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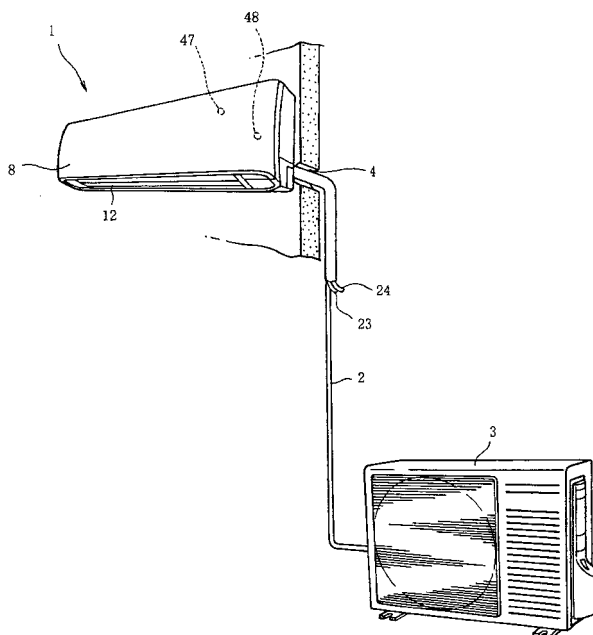
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(54) **Air conditioner**

(57) An air conditioner comprises air pipes (23, 24) inserted through a hole (4) of a building wall; a first fan unit (21) located in an indoor unit (1) and connected to the first air pipe; a second fan unit (22) located in the indoor unit and connected to the second air pipe to exhaust indoor air; and a control means (46). The control means (46) on receipt of a single exhaust instruction halts

the first fan unit and allows the exhaust operation of the second fan unit to execute the ventilation operation with only exhaust, and on receipt of an air-supply/exhaust operation instruction allows the running of the first fan unit and the exhaust operation of the second fan unit to execute the ventilation operation with simultaneous air-supply/exhaust.

**Fig. 1**



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## Description

### BACKGROUND OF THE INVENTION

#### Field of the Invention

[0001] The present invention relates to an air conditioner, and more particularly to ventilation of the room associated therewith.

#### Description of the Related Art

[0002] A general air conditioner such as a domestic appliance has no ventilator. It is therefore required timely to open a window manually to take outdoor air in for ventilation when it is poor in the room air.

[0003] There has been proposed an air conditioner equipped with a ventilator. For example, as disclosed in the patent publication 1 (JP-A 2001/304645), an air conditioner is provided with an air-supply duct (or ventilation pipe) and an outlet duct, and an air-supply fan is located in the air-supply duct and an exhaust fan in the exhaust duct.

[0004] Such the air conditioner may often be desired powerful exhausting without taking in air from the outdoor, for example, when the room is filled with cigarette smoke and the like. To the contrary, it may also be desired to supply fresh outdoor air. The operations of exhausting and taking in the air using respective special big ducts and big fans as described above require more powerful ventilation abilities to produce a desired volume of the airflow at the time of exhausting or taking in the air. Thus, the ventilator size increases more big size and the overall dimensions of the air conditioner are increased. Therefore, it is not suitable for such the air conditioner as the room air conditioner that is required to be compact.

### SUMMARY OF THE INVENTION

[0005] The present invention has been made in consideration of the above-described situation. It has an object to provide an air conditioner equipped with a pair of air pipes or air ducts or likes for ventilation with simultaneous taking in the air from outdoor / exhausting the room or only exhausting.

[0006] In a first aspect the invention provides an air conditioner with a refrigerant pipe from an indoor unit led out outdoors through a hole of a building wall and connected to an outdoor unit. The air conditioner comprises: a first air pipe and a second air pipe inserted through the hole of the building wall; a first fan unit located in the indoor unit and connected to the first air pipe; a second fan unit located in the indoor unit and connected to the second air pipe and having an exhausting structure for exhausting the room air outside the building through the second air pipe; and a control means for controlling the operation of the first fan unit and the second fan unit. The

control means on receipt of a single exhaust instruction halts the first fan unit and allows the exhaust operation of the second fan unit to execute the ventilation operation with only exhausting, and on receipt of an air-supply/exhaust operation instruction allows the running of the first fan unit and the exhaust operation of the second fan unit to execute the ventilation operation with simultaneous air-supply/exhaust.

[0007] In a second aspect of the invention, the first fan unit includes a first fan, and an air-path switching means for switching an air-path between an air-supply switched position, on which an outlet of the first fan is connected to the inside of the indoor unit and an inlet of the first fan is connected to the first air pipe, and an exhaust switched position, on which the inlet of the first fan is connected to the inside of the indoor unit and the outlet of the first fan is connected to the first air pipe.

[0008] In a third aspect of the invention, the control means on receipt of the air-supply/exhaust operation instruction switches the air-path switching means to the air-supply switched position to allow the running of the first fan unit and the exhaust operation of the second fan unit, on receipt of the single exhaust instruction halts the first fan unit and allows the exhaust operation of the second fan unit, and on receipt of a double exhaust instruction switches the air-path switching means to the exhaust switched position to allow the running of the first fan unit and the exhaust operation of the second fan unit.

[0009] In a fourth aspect of the invention, the indoor unit includes an air pollution sensor operative to detect air pollution, wherein the control means on receipt of an automatic ventilation instruction switches from a single operation of the first fan unit or the second fan unit to a double operation of both the first fan unit and the second fan unit if the air pollution sensor provides a high detected value.

[0010] In a fifth aspect of the invention, the second fan unit includes a second fan, and a second air-path switching means operative to switch between an air-supply switched position, on which an outlet of the second fan is connected to a space in the indoor unit and an inlet of the second fan is connected to the second air pipe, and an exhaust switched position, on which the inlet of the second fan is connected to the space in the indoor unit and the outlet of the second fan is connected to the second air pipe.

[0011] In the first aspect of the invention, the control means on receipt of the single exhaust instruction halts the first fan unit and allows the exhaust operation of the second fan unit to execute the ventilation operation with only exhausting, and on receipt of the air-supply/exhaust operation instruction allows the running of the first fan unit and the exhaust operation of the second fan unit to execute the ventilation operation with simultaneous air-supply/exhaust. Therefore, it is capable of executing a ventilation operation with simultaneous air-supply/exhaust or simultaneous execution of both air-supply and exhaust as well as executing a ventilation operation with

only exhaust.

**[0012]** The second aspect of the invention is configured such that the first fan unit includes the first fan, and the air-path switching means for switching the air-path between the air-supply switched position, on which the outlet of the first fan is connected to the inside of the indoor unit and the inlet of the first fan is connected to the first air pipe, and the exhaust switched position, on which the inlet of the first fan is connected to the inside of the indoor unit and the outlet of the first fan is connected to the first airpipe. Therefore, it is possible to switch the first fan unit between two modes of the ventilation function, or air-supply and exhaust, in accordance with the required mode of ventilation.

**[0013]** The third aspect of the invention is configured such that the control means on receipt of the air-supply/exhaust operation instruction switches the air-path switching means to the air-supply switched position to allow the running of the first fan unit and the exhaust operation of the second fan unit, on receipt of the single exhaust instruction halts the first fan unit and allows the exhaust operation of the second fan unit, and on receipt of the double exhaust instruction switches the air-path switching means to the exhaust switched position to allow the running of the first fan unit and the exhaust operation of the second fan unit. Therefore, when the air-path switching means is switched to the exhaust switched position to allow the running of the first fan unit and the exhaust operation of the second fan unit, a double exhaust operation can be performed with both the first fan unit and the second fan unit. This is effective to ensure a larger amount of air to be sent compared to the exhaust with either the first fan unit or the second fan unit. Accordingly, it is possible to reduce the capacities of the air pipes and fan units and reduce the aperture area of the hole formed through the building as well as the dimensions of the indoor unit.

