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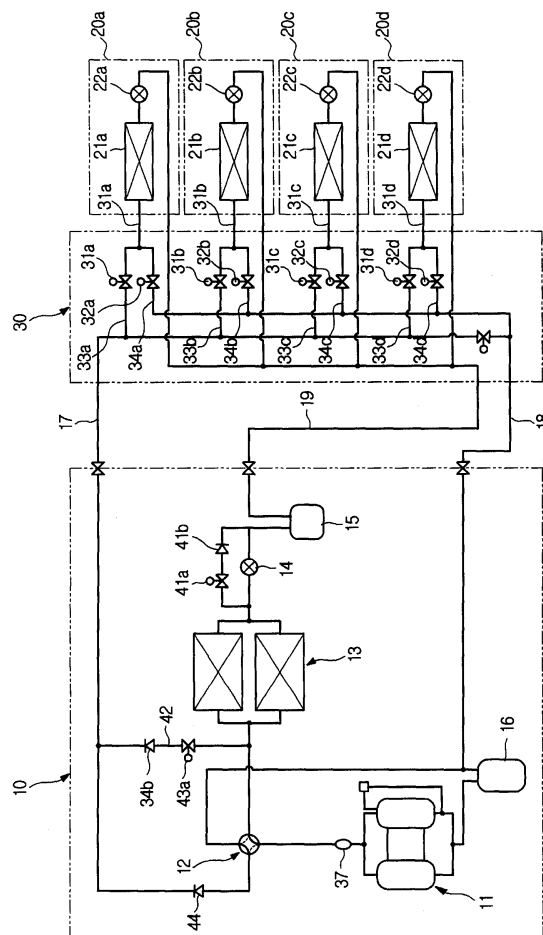
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(54) User Interface Device for a Multi Air Conditioning System

(57) A multi air conditioning system for inputting various connections between valves of a mode converter and indoor units. The multi air conditioning system, which has a plurality of indoor units, a plurality of pipes for connecting an outdoor unit to the indoor units, and a plurality of valves installed in the pipes, includes first switches for inputting whether or not the indoor units are respectively connected to the pipes, and second switches for inputting addresses of the indoor units connected to the pipes.

Fig 2.



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Description

[0001] The present invention relates to a user interface device for inputting configuration information into a multi air conditioning system.

[0002] Generally, a multi air conditioning system comprises an outdoor unit, a plurality of indoor units, connected in parallel and with the outdoor unit, and a mode changer, installed between the outdoor unit and the indoor units, which includes a plurality of heating valves and a plurality of cooling valves.

[0003] The above conventional multi air conditioning system requires means for inputting the connections between the indoor units and the heating and cooling valves so that a microcomputer of the mode changer knows which indoor unit is connected to which of the heating and cooling valves of the mode changer.

[0004] Various means for inputting the connections between the mode change and refrigerant pipes from the indoor units have been proposed. One example of such a means will now be described with reference to Figure 1.

[0005] As shown in Figure 1, the mode changer 1 of a conventional multi air conditioning system includes a plurality of branch holes 4a, ..., 4d, formed through its case, through which pipes 3a to 3d for connecting heating valve-cooling valve sets pass. Each heating valve-cooling valve set includes one heating valve and one cooling valve. The mode changer 1 also has a plurality of feed-back holes 6a to 6d, formed through its case, through which refrigerant return pipes 5a to 5d from the indoor units 2a, ..., 2d pass. The indoor units 2a, ..., 2d each include a rotary switches 7a, ..., 7d for inputting the numbers of the branch holes 4a, ..., 4d connected to the indoor units 2a, ..., 2d. The numbers of the branch holes 4a, ..., 4d coincide with the numbers of the heating valve-cooling valve sets connected to the pipes 3a, ..., 3d passing through the branch holes 4a, ..., 4d.

[0006] During installation, the installer sets the rotary switches 7a, ..., 7d of the indoor units 2a, ..., 2d to the numbers of the branch holes 4a, ..., 4d to which they are respectively connected and then turns on the multi air conditioning system. In each indoor unit 2a, ..., 2d, a microcomputer (not shown) receives the number set using the indoor unit's rotary switch 7a, ..., 7d and informs the outdoor unit's microcomputer (not shown) and the mode changer's microcomputer (not shown) of set number, thereby informing the outdoor unit's microcomputer and the mode changer's microcomputer of which indoor unit is connected through which branch hole.

