

HEAT-EXCHANGING VENTILATION SYSTEM

BACKGROUND OF THE INVENTION

5 1. FIELD OF THE INVENTION

This invention relates to a heat-exchanging ventilation system for exchanging heat during the ventilation of a room.

2. DESCRIPTION OF RELATED ART

Fig. 7 shows an example of conventional heat-exchanging ventilation systems for exchanging heat during the ventilation of a room.

The conventional heat-exchanging ventilation system is installed in a space 1 above the ceiling of a building such as an office building. A ventilation unit 2 of the system is connected to an air-supplying main duct 3 and an air-exhausting main duct 4. Openings 3a, 4a of the respective main ducts 3, 4 open toward the outside to take in fresh air from outdoors into the ventilation unit 2 through the air-supplying main duct 3, and to exhaust the air in the ventilation unit 2 through the air-exhausting main duct 4 to the outside.

The ventilation unit 2 is further connected to an air-supplying duct 6 and an air-exhausting duct 7. The air-supplying duct 6 is connected to an air outlet 8 of each of rooms 5, and the air-exhausting duct 7 is connected to an air inlet 9 of each of the rooms 5.

As illustrated in Fig. 8, the ventilation unit 2 has a casing 10 incorporating a plurality of heat-exchange panels 11 in a grid form to form air-supplying passages 12 and air-exhausting passages

13 which are alternated in position. The air-supplying passage 12 has one end connected to the air-supplying main duct 3 and the other end connected to the air-supplying duct 6. The air-exhausting passage 13 has one end connected to the
5 air-exhausting main duct 4 and the other end connected to the air-exhausting duct 7.

Upon actuating a fan (not shown) connected to the air-supplying main duct 3, the ventilation unit 2 supplies outdoor air into the rooms 5 through the air-supplying main duct 3, the
10 air-supplying passages 12 in the ventilation unit 2, the air-supplying duct 6 and then the air outlets 8 in that order.

On the other hand, upon actuating an exhaust fan (not shown) connected to the air-exhausting main duct 4, the air in the rooms 5 is exhausted to the outside through the air inlets 9, the
15 air-exhausting duct 7, the air-exhausting passages 13 in the ventilation unit 2, and then the air exhausting main duct 4 in that order.

When the air is supplied and exhausted, the heat is exchanged through the heat-exchange panels 11 of the ventilation unit 2.

20 For example, assuming that the outdoor temperature in summer is 35°C and an air conditioner (not shown) cools the rooms 5 to 25°C, when the outdoor air at 35°C flows into the air-supplying passage 12 of the ventilation unit 2, it is cooled therein by the exhausted air at 25°C flowing through the air-exhausting
25 passage 13. Thus, air cooled to a certain degree is supplied into the rooms 5.

On the other hand, assuming that the outdoor temperature in winter is 5°C and an air conditioner (not shown) heats the

rooms 5 to 20°C, when the outdoor air at 5°C flows into the air-supplying passage 12, it is heated therein by the exhausted air at 20°C passing through the air-exhausting passage 13. Thus, air heated to a certain degree is supplied into the rooms 5.

5 In short, outdoor air is not supplied directly but supplied after being cooled or heated by the use of the exhausted cooled-or-heated air.

 The heat-exchanging ventilation system as described above is designed such that the opening 3a of the air-supplying main duct 3 is positioned as far away as possible from the opening 10 4a of the air-exhausting main duct 4. The reason why the openings 3a and 4a are positioned apart from each other is to prevent the air exhausted from the air-exhausting main duct 4 from being re-sucked into the air-supplying main duct 3. In other words, 15 if the openings 3a and 4a are close to each other, this produces a disadvantage that the exhausted air may be re-sucked into the air-supplying main duct 3, for example, if a person is smoking in one of the rooms 5, the smell of the smoke will be supplied to the other room 5.

20 Therefore, the openings 3a and 4a of the respective main ducts 3 and 4 are positioned at a distance from each other to improve the efficiency of ventilation and to prevent the above disadvantages.