**[0014]** The fourth aspect of the invention is configured such that the indoor unit includes the air pollution sensor operative to detect air pollution, wherein the control means on receipt of the automatic ventilation instruction switches from the single operation of the first fan unit or the second fan unit to the double operation of both the first fan unit and the second fan unit if the air pollution sensor provides a high detected value. Therefore, when the air pollution degree is high, both the first fan unit and the second fan unit are operated to efficiently ventilate depending on indoor air pollution. In addition, when the air pollution degree lowers, either the first fan unit or the second fan unit can be halted to reduce the running cost.

**[0015]** The fifth aspect of the invention is configured such that the second fan unit includes the second fan, and the second air-path switching means operative to switch between the air-supply switched position, on which the outlet of the second fan is connected to the space in the indoor unit and the inlet of the second fan is connected to the second air pipe, and the exhaust switched position, on which the inlet of the second fan is

connected to the space in the indoor unit and the outlet of the second fan is connected to the second air pipe. Therefore, it is possible to perform a double air-supply operation with both the first fan unit and the second fan unit in air-supply operation.

## **BRIEF DESCRIPTION OF THE DRAWINGS**

### **[0016]**

Fig. 1 is a perspective view of an indoor unit and an outdoor unit of an air conditioner according to the present invention;

Fig. 2 is a cross-sectional view of the indoor unit;

Fig. 3 is a partly cut-off perspective view of the major part of the indoor unit;

Fig. 4 illustrates a remote in (A) a front view and (B) a front cover-removed front view;

Fig. 5 illustrates control of the air conditioner in (A) an operation pattern table and (B) a controller input/output diagram;

Fig. 6 is a brief illustrative view of an air-supply/exhaust operation;

Fig. 7 is a brief illustrative view of double exhaust;

Fig. 8 is a flowchart on receipt of an instruction for a ventilation operation mode from an operating unit;

Fig. 9 is an operation flowchart of an automatic ventilation based on detection at an air sensor;

Fig. 10 is an operation pattern table for control of an air conditioner according to a second example; and

Fig. 11 is a brief illustrative view of double air-supply.

## **DETAILED DESCRIPTION OF THE INVENTION**

**[0017]** The object to provide an air conditioner equipped with a pair of air pipes for executing a ventilation operation with simultaneous air-supply/exhaust or simultaneous execution of both air-supply and exhaust as well as executing a ventilation operation with only exhaust, can be achieved by an air conditioner with a refrigerant pipe from an indoor unit led out outdoors through a hole of a building wall and connected to an outdoor unit, comprising: a first air pipe and a second air pipe inserted through the hole of the building wall; a first fan unit located in the indoor unit and connected to the first air pipe; a second fan unit located in the indoor unit and connected to the second air pipe and having an exhausting structure for exhausting the room air outside the building through the second air pipe; and a control means for controlling the first fan unit and the second fan unit, wherein the control means on receipt of a single exhaust instruction halts the first fan unit and allows the exhaust operation of the second fan unit to execute the ventilation operation with only exhaust, and on receipt of an air-supply/exhaust operation instruction allows the running of the first fan unit and the exhaust operation of the second fan unit to execute the ventilation operation with simultaneous air-supply/exhaust.

## EXAMPLE 1

**[0018]** A first example of the air conditioner according to the present invention is described next with reference to Figs. 1-9.

Fig. 1 is a perspective view of an indoor unit and an outdoor unit of the air conditioner according to the present invention.

Fig. 2 is a cross-sectional view of the indoor unit. Fig. 3 is a partly cut-off perspective view of the major part of the indoor unit. Fig. 4 illustrates a remote in (A) a front view and (B) a front cover-removed front view. Fig. 5 illustrates control of the air conditioner in (A) an operation pattern table and (B) a controller input/output diagram. Fig. 6 is a brief illustrative view of an air-supply/exhaust operation. Fig. 7 is a brief illustrative view of double exhaust. Fig. 8 is a flowchart on receipt of an instruction for a ventilation operation mode from an operating unit. Fig. 9 is an operation flowchart of an automatic ventilation based on detection at an air sensor. In Fig. 5(B) only ventilation-related primary parts are shown and other parts not shown are also connected to the controller.

**[0019]** At first, the whole arrangement of the air conditioner is described.

**[0020]** In Fig. 1 the air conditioner comprises an indoor unit 1, and an outdoor unit 3 connected to the indoor unit 1 via a pair of refrigerant pipe 2. The indoor unit 1 is located a indoor wall while the outdoor unit 3 is located outdoor. The refrigerant pipe 2 runs through an hole 4 formed through the wall of the house to connect the indoor unit 1 with the outdoor unit 3.

**[0021]** The outdoor unit 3 includes equipment such as a compressor (not shown) operative to compress a refrigerant gas, an outdoor side heat exchanger (not shown), a refrigerant circulation path-changing valve (not shown) operative to switch between refrigerant flow direction in circulation paths, and a heat exchanger fan (not shown). In operation of the outdoor unit 3, the refrigerant circulates from the outdoor unit 3 through the refrigerant pipe 2 to the indoor unit 1 for heating/cooling.

**[0022]** In Fig. 2 the indoor unit 1 includes an indoor side heat exchanger 6, and a circulation fan 7. A movable front panel 8 is provided at the front of the indoor unit 1, and an air inlet 11 is provided behind the front panel 8. On running of the indoor unit 1, the front panel 8 moves forward to allow the air inlet 11 to take room air there through into the indoor unit 1. During halts of the indoor unit 1, the front panel 8 moves rearward or toward the air inlet 11 to enhance the appearance. An air outlet 12 is provided under side of the indoor unit 1. A filter 13 (see Fig. 2) is provided at the front of the air inlet 11. An ultraviolet lamp unit 14 is located above the indoor unit heat exchanger 6.

**[0023]** On running of the circulation fan 7 in the indoor unit 1, indoor air is drawn through the air inlet 11, filtered

through the filter 13, heat-exchanged at the indoor unit heat exchanger 6, and blown to the room from the air outlet 12. Thus, during circulation of indoor air by the circulation fan 7, the air is heat-exchanged at the indoor side heat exchanger 6.

**[0024]** To change the direction of airflow, louvers 16, 17 are provided in the air outlet 12. The lateral louver 16 changes the lateral direction of air blown out. The vertical louver 17 changes the vertical direction of air blown out.

**[0025]** In Fig. 3 a first fan unit 21 and a second fan unit 22 are provided at a side end of the indoor unit 1. In Figs. 1 and 6 the fan units 21, 22 are connected to air pipes 23, 24. The air pipes 23, 24, like the refrigerant pipe 2, are led out outdoors through the hole 4 formed through the wall of the house, and brought into communication with outdoor air.

**[0026]** In Fig. 6 the first fan unit 21 is the ventilation fan unit for taking in the air from the outside or exhausting the room air, which includes a first fan 31, an inlet side damper 32, and an outlet side damper 33. The first fan 31 is a sirocco fan capable of sending a sufficient amount of air, which, on running, forms airflow in a predetermined direction which is to outlet side from inlet side. As shown in Figs. 6 and 7, the inlet side of the first fan 31 is selectively connected by the inlet damper 32 either to the first air pipe 23 or to the inside of the indoor unit 1.

**[0027]** On the other hand, the outlet side of the first fan 31 is selectively connected by the outlet damper 33 either to the first air pipe 23 or to the inside of the indoor unit 1. Thus, the dampers 32, 33 make an air path changing means operative to switch airflow.