[0007] In the case that the above conventional multi air conditioning system employs large capacity indoor units, each using two or more branch holes of the mode changer, it is difficult to input the numbers of the branch holes connected to a particular indoor unit.

[0008] That is, since the number of only one branch hole can be assigned to each indoor unit using the rotary switch, the conventional multi air conditioning system is disadvantageous in that one indoor unit cannot be con-

nected to two branch holes.

[0009] A user interface device, according to the present invention, is characterised by a plurality of two-state elements for indicating which of a set of available indoor unit connections are in use and plurality of multi-state elements for indicating which indoor unit, if any, is connected to which indoor unit connection, each multi-state element being provided for a respective one of said two-state elements and having a number of states not less than the number of available indoor unit connections.

[0010] Preferably, each two-state element comprises a single throw switch pole and/or each multi-state element comprises a rotary switch. The elements need not be physical switches.

[0011] A user interface device, according to the present invention, may be employed in a multi air conditioning system comprising a valve unit having a plurality of indoor unit connections for indoor unit refrigerant circuits.

[0012] Such a multi air conditioning system preferably includes processing means and the user interface device is configured to provide an input to the processing means and the processing means is configured to control the multi air conditioning system in dependence on said input.

[0013] Additional preferred and optional features of the present invention are set forth in claims 5 to 11 appended hereto.

[0014] An embodiment of the present invention will now be described, by way of example, with reference to Figures 2 to 4 of the accompanying drawings, in which:

Figure 1 is a schematic diagram of the mode changer and the indoor units of a conventional multi air conditioning system;

Figure 2 is a schematic diagram of the refrigerant circuit of a multi air conditioning system in according to the present invention;

Figure 3 is a perspective view of a switch unit for inputting mode changer connection information in the multi air conditioning system of Figure 2; and

Figure 4 is a schematic diagram illustrating the switch unit of Figure 3 in use.

[0015] Referring to Figure 2, a multi air conditioning system according to the present invention comprises an outdoor unit 10, first to fourth indoor units 20a, 20b, 20c, 20d, connected in parallel and to the outdoor unit 10, and a mode changer 30 for changing the operating mode of the first to fourth indoor units 20a, 20b, 20c, 20d from cooling mode to heating mode and *vice versa*. The first to fourth indoor units 20a, 20b, 20c, 20d and the outdoor unit 10 are interconnected by a high-pressure gas pipe 17, a low-pressure gas pipe 18 and a high-pressure liquid pipe 19.

[0016] The outdoor unit 10 includes a four-way valve 12 for setting the flow direction of refrigerant discharged

from compressors 11, an outdoor heat exchanger 13, an outdoor electric valve 14 for expanding the refrigerant and a receiver tank 15 and an accumulator 16 for separating the liquid and gaseous components of the refrigerant from each other.

[0017] The low-pressure gas pipe 18 is connected to an inlet side of the compressors 11 through the accumulator 16, the outdoor heat exchanger 13 is connected in series with the outdoor electric valve 14 and the high-pressure liquid pipe 19 is connected to the outdoor electric valve 14 through the receiver tank 15. A bypass valve 41 a, serving as a flow control valve, and a non-return valve 41 b are connected in parallel with the outdoor electric valve 14. Thus, liquid refrigerant, discharged from the outdoor heat exchanger 13, passes through the bypass valve 41a and the non-return valve 41 b and detours around the outdoor electric valve 14 during cooling operation. The bypass valve 41a is closed and the refrigerant passes through the outdoor electric valve 14 during heating operation.

[0018] A high-pressure branch pipe 42, which branches from the high-pressure gas pipe 17, is located between the four-way valve 12 and the high-pressure liquid pipe 19 and an electric valve 43a, serving as a switching valve, and a non-return valve 43b, for preventing the back flow of refrigerant discharged from the high-pressure gas pipe 17, are installed in the high-pressure branch pipe 42. Furthermore, another non-return valve 44 for preventing the back flow of the refrigerant is installed between the four-way valve 12 and the high-pressure gas pipe 17.