 In the above conventional example, due to the connection 25 of the ventilation unit 2 with the air-supplying main duct 3 and air-exhausting main duct 4, in order to make the distance between the openings 3a and 4a of the respective main ducts 3 and 4, at least one of the main ducts must be longer than the other.

However, owing to the fact that the main ducts 3, 4 are placed in the limited space above the ceiling, the longer the length of the duct is, the more the duct tends to interfere with a cross-beam, other pieces of equipment or the like. In other words, the longer the duct is, the more restrictions there are on installation location of the duct.

Further, the piping resistance of the duct increases in proportion to the length thereof. Hence, when a longer duct is employed as described above, typically, the duct must have a larger diameter in order to restrain any increase in the piping resistance.

However, if the diameter of the duct increases, it may be impossible to lay the main duct in the small space as described above. If the diameter of the duct cannot be increased, a high-powered oversize fan and exhaust fan will need to be provided in accordance with the increase of the piping resistance. If the fan or the exhaust fan is increased in size, it, in turn, will not be able to be installed.

As described above, increasing the entire length of the main duct 3, 4 produces various inconveniences. For this reason, it is impossible to practically establish any great distance between the openings 3a and 4a, resulting in the impossibility of improving the efficiency of ventilation.

Still further, the ventilation unit 2 has a limitation of a reduction in size because the air-supplying passage 12 and the air-exhausting passage 13 need to be formed therein. This produces a problem of limiting the installation location for the ventilation unit 2.

SUMMARY OF THE INVENTION

An object of the present invention is therefore to provide a heat-exchanging ventilation system having a high degree of freedom of installation location and having a high efficiency of ventilation.

The feature of a first aspect of the present invention is that a heat-exchanging ventilation system for ventilating a room through a heat exchanger includes: an air-supplying unit incorporating a fan for supplying outdoor air into the room; an air-supplying heat-exchanger provided in an air-supplying passage of the air-supplying unit; an air-exhausting unit incorporating an exhaust fan for exhausting the air in the room; an air-exhausting heat-exchanger provided in an air-exhausting passage of the air-exhausting unit; and a circulation mechanism connecting the air-supplying heat-exchanger and the air-exhausting heat-exchanger for circulation of fluid flowing through the air-supplying and air-exhausting heat-exchangers, in which when the outdoor air is supplied to the room through the air-supplying passage of the air-supplying unit, the air-supplying heat-exchanger exchanges the heat, and when the air in the room is exhausted to the outside through the air-exhausting passage of the air-exhausting unit, the air-exhausting heat-exchanger exchanges the heat.

According to the first aspect, due to the independent provision of the air-supplying unit and the air-exhausting unit, without use of the main duct as formed in the aforementioned conventional example, it is possible to place the air-supplying unit and the air-exhausting unit with a sufficient distance between

the respective openings.

For this reason, the system does not suffer the restrictions in installation location, and is able to achieve a high efficiency of ventilation.

5 Further, each of the units requires only either an air-supplying passage or an air-exhausting passage, leading to a reduction in size. The reduction in size of each unit can yield a further wide selection of the installation location.

The feature of a second aspect of the present invention
10 is that the heat-exchanging ventilation system in the first aspect further includes: a cooler and a heater provided in the air-supplying passage of the air-supplying unit; a heating/cooling panel using cold water or hot water as a thermal source; and a cold/hot water feeder for feeding cold water or
15 hot water to the heating/cooling panel, in which the cold water is fed from the cold/hot water feeder to the cooler, and the hot water is fed from the cold/hot water feeder to the heater.

According to the second aspect, a single thermal source is used in common such that the supply source used for supplying
20 the cold water and the hot water to the heating/cooling panel also supplies the cold water to the cooler and the hot water to the heater. This design eliminates the use of an extra thermal source for the cooler and the heater.

Hence, the cost of the entire system can be reduced as
25 compared with the use of an extra thermal source.