**[0028]** At taking in the air from outside, the dampers 32, 33 of the first fan unit 21, are changed to taking-in position as shown in Fig. 6. In this case, the inlet damper 32 connects the inlet side of the first fan 31 to the first air pipe 23, and the outlet damper 33 connects the outlet side of the first fan 31 to the inside of the indoor unit 1. This operation is air-supply mode.

**[0029]** At exhausting the room air, on the other hand, the dampers 32, 33 of the first fan unit 21 are changed to an exhausting position as shown in Fig. 7. In this case, the inlet damper 32 connects the inlet side of the first fan 31 to the inside of the indoor unit 1, and the outlet damper 33 connects the outlet side of the first fan 31 to the first air pipe 23. This operation is exhaust mode.

**[0030]** The second fan unit 22 is an exhausting fan unit, which includes a second fan 41, but includes no damper for changing the airflow. The second fan 41 is a sirocco fan, similar to the first fan 31, which, on running, forms airflow in a predetermined direction. As shown in Figs. 6 and 7, the second fan 41 has an inlet side connected to the inside of the indoor unit 1, and an outlet side connected to the second air pipe 24. This operation is exhaust mode.

**[0031]** As described, the first fan unit 21 has air-supply mode and exhaust mode, the second fan unit 22 has exhaust mode. As shown in Fig. 5(a), the air conditioner of the first example has therefore four types of ventilation

patterns: an air-supply/exhaust operation; a single air-supply operation; a single exhaust operation; and a double exhaust operation.

**[0032]** A controller 46 for controlling the air conditioner having a microcomputer and controls operation of the air conditioner. In particular, with respect to ventilation, as shown in Fig. 5(b), the controller 46 receives a signal from a CO<sub>2</sub> sensor 47 located in the vicinity of the indoor unit heat exchanger 6 and operative to detect the density of a CO<sub>2</sub> gas. It also receives a signal from a gas sensor 48 located in the vicinity of the indoor unit heat exchanger 6 and operative to detect the density of cigarette smoke, and a signal from a remote controller 49 serving as an operating unit. The CO<sub>2</sub> sensor 47 and the gas sensor 48 serve as air pollution sensors operative to detect air pollution.

**[0033]** The controller 46 provides drive signals to the first fan 31 and dampers 32, 33 in the first fan unit 21 and the second fan 41 in the second fan unit 31. The controller 46 is also connected to various types of other equipment in the indoor unit 1 and the outdoor unit 3, which are allowed to input and output.

**[0034]** The remote controller 49 having a display section 51 and a detachable front cover 52 as shown in Fig. 4. A plurality of various buttons 53 is provided on the front cover 52 and the body of the remote controller 49. As shown in Fig. 4(b), ventilation-related operational buttons such as a ventilation switching button 53a and a ventilation power button 53b are exposed and made operable when the front cover 52 is opened.

**[0035]** As an operational button for use in instruction of ventilation automatically performed depending on the condition of the air pollution, a ventilation and cleaning button 53c is provided on the front cover 52 as shown in Fig. 4(a). When the ventilation switching button 53a is pressed, instructions on an air-supply/exhaust operation with both air-supply mode and exhaust mode, an air-supply operation with only air-supply mode, and an exhaust operation with only exhaust mode are sequentially given to the controller 46 in the body of the indoor unit 1. At the same time, a corresponding ventilation state is shown in the display section 51.

**[0036]** When the ventilation power button 53b is pressed, instructions on the power of ventilation are sequentially selected among strong, middle and weak, and the selected instruction is given to the controller 46 in the body of the indoor unit 1.

**[0037]** The following description is given based on the flowchart of Fig. 8 to the flow of operation when the ventilation operation mode is instructed.

**[0038]** In STEP 1, every time when the ventilation switching button 53a is pressed, the instruction is switched among the air-supply/exhaust operation, the air-supply operation and the exhaust operation, and transmitted from the remote controller 49 to the controller 46. In addition, every time when the ventilation amount button 53b is pressed, the instructed amount of airflow to be sent to the room is switched among strong, middle

and weak, and the instruction is also transmitted from the remote controller 49 to the controller 46. The amount of airflow can be adjusted by changing the number of revolutions of the fans 31 (fan motor), 41, and the number of the fans 31, 41 to be run (single or double).

**[0039]** The controller 46 performs the single exhaust mode when the amount of airflow is middle or weak in the exhaust operation while it performs the double exhaust mode when the amount of airflow is strong in the exhaust operation. In the first example, the air-supply mode can be performed not with the double air-supply mode but with the single air-supply mode only.

**[0040]** The controller 46 goes to STEP 2 in the air-supply/exhaust operation, STEP 5 in the single air-supply mode, or STEP 8 in the single exhaust mode, and STEP 11 in the double exhaust mode.

**[0041]** In STEP 2, the controller 46 provides a drive signal to change the dampers 32, 33 for the air-supply mode. If the dampers 32, 33 have already been located at the air-supply mode, the controller 46 maintains the dampers 32, 33 at that state. If the object has been in the instructed state before the controller 46 provides a signal, the controller 46 naturally maintains the state. Accordingly, the associated description will be omitted hereinafter. Then, the controller goes to STEP 3.

**[0042]** In STEP 3, the controller 46 provides an signal to the first fan 31 for running. In this case, the first fan unit 21 having the air-supply mode and exhaust mode performs the air-supply mode. Then, the controller goes to STEP 4.

**[0043]** In STEP 4, the controller 46 provides an operation signal to the second fan unit 22 having the exhaust-specified fan unit for running, and returns to STEP 1. Then, this condition is maintained until the remote controller 49 is operated again and the ventilation mode is changed.

**[0044]** If the mode is the single air-supply mode in STEP 1, then the controller goes to STEP 5. In STEPS 5 and 6, similar to STEPS 2 and 3, the controller 46 allows the first fan unit 21 to perform the air-supply mode. Then, the controller goes to STEP 7.

**[0045]** In STEP 7 the controller 46 halts the second fan unit 22, and returns to STEP 1, remaining the state until the ventilation mode is changed.

**[0046]** If the mode is the single exhaust mode in STEP 1, then the controller goes to STEP 8. In STEP 8, the controller 46 provides no signal to the dampers 32, 33 and goes to STEP 9.

**[0047]** In STEP 9, the controller 46 provides a halt signal to the first fan 31 for stopping the first fan 31. Consequently, the first fan unit 21 stops. Then, the controller goes to STEP 10.

**[0048]** In STEP 10, the controller 46 provides a signal to the second fan unit 22 for running, and returns to STEP 1. Then, the state is maintained until the ventilation mode is changed again.

**[0049]** If the mode is the double exhaust mode in STEP 1, then the controller goes to STEP 11. In STEP 11, the

controller 46 provides a drive signal to change the dampers 32, 33 for the exhaust switched mode. Then, the controller goes to STEP 12.

**[0050]** In STEP 12, the controller 46 provides a signal to the first fan 31 for running. Consequently, the first fan unit 21 performs the exhaust mode. Then, the controller goes to STEP 13.

**[0051]** In STEP 13, the controller 46 provides a signal to the second fan unit 22 for running, and returns to STEP 1. Then, the state is maintained until the remote controller 49 is operated again and the ventilation mode is changed.

**[0052]** The following description is given based on the flowchart of Fig. 9 to the flow of ventilation operation performed based on the condition of the air pollution detected at the air pollution sensor such as the CO<sub>2</sub> sensor 47 and the gas sensor 48.

**[0053]** In STEP 20, when the ventilation and cleaning button 53c is pressed on the remote controller 49, an instruction signal for a ventilation and cleaning operation (or an automatic ventilation based on the condition of the air pollution in the room) is transmitted to the controller 46, which starts the ventilation and cleaning operation and then goes to STEP 21.