[0019] The first to fourth indoor units 20a, 20b, 20c, 20d include respective indoor heat exchangers 21a, 21b, 21c, 21d and indoor electric valves 22a, 22b, 22c, 22d, connected in series with respective ones of the indoor heat exchangers 21a, 21b, 21c, 21d.

[0020] The mode changer 30 includes first to fourth heating valves 31a, 31b, 31c, 31d installed in first to fourth high-pressure gas branch pipes 33a, 33b, 33c, 33d, which branch from the high-pressure gas pipe 17, and first to fourth cooling valves 32a, 32b, 32c, 32d installed in first to fourth low-pressure branch pipes 34a, 34b, 34c, 34d, which branch from the low-pressure gas pipe 18. A first heating valve-cooling valve set comprises the first heating valve 31a and the first cooling valve 32a and is connected to a first refrigerant pipe 35a, connected to the first indoor heat exchanger 20a. Second to fourth heating valve-cooling valve sets similarly comprises heating valves and cooling valves from among the second to fourth heating valves 31b, 31c, 31d and the second to fourth cooling valves 32b, 32c, 32d and connected to second to fourth refrigerant pipes 35b, 35c, 35d. The mode changer 30 further includes first to fourth branch holes 55a, 55b, 55c, 55d (Figure 4), formed through its case, through which the first to fourth refrigerant pipes 35a, 35b, 35c, 35d pass. Here, numbers of the first to fourth branch holes 55a, 55b, 55c, and 55d coincide with numbers of the first to fourth heating valves 31a, 31b, 31c, and 31d and numbers of the first to fourth cooling

valves 32a, 32b, 32c, and 32d.

[0021] A switch unit, for inputting the connections between the mode changer 30 and the indoor units 20a, 20b, 20c, 20d of the multi air conditioning system, will now be described in detail.

[0022] Referring to Figure 3, a DIP switch 52, for inputting whether or not the first to fourth refrigerant pipes 35a, 35b, 35c, 35d are connected to the first to fourth branch holes 55a, 55b, 55c, 55d (Figure 4) (i.e. whether or not the first to fourth indoor units are connected to the first heating valve-first cooling valve set, the second heating valve-second cooling valve set, the third heating valve-third cooling valve set, and the fourth heating valve-fourth cooling valve set), and first to fourth rotary switches 53a, 53b, 53c, 53d, for inputting addresses of the indoor units connected to the first to fourth branch holes 55a, 55b, 55c, 55d (Figure 4) through the first to fourth refrigerant pipes 35a, 35b, 35c, and 35d, are mounted on a PCB 51.

[0023] The DIP switch 52 includes first to fourth poles 54a, 54b, 54c, 54d. The first pole 54a indicates whether or not the corresponding indoor unit is connected to the first branch hole 55a (i.e. the first heating valve-first cooling valve set), and the second to fourth poles 54b, 54c, and 54d respectively indicate whether or not the corresponding indoor units are respectively connected to the second to fourth branch holes 55b, 55c, 55d.

[0024] The poles 54a, 54b, 54c, 54d, which are raised, indicate which indoor units are connected to the corresponding branch holes and the poles 54a, 54b, 54c, 54d, which are lowered, indicate which indoor units are not connected to the corresponding branch holes. In Figure 3, since the first and fourth poles 54a, 54d are lowered, the corresponding indoor units are not respectively connected to the first and fourth branch holes 55a, 55d, and since the second and third poles 54b, 54c are raised, the corresponding indoor units are respectively connected to the second and third branch holes 55b, 55c.

[0025] Numbers, indicated by the first to fourth rotary switches 53a, 53b, 53c, and 53d, denote addresses of the corresponding indoor units. That is, the number, indicated by the first rotary switch 53a, denotes the address of the indoor unit connected to the first branch hole 55a, and the numbers, indicated by the second to fourth rotary switches 53a, 53c, and 53d, respectively denote the addresses of the indoor units connected to the second to fourth branch holes 55b, 55c, and 55d.

[0026] Referring to Figure 4, the first and fourth poles 54a, 54d are in the OFF state and the second and third poles 54b, 54c are in the ON state. Thus, the corresponding units are connected only to the second and third branch holes 55b, 55c.