The feature of a third aspect of the present invention is that the heat-exchanging ventilation system in the second aspect further includes an auxiliary heat exchanger incorporated in a

duct for conducting the outdoor air from the air-supplying unit into the room, in which the cold water or hot water to be conducted to the heating/cooling panel is branched to provide a feed to the auxiliary heat exchanger.

5 According to the third aspect, since the auxiliary heat exchanger is incorporated in the duct for conducting outdoor air from the air-supplying unit into the room, the outdoor air to be supplied into the room can be further cooled or heated.

10 Further, the thermal source of the auxiliary heat exchange is derived from the thermal source of the heating/cooling panel. This configuration reduces the cost as compared with the provision of an extra thermal source.

15 The feature of a fourth aspect of the present invention is that the heat-exchanging ventilation system in the first to third aspects further includes a sprinkling mechanism provided at the air-exhausting heat-exchanger for sprinkling fluid on the air-exhausting heat-exchanger to generate heat of evaporation to remove heat from the fluid flowing through the air-exhausting heat-exchanger.

20 According to the fourth aspect, with the design of the system to utilize heat of evaporation for the removal of heat from the fluid flowing through the air-exhausting heat-exchanger, the temperature of the fluid flowing through the air-exhausting heat-exchanger can be further decreased.

25 The feature of a fifth aspect of the present invention is that, in the first to fourth aspects, the heat exchanger incorporates a mat-shaped pipe mat, formed by a connection of main pipes with a plurality of heat-exchanging pipes, into a casing

having an inflow port and an outflow port.

According to the fifth aspect, the constitution of the heat exchanger including the mat-shaped pipe mat allows a high thermal efficiency and the compact design of the heat exchanger.

5 The feature of a sixth aspect of the present invention is that the heat-exchanging ventilation system in the fifth aspect further includes a mesh-form filler including a large number of holes which is interposed between the pipe mats.

According to the sixth aspect, the use of fillers increases
10 the area for exchanging heat, thereby to further increase the rate of exchanging heat.

BRIEF DESCRIPTION OF THE DRAWINGS

15 Fig. 1 is a general diagram of an embodiment according to the present invention.

Fig. 2 is an explanatory diagram of an air-supplying unit
17 and an air-exhausting unit 18.

Fig. 3 is a sectional view illustrating a heat exchanger
20 32, 39.

Fig. 4 is a perspective view illustrating a pipe mat 43.

Fig. 5 is an explanatory diagram illustrating a mechanism
for recapturing heat.

Fig. 6 is a circuit diagram illustrating an example of the
25 use of heating/cooling panels 55, 56.

Fig. 7 is a general diagram illustrating a conventional
example.

Fig. 8 is a diagram illustrating an interior construction

of a ventilation unit 2.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Fig. 1 illustrates one of the floors of a building on which
5 there are two rooms 14, 15. In a space 16 above the ceiling of
the floor, there are provided an air-supplying unit 17 and an
air-exhausting unit 18. An intake port 19 of the air-supplying
unit 17 opens onto a wall face 21 and an exhaust port 20 of the
air-exhausting unit 18 opens onto the other wall face 22.

10 The air-supplying unit 17 is connected to an air-supplying
duct 23 of which manifolds 25, 26 are connected to air-outlets
(not shown) of the rooms 14, 15. The air-exhausting unit 18 is
connected to an air-exhausting duct 24 having manifolds 27, 28
which are connected to air-inlets (not shown) of the rooms 14,
15 15.

Fig. 2 is a diagram specifically illustrating the
configurations of the air-supplying unit 17 and the air-exhausting
unit 18.

In the air-supplying unit 17, the intake port 19 is provided
20 at one end of a housing 29 and the air-supplying duct 23 is connected
to the other end thereof. Inside the housing 29, an air-supplying
passage 30 is formed and a filter 31 for preventing the entry
of dust and the like from outside is provided in the air-supplying
passage 30 close to the intake port 19.

25 An air-supplying heat-exchanger 32 is placed downstream
from the filter 31, and a cooler 33 and a heater 34 are placed
downstream from the heat-exchanger 32. Further, a fan 35 is placed
downstream from the heater 34.