**[0054]** In STEP 21, the condition of the air pollution detected by the CO<sub>2</sub> sensor 47 or the gas sensor 48 is fed to the controller 46, which then goes to STEP 22. In STEP 22, the controller 46 compares the condition of the air pollution with predetermined high and middle settings to determine whether the condition of the air pollution is high state, middle state or low state. The controller goes to STEP 23 if high state, STEP 24 if middle state, and STEP 25 if low state.

**[0055]** In STEP 23, the controller 46 executes the above STEPS 11-13 to perform the double exhaust mode, and then returns to STEP 21 to maintain the present state until the condition of the air pollution will be under the high state.

**[0056]** In STEP 24, the controller 46 executes the above STEPS 8-10 to perform the single exhaust mode, and then returns to STEP 21 to maintain the present state until the condition of the air pollution will be under the middle state.

**[0057]** In STEP 25, the controller 46 provides a halt signal to the fan units 21, 22 to halt the fan units 21, 22 and then returns to STEP 21 to maintain the halt state until the condition of the air pollution will be over the low state.

**[0058]** Thus, the controller allows the double exhaust mode if the condition of the air pollution is high state, and allows the single exhaust mode if middle state, but halts the exhaust mode if low state.

**[0059]** As described above, the controller, as the control means, having following controls: 1) when air-supply/exhaust operation signal is made, the first fan unit 21 are changed to air-supply mode, the fan 31 will be started, and the exhaust mode of the second fan unit will be started; 2) when the signal of single exhaust mode is made, the fan 31 will be stopped, and the exhaust mode of the sec-

ond fan unit will be started; and 3) when the signal of double exhaust mode is made, the first fan unit 21 are changed to exhaust mode, the fan 31 will be started, and the exhaust mode of the second fan unit will be started.

**[0060]** In addition to the above means, the control means further includes means corresponding to each step to be executed, which is operative to execute each step. It is not always required to include all of the above means.

## EXAMPLE 2

**[0061]** A second example of the air conditioner according to the present invention is described next. Fig. 10 is an operation pattern table for control of the air conditioner according to the second example. Fig. 11 is a brief illustrative view of double air-supply mode. In the description of the second example those corresponding to the components of the preceding first example are denoted with the same reference numerals and omitted from the following detailed description.

**[0062]** In the preceding first example the second fan unit 22 is the exhausting fan unit while in the second example a second fan unit 60 is provided instead of the second fan unit 22. The second fan unit 60 the ventilation fan unit for taking in the air from the outside or exhausting the room air similar to the first fan unit 21 and includes a second fan 61, an inlet side damper 62, and an outlet side damper 63. The second fan 61, the inlet side damper 62 and the outlet side damper 63 have the same structures and functions as those of the second fan 31, the inlet side damper 32 and the outlet side damper 33 in the first fan unit 21. The second fan unit 60 is possible to perform both air-supply mode and exhaust mode. In the second example, therefore, a double air-supply mode can be performed as shown in Fig. 10.

**[0063]** The following description is given to the flow of operation in the air conditioner of the second example when the ventilation is instructed. Only steps added and modified are described. In STEP 1 of Fig. 8, in the air-supply mode, the controller 46 performs the single air-supply mode if the power of airflow to be sent is middle or weak while it performs the double air-supply mode if the power of airflow is strong. In the double air-supply mode, the following STEPS 14-16 (not shown in the figure) are added to the flow shown in Fig. 8 such that the first fan unit 21 is subjected to the air-supply mode (STEP 14), and the dampers 62, 63 are changed to the air-supply mode (STEP 15) and the second fan 61 is run (STEP 16). Consequently, both the first fan unit 21 and the second fan unit 60 are subjected to the air-supply mode as shown in Fig. 11.

**[0064]** As the second fan unit 60 is the air-supply/exhaust double-functioned fan unit, in STEPS 4, 7, 10, 13 the indication "EXHAUST-SPECIFIED UNIT" should be replaced by "AIR-SUPPLY/EXHAUST DOUBLE-FUNCTIONED UNIT" and the indication "RUN" by "ALLOW EXHAUST OPERATION OF". The flow of the exhaust

operation of the second fan unit 60 is same as the flow (STEPS 11, 12) of the exhaust operation of the first fan unit 21, which switches the dampers 62, 63 to the exhaust switched position and runs the second fan 61.

**[0065]** The examples of the invention have been described in detail though the present invention is not limited to the above examples but rather can be modified variously within the scope of the invention as recited in the appended claims. Modifications of the present invention may be exemplified as below.

- (1) The fan is preferably a sirocco fan though it may also be a fan in another form.
- (2) The sequence of the steps in each flowchart may be modified appropriately.
- (3) The control means comprises a microcomputer though it may have another configuration.
- (4) The refrigerant pipe 2 and the air pipes 23, 24 may be inserted either through the same hole of the wall of house or through different holes separately. The hole of the wall for the air conditioner may be employed to insert a drain pipe, power wires and communications wires therethrough, in addition to the refrigerant pipe 2 and the air pipes 23, 24.
- (5) In the automatic ventilation based on the condition of the air pollution, the single exhaust mode or the double exhaust mode is performed though the single air-supply mode or the double air-supply mode may also be performed.
- (6) The air pollution sensors may select appropriate sensors other than the CO<sub>2</sub> sensor and the gas sensor if they can detect indoor air pollution.

#### **INDUSTRIAL AVAILABILITY**

**[0066]** The control means changes the airflow switching means to the exhaust mode to allow the running of the first fan unit and the exhaust mode of the second fan unit. Consequently, the double exhaust mode can be performed with both the first fan unit and the second fan unit. This is effective to ensure a more power of airflow to be exhausted. Therefore, the present invention is optimally applicable to air conditioners operative to ventilate while air conditioning.

#### **Claims**

1. An air conditioner with a refrigerant pipe from an indoor unit led out outdoors through a hole of a building wall and connected to an outdoor unit, comprising:
  - a first air pipe and a second air pipe inserted through the hole of the building wall;
  - a first fan unit located in the indoor unit and connected to the first air pipe;
  - a second fan unit located in the indoor unit and connected to the second air pipe and having an

exhausting structure for exhausting the room air outside the building through the second air pipe; and

a control means for controlling the operation of the first fan unit and the second fan unit, wherein the control means on receipt of a single exhaust instruction halts the first fan unit and allows the exhaust operation of the second fan unit to execute the ventilation with only exhausting, and on receipt of an air-supply/exhaust operation instruction allows the running of the first fan unit and the exhaust operation of the second fan unit to execute the ventilation operation with simultaneous air-supply/exhaust.

2. The air conditioner according to claim 1, wherein the first fan unit comprises a first fan, and an air-path switching means for switching an air-path between an air-supply switched position, on which an outlet of the first fan is connected to the inside of the indoor unit and an inlet of the first fan is connected to the first air pipe, and an exhaust switched position, on which the inlet of the first fan is connected to the inside of the indoor unit and the outlet of the first fan is connected to the first air pipe.
3. The air conditioner according to claim 1 or 2, wherein the control means on receipt of the air-supply/exhaust operation instruction switches the air-path switching means to the air-supply switched position to allow the running of the first fan unit and the exhaust operation of the second fan unit, on receipt of the single exhaust instruction halts the first fan unit and allows the exhaust operation of the second fan unit, and on receipt of a double exhaust instruction switches the air-path switching means to the exhaust switched position to allow the running of the first fan unit and the exhaust operation of the second fan unit.
4. The air conditioner according to claim 1, wherein the indoor unit includes an air pollution sensor operative to detect air pollution, wherein the control means on receipt of an automatic ventilation instruction switches from a single operation of the first fan unit or the second fan unit to a double operation of both the first fan unit and the second fan unit if the air pollution sensor provides a high detected value.
5. The air conditioner according to claim 1, wherein the second fan unit includes a second fan, and a second air-path switching means operative to switch between an air-supply switched position, on which an outlet of the second fan is connected to a space in the indoor unit and an inlet of the second fan is connected to the second air pipe, and an exhaust switched position, on which the inlet of the second fan is connected to the space in the indoor unit and

the outlet of the second fan is connected to the second air pipe.