[0027] Numeral "3", indicated by the second rotary switch 53b, denotes that the address/identity of the indoor unit connected to the second branch hole 55b is 3 and numeral "7", indicated by the third rotary switch 53c, denotes that the address/identity of the indoor unit connected to the third branch hole 55c is 7.

[0028] The operation of the multi air conditioning system will now be described in detail.

[0029] When the multi air conditioning system is installed, a worker connects the mode changer 30, the outdoor unit 10 and the indoor units 20a, 20b, 20c, 20d by pipes, and checks whether or not the indoor units 20a, 20b, 20c, 20d are connected to the first to fourth branch holes 55a, 55b, 55c, 55d sets the positions of the first to fourth poles 54a, 54b, 54c, 54d of the DIP switch 52, which correspond to the first to fourth branch holes 55a, 55b, 55c, and 55d. That is, the worker sets the positions of the first to fourth poles 54a, 54b, 54c, 54d of the DIP switch 52 such that the poles corresponding to the branch holes, to which the indoor units are connected, are in the ON state and the poles corresponding to the branch holes, to which the indoor units are not connected, are in the OFF state. Thereafter, the worker sets the addresses of the indoor units connected to the first to fourth branch holes 55a, 55b, 55c, 55d using the first to fourth rotary switches 53a, 53b, 53c, 53d.

[0030] When the worker turns on the system, in order to test it under the above conditions, the mode converter microcomputer reads the condition of the DIP switch 52 and determines which of the first to fourth branch holes 55a, 55b, 55c, 55d are connected to the corresponding indoor units, and reads the states of the first to fourth rotary switches 53a, 53b, 53c, 53d and detects the addresses/identities of the indoor units connected to the first to fourth branch holes 55a, 55b, 55c, 55d. When the addresses of the indoor units connected to the first to fourth branch holes 55a, 55b, 55c, 55d are detected, the mode changer microcomputer transmits data regarding the addresses/identities of the indoor units to the outdoor unit's microcomputer and the indoor units' microcomputers so that the outdoor unit's microcomputer and the indoor units' microcomputers can perform the correct control operations.

[0031] When the addresses/identities of the indoor units, connected to the first to fourth branch holes 55a, 55b, 55c, 55d, are input into the mode changer's microcomputer, the outdoor unit's microcomputer and the indoor units' microcomputers, it is possible to properly control the amount of refrigerant flowing into the indoor units.

[0032] For example, in order to operate only the first indoor unit 20a in the cooling mode, the outdoor unit microcomputer recognizes the address of the branch hole, to which the first indoor unit 20a is connected, opens the cooling valve of the heating valve-cooling valve set connected to the pipe passing through the above branch hole, thus operating the first indoor unit 20a in the cooling mode.

[0033] Although this embodiment of the present invention describes the system which inputs the connections between the numbers of the branch holes of the mode converter (i.e., the numbers of the heating valve-cooling valve sets) and the addresses of the indoor units, the present invention can be applied to a system in which an outdoor unit and indoor units are connected by a plurality

of refrigerant pipes without the mode converter. In this case, the DIP switch indicates connections between indoor units and the refrigerant pipes, and the rotary switches respectively indicate the addresses of the indoor units connected to the corresponding refrigerant pipes.

[0034] As apparent from the above description, the present invention provides a multi air conditioning system, which comprises means for inputting numbers of branch holes of a mode converter and addresses of indoor units connected to the branch holes, thereby being capable of inputting various connections between the mode converter and the indoor units when each of the indoor units is connected to the plural branch holes.