The air-supplying unit 17 constructed as described above actuates the fan 35 to introduce fresh air from outdoor into the air-supplying duct 23 through the intake port 19, the filter 31, the air-supplying heat-exchanger 32, the cooler 33, the heater 34 and the fan 35 in that order. At this point, the air-supplying heat-exchanger 32 exchanges the heat, of which the operation will be described in detail hereinafter.

The cooler 33 cools and moderately dehumidifies the taken-in air. Then, the heater 34 located downstream from the cooler 33 heats the air thus dehumidified and decreased in temperature to a proper temperature. In short, the cooler 33 and the heater 34 constitute a dehumidifier.

On the other hand, in the air-exhausting unit 18, the exhaust port 20 is provided at one end of a housing 36 and the air-exhausting duct 24 is connected to the other end thereof. Inside the housing 36, an air-exhausting passage 37 is formed and a filter 38 for excluding dust and the like is provided in the air-exhausting passage 37 close to the exhaust port 24. An air-exhausting heat-exchanger 39 is placed downstream from the filter 38.

Further, a liquid-removal apparatus 40 is provided downstream from the air-exhausting heat-exchanger 39, and an exhaust fan 41 is provided downstream from the liquid-removal apparatus 40.

Inside the housing 36, a sprinkling mechanism constituted by a sprinkling nozzle 53 and a pump 54 is provided such that the sprinkling nozzle 53 sprinkles water on the air-exhausting heat-exchanger 39.

The liquid-removal apparatus 40 is provided for preventing

the water sprinkled on the air-exhausting heat-exchanger 39 from escaping to the outside.

The air-exhausting unit 18 constructed as described above actuates the exhaust fan 41 to exhaust the air inside the rooms 14, 15 to the outside through the air-exhausting duct 24, the filter 38, the air-exhausting heat-exchanger 39, the liquid-removal apparatus 40, the exhaust fan 41 and the exhaust port 20 in that order. At this point, the air-exhausting heat-exchanger 39 exchanges the heat, of which the operation will be described in detail hereinafter.

Fig. 3 is a diagram illustrating a specific configuration of the heat exchanger 32, 39 provided in each of the air-supplying and air-exhausting units 17 and 18.

For each of the heat exchangers 32, 39, a box-shaped casing 42 has an inflow port 48 at one end and an outflow port 49 at the other end and incorporates a plurality of pipe mats 43 and a plurality of fillers 44.

As illustrated in Fig. 4, each of the pipe mats 43 is shaped in a mat form by connecting an upstream main pipe 45 and a downstream main pipe 46 through a plurality of small-diameter heat-exchange pipes 47. The upstream main pipe 45, downstream main pipe 46 and heat-exchange pipes 47 are made of resin and have sufficient flexibility.

A plurality of such pipe mats 43 are arranged in parallel as shown in Fig. 3. The upstream main pipe 45 of each of the pipe mats 43 is connected to an upstream header (not shown), and the downstream main pipe 46 of each of the pipe mats 43 is connected to a downstream header (not shown).

When fluid is conducted from the upstream header into the upstream main pipe 45 of each of the pipe mats 43, the fluid is conducted via a plurality of heat-exchange pipes 47 into the corresponding downstream main pipe 46. The fluid conducted into
5 the downstream main pipe 46 is discharged from the downstream header.

Each of the fillers 44 shown in Fig. 3 has a mesh structure having a mesh size ranging from several millimeters to tens of millimeters so as to allow air or water to flow therethrough.
10 The filler 44 may be made of a metal such as stainless steel or a resin, a metal being preferable from considerations of thermal conductivity and a resin being preferable if considering the prevention of rust occurring and of debris being deposited.

A plurality of the fillers 44 and a plurality of the pipe
15 mats 43 are overlaid in alternate order before being incorporated in the casing 42.

With the heat exchanger 32, 39 configured as explained above, air is introduced from the inflow port 48 into the casing 42, and then cooled or heated during the process of flowing between
20 the heat-exchange pipes 47 and through the fillers 44. Then, the cooled or heated air is discharged from the outflow port 49.

