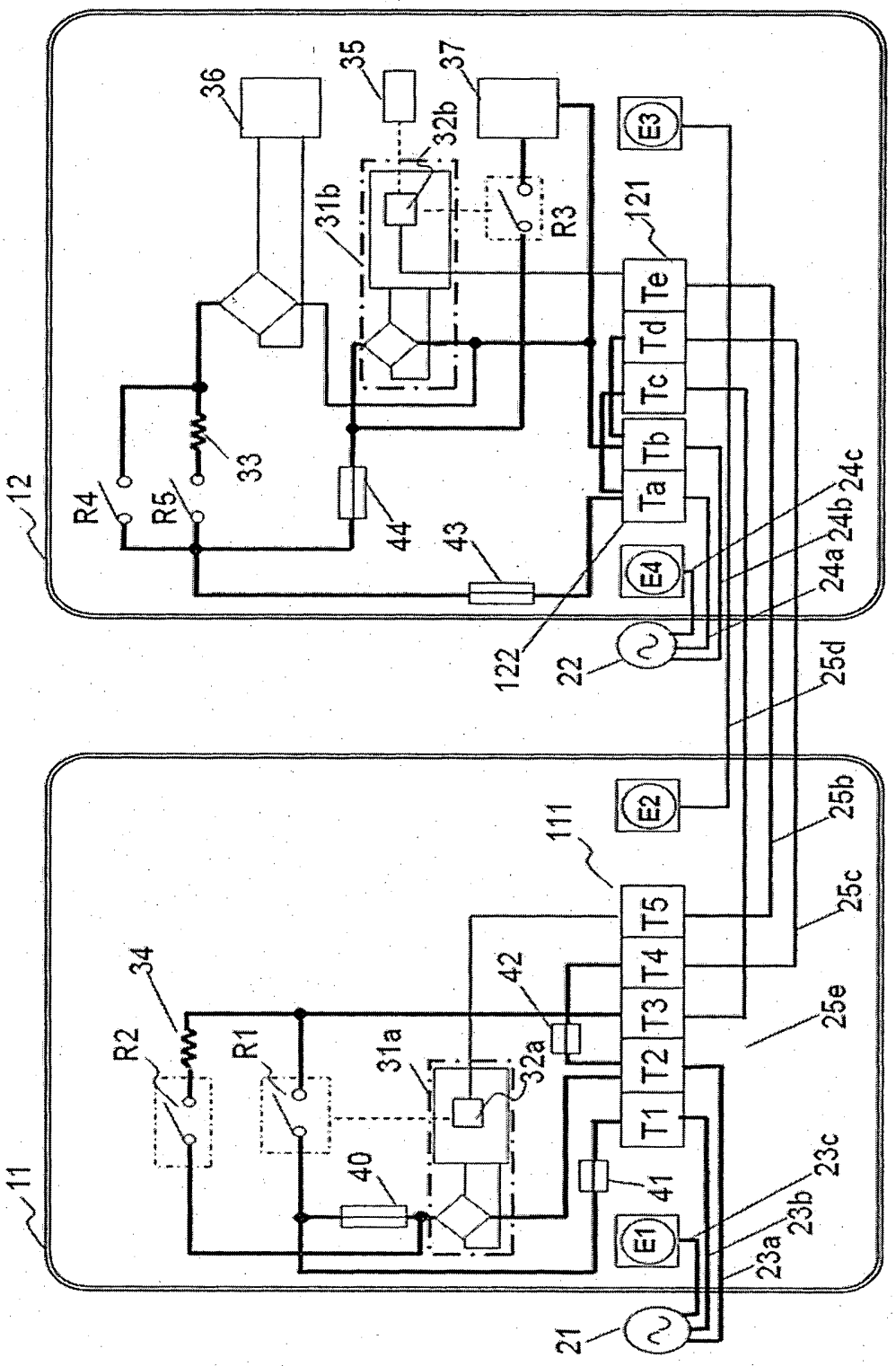

11
12
21
22
111
121
122
R1
R2
R3
R4
R5
31a
31b
32a
32b
33
34
35
36
37
40
41
42
43
44
T1
T2
T3
T4
T5
Ta
Tb
Tc
Td
Te
E1
E2
E3
E4
23a
23b
23c
24a
24b
24c
25b
25c
25d
25e

Figure 7