Claims

1. A user interface device for inputting configuration information into a multi air conditioning system, the device being **characterised by** a plurality of two-state elements (54a, ..., 54d) for indicating which of a set of available indoor unit connections (55a, ..., 55d) are in use and plurality of multi-state elements (53a, ..., 53d) for indicating which indoor unit (20a, ..., 20d), if any, is connected to which indoor unit connection (55a, ..., 55d), each multi-state element (53a, ..., 53d) being provided for a respective one of said two-state elements (54a, ..., 54d) and having a number of states not less than the number of available indoor unit connections (55a, ..., 55d).
2. A user interface device according to claim 1, wherein each two-state element (54a, ..., 54d) comprises a single throw switch pole and/or each multi-state element (53a, ..., 53d) comprises a rotary switch.
3. A multi air conditioning system comprising a valve unit (30) having a plurality of indoor unit connections (55a, ..., 55d) for indoor unit refrigerant circuits (31a, ..., 31d) and a user interface device (51, 52, 53a, ..., 53d) according to claim 1 or 2.
4. A multi air conditioning system according to claim 3, including processing means, wherein the user interface device (51, 52, 53a, ..., 53d) is configured to provide an input to the processing means and the processing means is configured to control the multi air conditioning system in dependence on said input.
5. A multi air conditioning system, which has a plurality of indoor units, a plurality of pipes for connecting an outdoor unit to the indoor units, and a plurality of valves installed in the pipes, comprising:

first switches for inputting whether or not the indoor units are respectively connected to the pipes; and

second switches for inputting addresses of the indoor units connected to the pipes.

6. The multi air conditioning system according to claim 5, wherein the first switches are DIP switches for denoting that the indoor units are connected to the corresponding pipes when the DIP switches are in an ON state and for denoting that the indoor units are not connected to the corresponding pipes when the DIP switches are in an OFF state. 5

7. The multi air conditioning system according to claim 5, wherein the second switches are rotary switches for indicating the addresses of the indoor units connected to the corresponding pipes in Arabic numerals. 10 15

8. A multi air conditioning system, which has a mode converter including a plurality of heating valve-cooling valve sets having a plurality of heating valves, installed in pipes branched from a high-pressure gas pipe, in which refrigerant in a high-pressure gaseous state, discharged from compressors, flows, and a plurality of cooling valves, installed in pipes branched from a high-pressure liquid pipe, in which refrigerant in a high-pressure liquid state, having passed through an outdoor electric valve, flows, for controlling opening degrees of the heating valve-cooling valve sets connected to corresponding indoor units and thus controlling amounts of the refrigerant flowing into the indoor units, comprising: 20 25 30

first switches for inputting whether or not the indoor units are respectively connected to the heating valve-cooling valve sets; and 35
second switches for inputting addresses of the indoor units connected to the heating valve-cooling valves sets.

9. The multi air conditioning system according to claim 8, wherein: 40

branch holes for passing pipes connecting the heating valve-cooling valve sets and the indoor units are formed through a case of the mode converter; and 45
the first switches indicate which indoor units correspond to the branch holes, and the second switches indicate addresses of the indoor units corresponding to the branch holes. 50

10. The multi air conditioning system according to claim 9, wherein:

the first switches are DIP switches for denoting that the indoor units are connected to the corresponding pipes when the DIP switches are in an ON state and for denoting that the indoor units 55

are not connected to the corresponding pipes when the DIP switches are in an OFF state; and the second switches are rotary switches for indicating the addresses of the indoor units connected to the corresponding pipes in Arabic numerals.

11. The multi air conditioning system according to claim 8, wherein the first switches and the second switches are installed in the mode converter.

Fig 1.