In the embodiment, providing the fillers 44 increases the contact area with the air to improve the heat-exchanger effectiveness, but the filler 44 is not an absolutely necessary
25 component. Only the pipe mats 43 may be incorporated in the casing 42 for constituting the heat exchanger 32, 39.

Further, in the embodiment, a plurality of the pipe mats 43 are incorporated, but a single pipe mat 43 can be folded back

several times before being incorporated in the casing 42.

Further, the embodiment employs the box-shaped casing 42, but a cylinder-shaped casing can be employed and the pipe mats 43 and the fillers 44 can be rolled up for incorporation into the cylinder-shaped casing. In this case, the resin-made pipe mat 43 having sufficient flexibility can be rolled up easily. If using the resin-made filler 44, the filler 44 can also be rolled up easily. Employing the cylinder-shaped casing in a such manner allows the heat exchanger to be incorporated into the duct of circular section as it is, resulting in enhancing a degree of freedom of installation location.

As illustrated in Fig. 2, the air-supplying heat-exchanger 32 and the air-exhausting heat-exchanger 39 designed as explained above are connected through pipings 50 and 51. Specifically, the piping 50 connects the downstream header of the air-supplying heat-exchanger 32 and the upstream header of the air-exhausting heat-exchanger 39, and the piping 51 connects the upstream header of the air-supplying heat-exchanger 32 and the downstream header of the air-exhausting heat-exchanger 39.

The piping 51 is connected to a pump 52. The pump 52 is provided for circulating the fluid in both heat-exchangers 32 and 39.

The sprinkling nozzle 53 sprinkles water on the air-exhausting heat-exchanger 39. The sprinkled water passes over the surfaces of the heat-exchange pipes 47 and through the inside of the fillers 44 so as to flow out downward, then collects in a recovery container. Then the water is circulated by the pump 54.

The pipings 50, 51 and the pump 52 constitute a circulation mechanism of the present invention.

Next, Fig. 5 is referred for the description of the principle of heat recovery performed by the air-supplying and the
5 air-exhausting heat-exchangers 32 and 39.

For example, assuming that in summer the outdoor temperature is 35°C and an air conditioner cools the rooms 14, 15 to 26°C, when the outdoor air at 35°C flows into the air-supplying heat-exchanger 32, it is cooled therein by the fluid flowing through
10 the air-supplying heat-exchanger 32. At this point, the fluid flowing through the air-supplying heat-exchanger 32 is set to a temperature of 20°C to allow the air-supplying heat-exchanger 32 to cool the incoming outdoor air to the temperature of 28°C. After the heat exchange, the fluid flows out from the air-supplying
15 heat-exchanger 32 at a temperature of 33°C.

The air cooled to 28°C by the air-supplying heat-exchanger 32 is supplied to the rooms 14, 15, then further cooled to the temperature of 26°C by the air conditioner.

The air thus cooled to 26°C in the rooms 14, 15 is exhausted
20 through the air-exhausting heat-exchanger 39 to the outside. At this point, the fluid at 33°C is inducted from the air-supplying heat-exchanger 32 into the air-exhausting heat-exchanger 39. Accordingly, the fluid at 33 °C is cooled in the air-exhausting heat-exchanger 39 by the exhausted air at 26°C.

25 Water is sprinkled into the air-exhausting heat-exchanger 39 from the sprinkling nozzle 53, then the water is evaporated due to the air flowing through the heat exchanger 39, while flowing downward therein. The water is thus evaporated and the heat of

vaporization is removed, resulting in a decrease in water temperature.

In other words, the air-exhausting heat-exchanger 39 removes the heat of vaporization to further cool the fluid flowing
5 through therein.

As described above, the fluid cooled to a temperature of 20°C flows out from the air-exhausting heat-exchanger 39 via the piping 51 into the air-supplying heat-exchanger 32. Then the fluid at 20°C cools the outdoor air to the temperature of 28°C.