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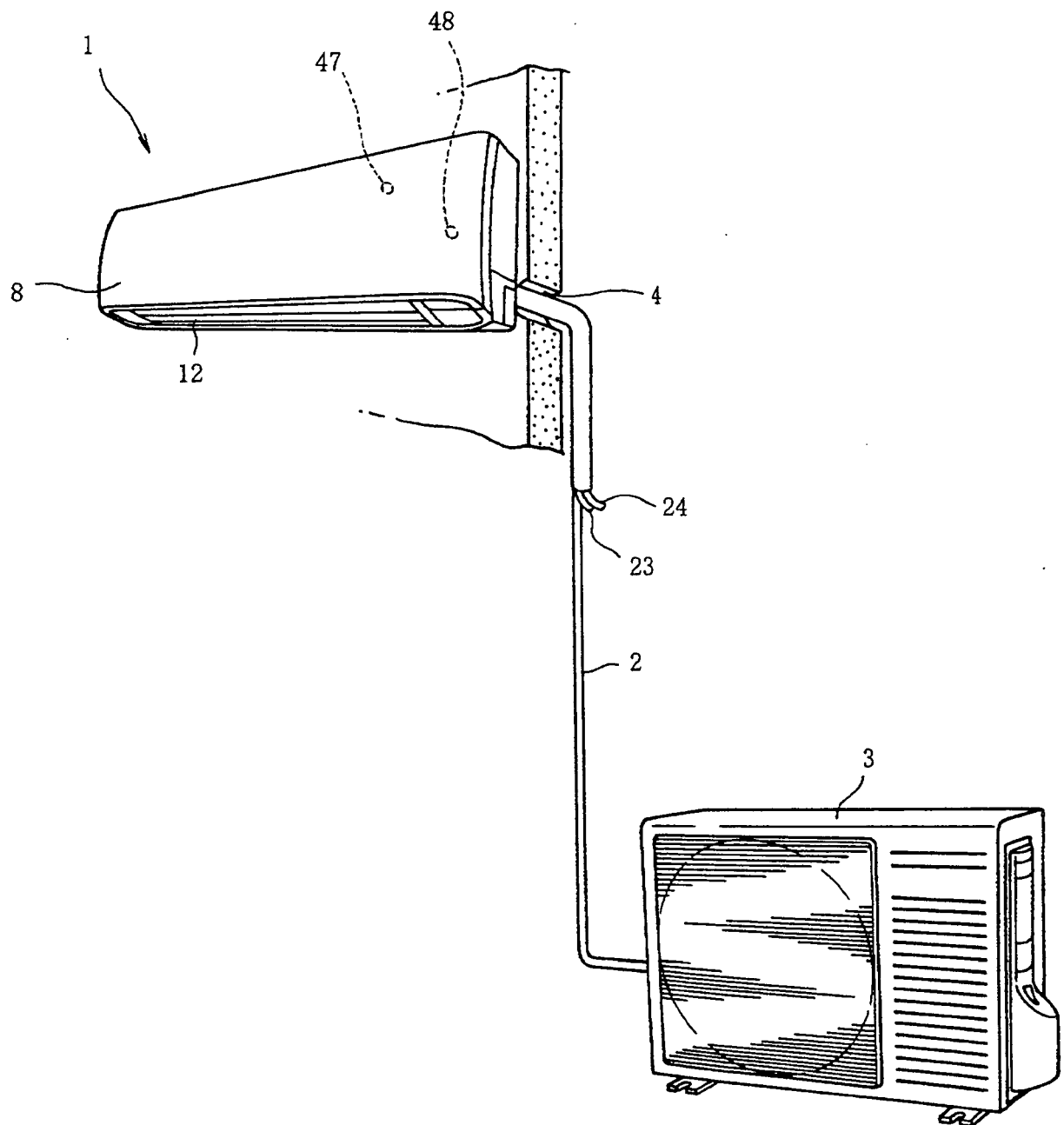
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