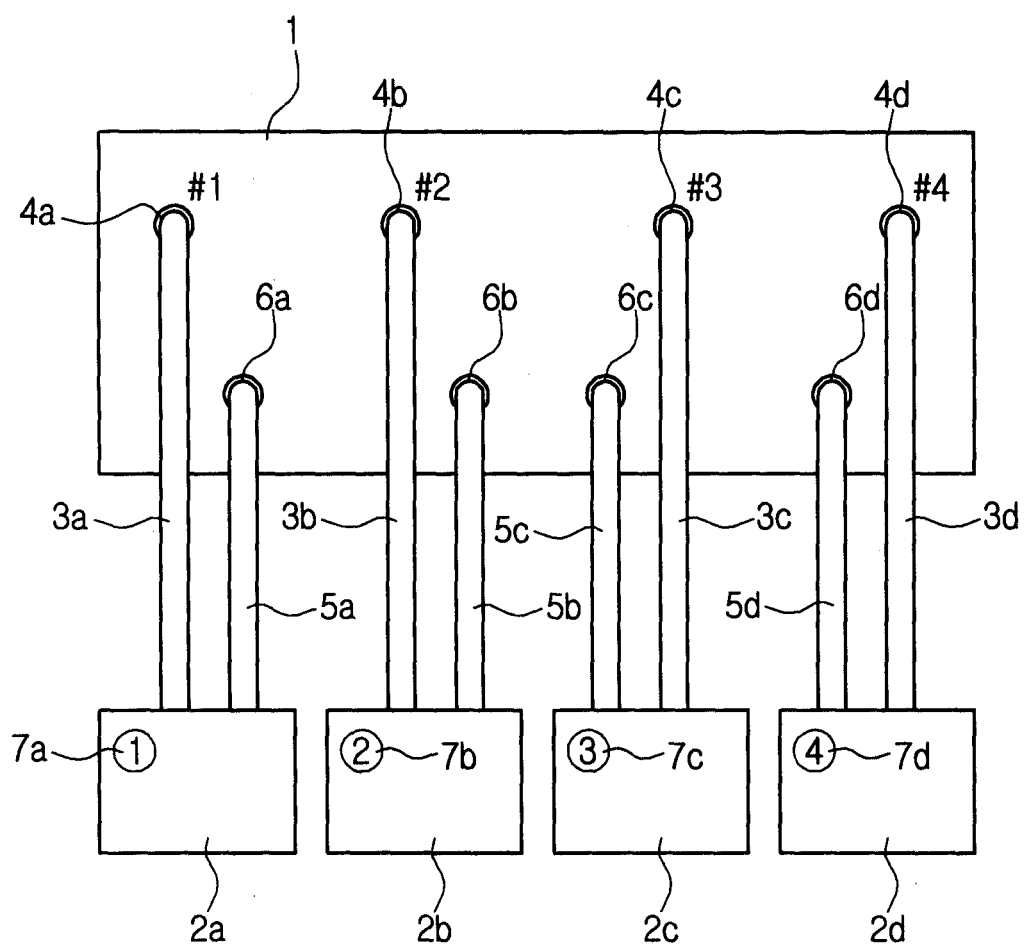


Fig 2.