10 Further, for example, assuming that in winter the outdoor temperature is 5°C and the heating apparatus heats the rooms 14, 15 to the temperature of 25°C, when outdoor air at 5°C is introduced into the air-supplying heat-exchanger 32, it is heated by the fluid flowing through the air-supplying heat-exchanger 32. At
15 this point, the fluid flowing into the air-supplying heat-exchanger 32 is set at a temperature of 20°C to allow the air-supplying heat-exchanger 32 to heat the outdoor air to the temperature of 15°C. After the heat exchange, the fluid flows out from the air-supplying heat-exchanger 32 at the temperature
20 of 18°C.

Then, the air heated to 15°C by the air-supplying heat-exchanger 32 is supplied to the rooms 14, 15, then is reheated to 25°C by the heating apparatus.

The air heated to 25°C in the rooms 14, 15 is exhausted through
25 the air-exhausting heat-exchanger 39 to the outside. Into the air-exhausting heat-exchanger 39, the fluid at 18°C is conducted from the air-supplying heat-exchanger 32. Accordingly, the fluid at 18°C is heated to 20°C by the exhausted air at 25°C.

Thus, the fluid heated to 20°C flows out from the air-exhausting heat-exchanger 39 and is conducted via the piping 51 into the air-supplying heat-exchanger 32. Then the fluid at 20°C heats the outdoor air at 5°C to a temperature of 15°C.

5 It should be noted that when the rooms are heated as described above, water is not sprinkled onto the air-exhausting heat-exchanger 39.

As described above, the air-supplying heat-exchanger 32 and air-exhausting heat-exchanger 39 serve in combination for
10 recovering the thermal energy of the air exhausted from the rooms 14, 15.

According to the embodiment, as illustrated in Fig. 1, the independent provision of the air-supplying unit 17 and the air-exhausting unit 18 allows the placement of the units 17 and
15 18 with a distance from each other. Additionally, the intake port 19 of the air-supplying unit 17 opens directly onto one wall face 21, and the exhaust port 20 of the air-exhausting unit 18 opens directly onto the other wall face 22. The above design eliminates the need of the main duct as used in the aforementioned
20 conventional example.

Hence, without any constraints on the layout due to the main duct, it is possible to position the intake port 19 and the exhaust port 20 at locations sufficient far apart from each other. Due to the sufficiently separated placement of the intake port
25 19 and the exhaust port 20, a high efficiency of ventilation can be obtained.

In the case of each of the units, the air-supplying unit 17 incorporating the air-supplying heat-exchanger 32 and the

air-exhausting unit 18 incorporating the air-exhausting heat-exchanger 39, there is only a need to provide either the air-supplying passage 30 or the air-exhausting passage 37. Therefore, both the units 17 and 18 are decreased in size.

5 Accordingly, restrictions on the place of installation of the air-supplying unit 17 or the air-exhausting unit 18 are decreased.

Fig. 6 illustrates a combination system of the above heat-exchanging ventilation system and heating/cooling panels 10 55, 56. The same components as those in Fig. 1 are designated with the same reference numerals, and a detailed description is omitted.

The air-supplying unit 17 and the air-exhausting unit 18 are installed in the space 16 above the ceiling. Both the units 15 17, 18 are provided for ventilating the rooms 14, 15 while exchanging the heat as described above.

The heating/cooling panels 55, 56 are used for the ceiling of the rooms 14, 15, and constructed so that the pipe mat 43 shown in Fig. 4 is laid on a radiation panel, and covered with a heat 20 insulation material. Cold or hot water is supplied to the pipe mat 43 for cooling or heating the radiation panel. The thermal radiation of the radiation panel cools or heats each of the rooms 14, 15.

In Fig. 6, reference numeral 57 represents a cold water 25 feeder installed on the roof or the like and reference numeral 58 represents a hot water feeder installed in the basement.

Reference numerals 59 and 60 represent first and second heat exchangers, respectively.

The cold water feeder 57 is connected to the first heat exchanger 59 and the cooler 33 of the air-supplying unit 17 to supply cold water to them.