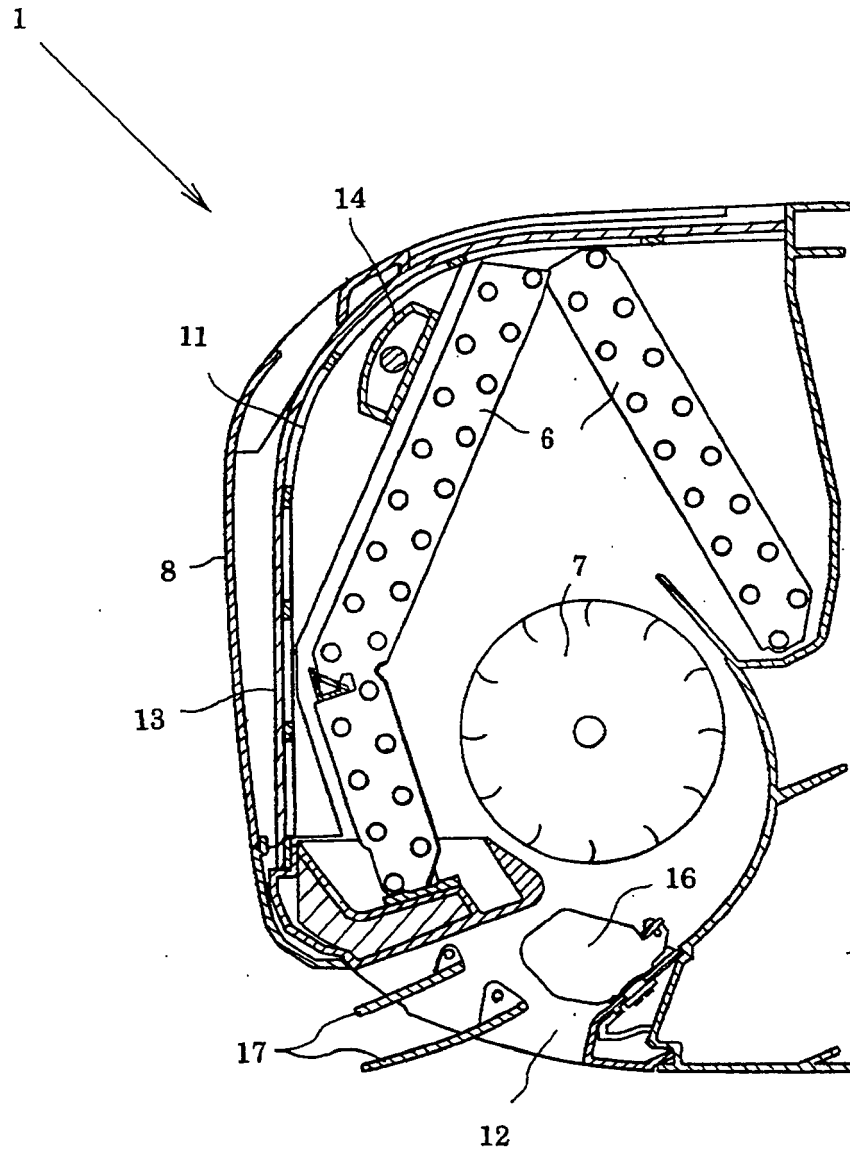
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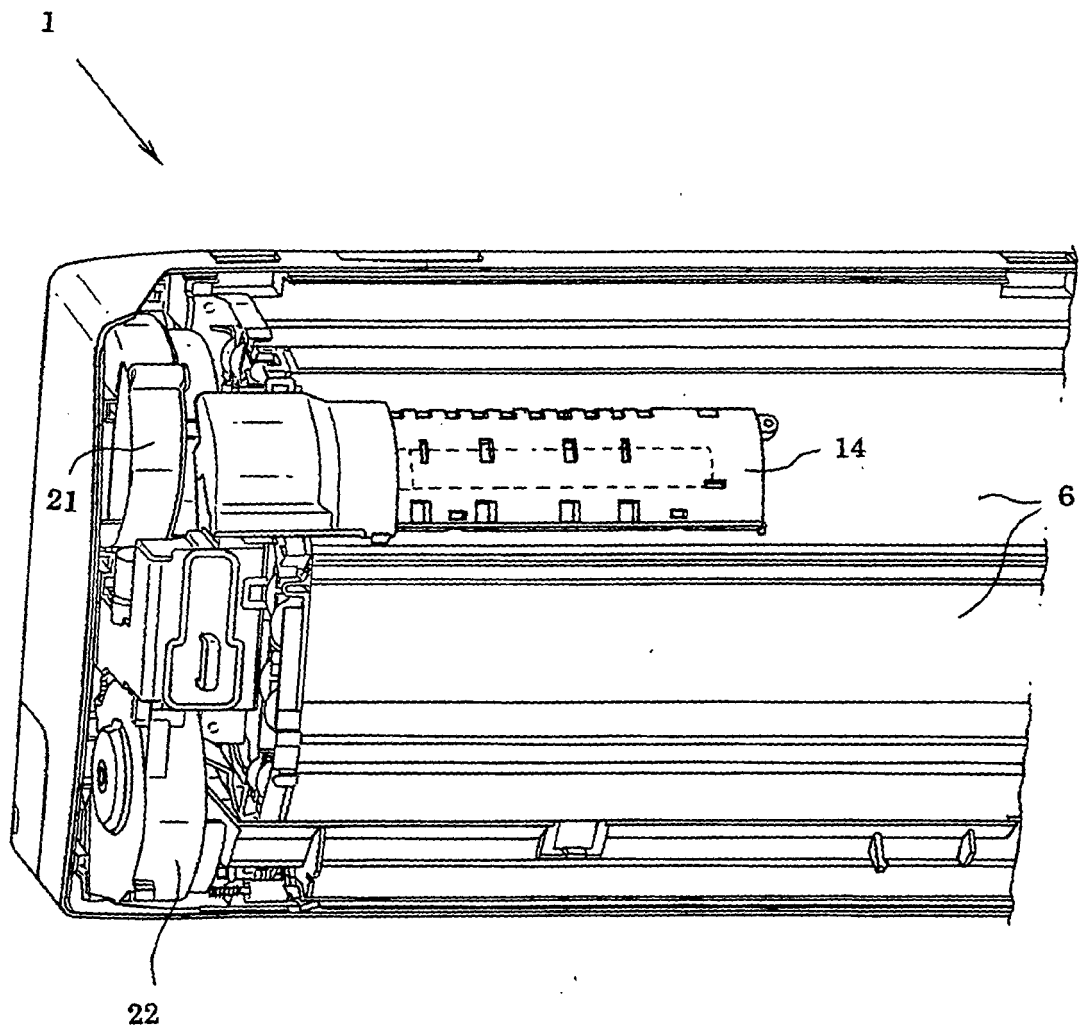
**Fig. 1**