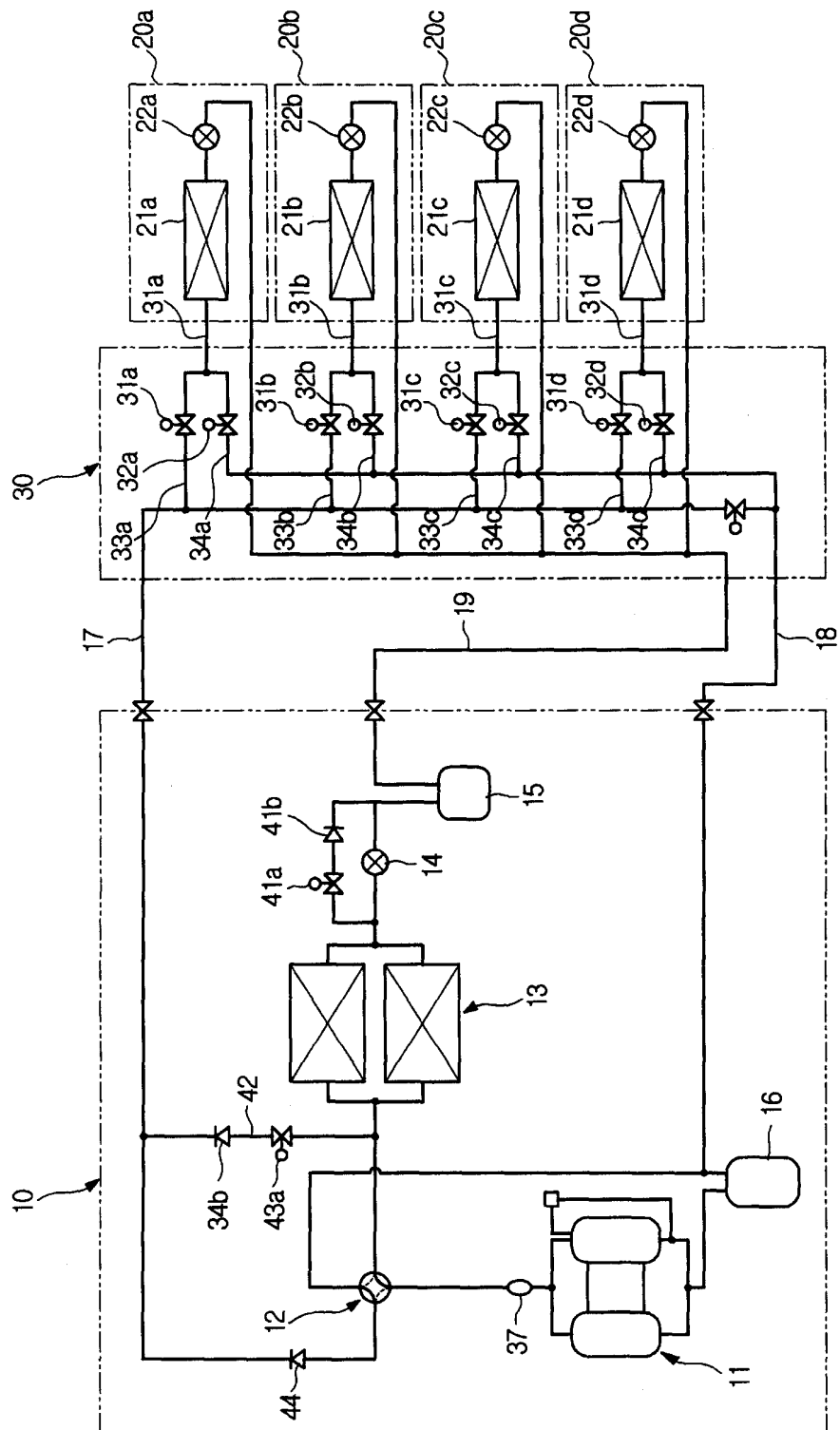


Fig 3.

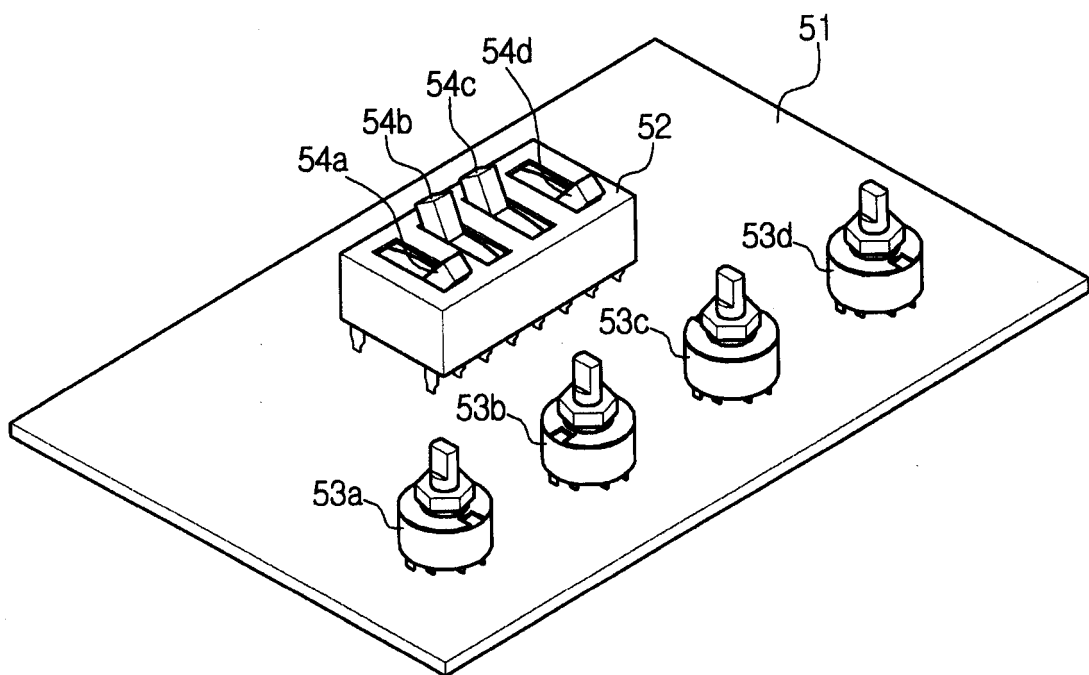


Fig 4.