The hot-water feeder 58 is connected to the second heat exchanger 60 and the heater 34 of the air-supplying unit 17 to supply hot water to them.

The heating/cooling panels 55, 56 are connected to the first and second heat exchangers 59, 60. The cold water cooled in the first heat exchanger 59 is conducted into each of the heating/cooling panels 55, 56, and the hot water heated in the second heat exchanger 60 is conducted into each of the heating-cooling panels 55, 56.

A valve V is connected to each of pipings for introducing the cold water or hot water to the heating/cooling panels 55, 56. Either the cold water or the hot water is conducted through the valve into each of the heating/cooling panels 55, 56.

The rooms 14, 15 are cooled by conducting the cold water into the heating/cooling panels 55, 56, and are heated by conducting the hot water into the heating/cooling panels 55, 56.

It should be noted that the cold water feeder 57 and the hot-water feeder 58 may be connected directly to the heating/cooling panels 55, 56 without intervention of the first and second heat exchangers 59, 60 so as to directly supply the cold water and the hot water to the heating-cooling panels 55, 56.

A bypass passage 61 is connected to the manifold 25 connected to the air-supplying duct 23 of the air-supplying unit 17, and it is also connected to an auxiliary heat exchanger 62. The

auxiliary heat exchanger 62 equivalent to that shown in Fig. 3 has a supply header which is connected to a piping 63 provided for conducting the cold water to the heating/cooling panel 55 and a return header which is connected to a piping 64 provided
5 for returning the cold water from the heating/cooling panel 55 to the first heat exchanger 59.

The auxiliary heat exchanger 62 further cools the air flowing through the bypass passage 61. For example, if population density in the room 14 is higher because of holding a meeting or the like
10 and the heating/cooling panel 55 alone cannot cool the room 14, a three-way valve 65 is shifted to a position for inducting the outdoor air from the air-supplying unit 17 through the bypass passage 61 into the room 14. This arrangement allows the auxiliary heat exchanger 62 provided on the bypass passage 61 to further
15 cool the outdoor air. As a result, the room 14 can be cooled to proper temperatures.

Normally, the outdoor air flowing from the air-supplying duct 23 is not introduced into the bypass passage 61 but is supplied directly to the room 14 via the manifold 25.

20 A valve may be placed in the piping provided for supplying the cold water to the auxiliary heat exchanger 62 in order to supply the cold water to the auxiliary heat exchanger 62 only when the auxiliary heat exchanger 62 is used.

According to the above system, owing to the fact that the
25 air-supplying unit 17 dehumidifies the outdoor air, when the heating/cooling panels 55, 56 are operated for cooling, it is possible to prevent condensation from occurring in the heating/cooling panels 55, 56. Specifically, when the

heating/cooling panels 55, 56 cool the rooms 14, 15, if moist outdoor air is supplied thereto, condensation occurs on the radiation faces of the heating/cooling panels 55, 56. Therefore, it is conventionally required to provide a special dehumidifier
5 system for dehumidifying the outdoor air.

However, according to the system of the present invention, the cooler 33 and the heater 34 incorporated in the air-supplying unit 17 constitute a dehumidifier for the dehumidification of the outdoor air, which eliminates the need for a special
10 dehumidifier system.

Further, since the cold water supplied to the cooler 33 and the hot water supplied to the heater 34 are used in common with the cold water and the hot water supplied to the heating/cooling panels 55, 56, an extra heat source for
15 dehumidification is not needed.

For this reason, as compared with the use of an extra heat source for dehumidification, the cost for the entire system can be kept down.

Further, if the rate in temperature rise in the room 14
20 is different from other rooms, it is possible to operate the auxiliary heat exchanger 62 for the room 14 so that the rooms can be individually addressed.

Additionally, since the thermal source of the auxiliary heat exchanger 62 is derived from the heating-cooling panel 55
25 provided in the room 14, the execution of the construction work can easy and the cost can be reduced with ease.