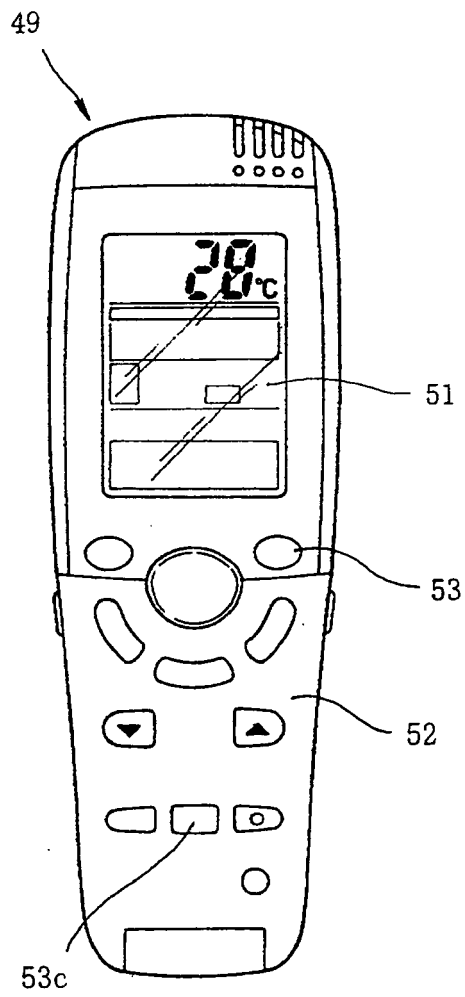
**Fig. 2**



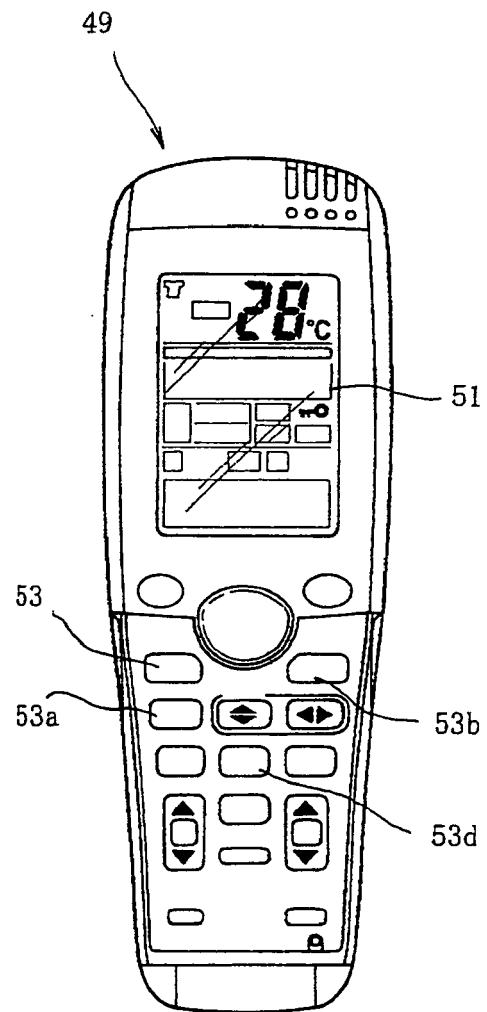
**Fig. 3**



**Fig. 4(a)**



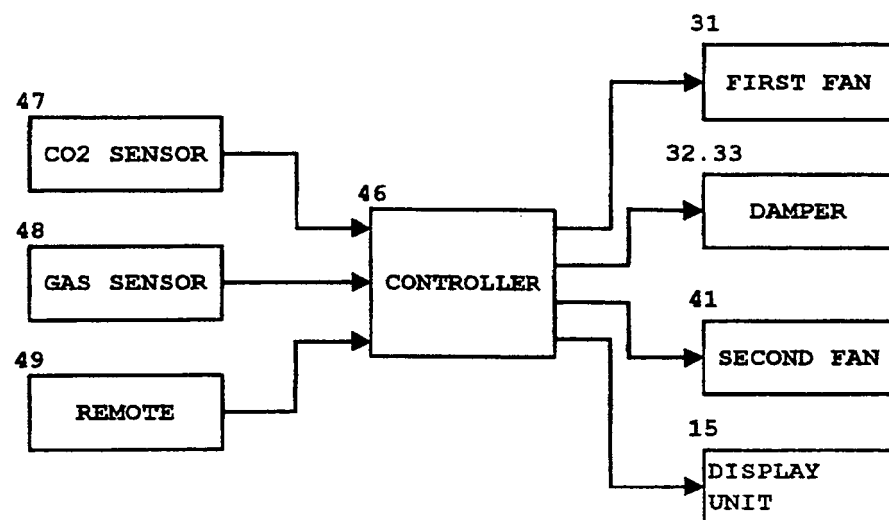
**Fig. 4(b)**



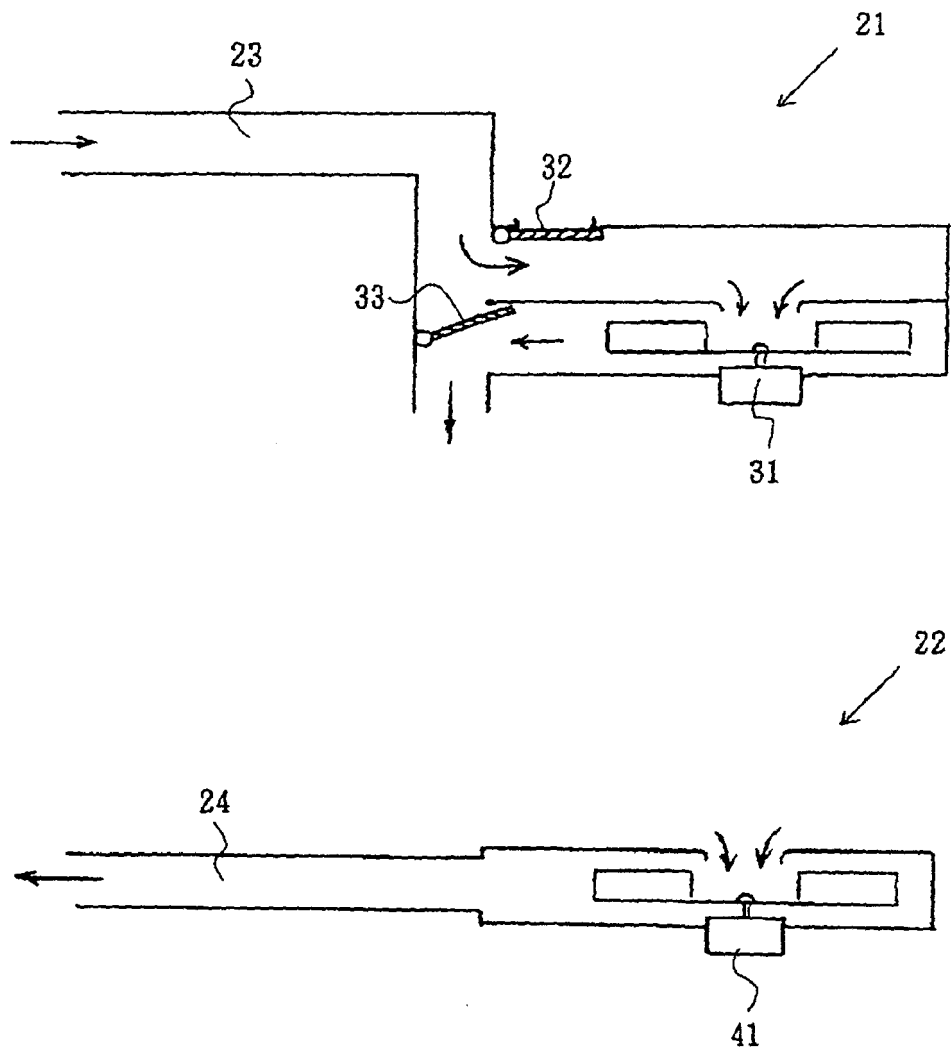
**Fig. 5(a)**

	AIR-SUPPLY/ EXHAUST OPERATION	SINGLE AIR-SUPPLY	SINGLE EXHAUST	DOUBLE EXHAUST
FIRST FAN UNIT (AIR-SUPPLY/EXHAUST DOUBLE -FUNCTIONED FAN UNIT)	AIR-SUPPLY OPERATION	AIR-SUPPLY OPERATION	HALT	EXHAUST OPERATION
SECOND FAN UNIT (EXHAUST-SPECIFIED FAN UNIT)	EXHAUST OPERATION	HALT	EXHAUST OPERATION	EXHAUST OPERATION