The heating/cooling panels 55, 56 are provided to form the ceiling in the above system, but they may be provided to form

walls in the rooms.

The auxiliary heat exchanger 62 is set for cooling in the above system, but it may be designed to receive a supply of the hot water to be utilized for heating.

5

EXPLANATION OF REFERENCE NUMERALS

	17	AIR-SUPPLYING UNIT
	18	AIR-EXHAUSTING UNIT
10	30	AIR-SUPPLYING PASSAGE
	32	AIR-SUPPLYING HEAT-EXCHANGER
	35	FAN
	37	AIR-EXHAUSTING PASSAGE
	39	AIR-EXHAUSTING HEAT-EXCHANGER
15	41	EXHAUST FAN
	42	CASING
	43	PIPE MAT
	44	FILLER
	45	UPSTREAM MAIN PIPE
20	46	DOWNSTREAM MAIN PIPE
	47	HEAT-EXCHANGE PIPE
	48	INFLOW PORT
	49	OUTFLOW PORT
	50, 51	PIPING CONSTITUTING CIRCULATION MECHANISM OF THE
25		PRESENT INVENTION
	52	PUMP CONSTITUTING CIRCULATION MECHANISM OF THE
		PRESENT INVENTION
	53	SPRINKLING NOZZLE CONSTITUTING SPRINKLING MECHANISM

OF THE PRESENT INVENTION

54 PUMP CONSTITUTING SPRINKLING MECHANISM OF THE PRESENT
INVENTION

55, 56 HEATING/COOLING PANEL

5 57 COLD WATER FEEDER

58 HOT WATER FEEDER

62 AUXILIARY HEAT EXCHANGER

I claim:

1. A heat-exchanging ventilation system for ventilating a room through a heat exchanger, comprising:

5 an air-supplying unit incorporating a fan for supplying outdoor air into the room;

an air-supplying heat-exchanger provided in an air-supplying passage of said air-supplying unit;

an air-exhausting unit incorporating an exhaust fan for
10 exhausting the air in the room;

an air-exhausting heat-exchanger provided in an air-exhausting passage of said air-exhausting unit; and

a circulation mechanism connecting said air-supplying heat-exchanger and said air-exhausting heat-exchanger for
15 circulation of fluid flowing through said air-supplying and air-exhausting heat-exchangers,

wherein when the outdoor air is supplied to the room through the air-supplying passage of said air-supplying unit, said air-supplying heat-exchanger exchanges the heat, and when the
20 air in the room is exhausted to the outside through the air-exhausting passage of said air-exhausting unit, said air-exhausting heat-exchanger exchanges the heat.

2. A heat-exchanging ventilation system according to claim
25 1, further comprising:

a cooler and a heater provided in the air-supplying passage of said air-supplying unit;

a heating/cooling panel using cold water or hot water as



a thermal source; and

a cold/hot water feeder for feeding cold water or hot water to said heating/cooling panel,

wherein the cold water is fed from said cold/hot water feeder to said cooler, and the hot water is fed from said cold/hot water feeder to said heater.

3. A heat-exchanging ventilation system according to claim 2, further comprising an auxiliary heat exchanger incorporated in a duct for conducting the outdoor air from said air-supplying unit into the room, wherein the cold water or hot water to be conducted to said heating/cooling panel is branched to provide a feed to said auxiliary heat exchanger.

4. A heat-exchanging ventilation system according to any one of claims 1, 2 and 3, further comprising a sprinkling mechanism provided at said air-exhausting heat-exchanger for sprinkling fluid on the air-exhausting heat-exchanger to generate heat of evaporation to remove heat from the fluid flowing through the air-exhausting heat-exchanger.

5. A heat-exchanging ventilation system according to any one of claims 1, 2, 3 and 4, wherein the heat exchanger incorporates a mat-shaped pipe mat, formed by a connection of main pipes with a plurality of heat-exchanging pipes, into a casing having an inflow port and an outflow port.



6. A heat-exchanging ventilation system according to claim

5, further comprising a mesh-form filler, including a large number of holes, interposed between said pipe mats.