**Fig. 5(b)**



**Fig. 6**



**Fig. 7**

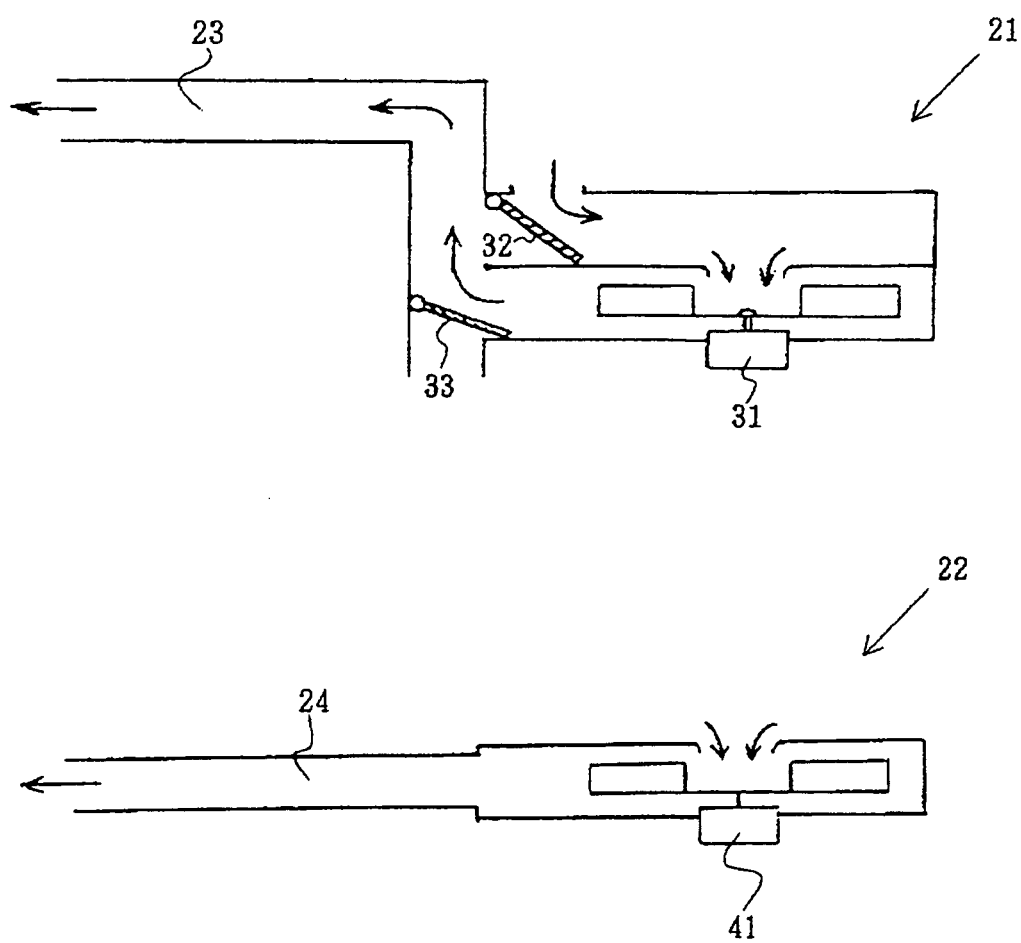
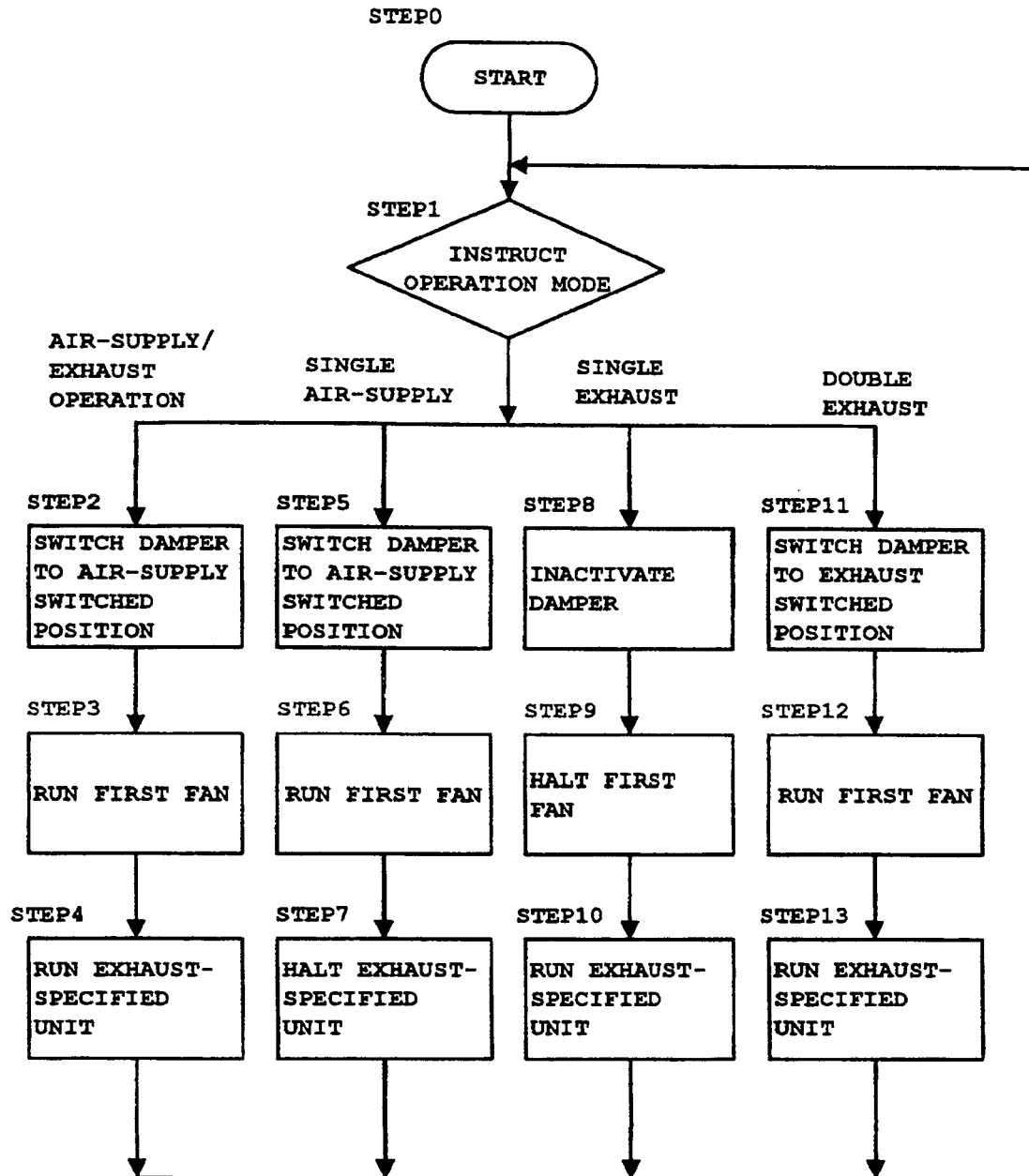
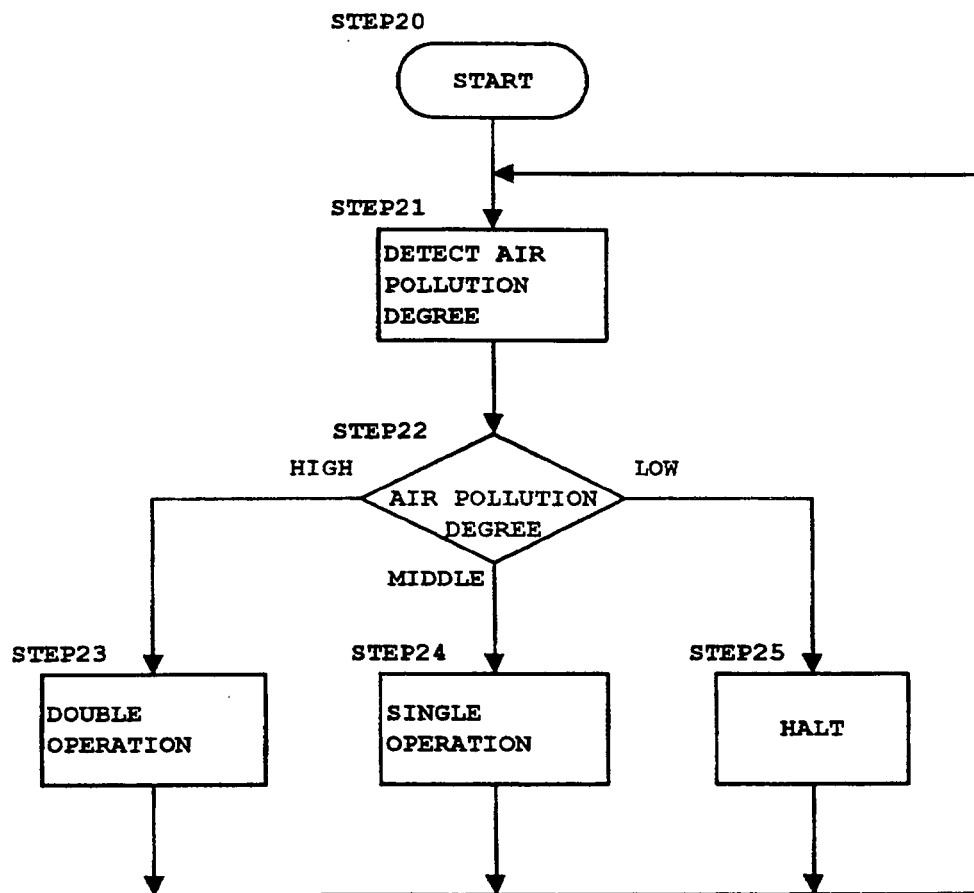




Fig. 8



**Fig. 9**

**Fig. 10**

	AIR-SUPPLY / EXHAUST OPERATION	SINGLE AIR-SUPPLY	SINGLE EXHAUST	DOUBLE EXHAUST	DOUBLE AIR-SUPPLY
FIRST FAN UNIT (AIR-SUPPLY/EXHAUST DOUBLE-FUNCTIONED FAN UNIT)	AIR-SUPPLY OPERATION	AIR-SUPPLY OPERATION	HALT	EXHAUST OPERATION	AIR-SUPPLY OPERATION
SECOND FAN UNIT (AIR-SUPPLY/EXHAUST DOUBLE-FUNCTIONED FAN UNIT)	EXHAUST OPERATION	HALT	EXHAUST OPERATION	EXHAUST OPERATION	AIR-SUPPLY OPERATION

**Fig. 11**

