

TITLE

AIR CONDITIONING SYSTEM

TECHNICAL FIELD

[0001] The present disclosure relates to air conditioning systems provided in a space defined by a ceiling and walls.

BACKGROUND

[0002] Japanese Unexamined Patent Publication No. 2018-169102 describes an air conditioning method and an air conditioning system. The air conditioning system is installed in a room partitioned by the ceiling, a floor, and side walls. A plurality of air supply chambers is arranged on the floor, and a plurality of suction ports is provided in the ceiling. A portion of the plurality of air supply chambers is supplied with the air heated or cooled by an outside air processing air conditioner, and in a remaining portion of the plurality of supply air chambers, the air heated or cooled is supplied to a return air processing air conditioner. When the working is performed in the room, the air cooled by the outside air processing air conditioner is supplied into the room, and the air in the room is exhausted from a suction port.

[0003] Japanese Unexamined Patent Publication No. 2009-30845 describes an air conditioning control system. The air conditioning control system includes an air conditioner adjusting temperature of an upper area to predetermined upper target temperature, and a ceiling fan installed on a ceiling of a room and serving as a blowing device generating an air flow in the vertical direction. The wall of the room is provided with a setting unit setting the target temperature and operating conditions of the ceiling fan and a setting operation device having a

temperature sensor measuring temperature of a lower area where persons mainly work in the room. On/off of the ceiling fan is controlled based on setting contents of the setting operation device and the measured temperature, and the air conditioner operates in cooperation with the ceiling fan.

[0004] Japanese Unexamined Patent Publication No. 2020-30010 describes a ventilation system discharging substances released into a space in a room due to coughing or sneezing. The ventilation system includes a cough detection device detecting coughs or sneezes in the room, a ventilation device exhausting air in the room to an outside of the room, and a control device controlling the ventilation device. The control device calculates a standby time from a generation time of the cough or sneeze until the ventilating device is operated, and operates the ventilation device after standing by the standby time from the time when the cough detection device detects the cough or sneeze. The ventilation device is realized by a fan installed on the ceiling and a motor rotating the fan.

[0005] In the ventilation system described above, since the ventilation device, which is the fan installed in the ceiling, operates unless after standing by the standby time from the time when the coughing or sneezing is detected, there is room for improvement in reducing the infection risk of the viruses or the like. Further, in the air conditioning system in the related art, there is a problem that the droplets generated when the human body breathes or talks move upward due to the upward flow generated by the heat of the human body, and the droplets stay in the vicinity of the ceiling surface. If the droplets staying in the vicinity of

the ceiling surface are left unattended, the droplets may be re-scattered due to the air flow in the room, and it is assumed that it will be difficult to collect the re-scattered droplets. Therefore, the infection risk is required to be reduced quickly by diluting, capturing, and removing the contaminants, when contaminants of the droplets and the like are generated.

SUMMARY

[0006] An object of the present disclosure is to provide an air conditioning system capable of reducing infection risk by diluting, capturing, and removing contaminants generated in a room immediately after the contaminants are generated.

[0007] An air conditioning system according to the present disclosure is (1) an air conditioning system installed in a space defined by a ceiling and a wall. The air conditioning system includes: an air conditioner supplying air to a space; a ceiling fan provided on the ceiling; and an inner ceiling separated from the ceiling at a position adjacent to the ceiling fan and extending along the ceiling. Rotation of the ceiling fan circulates the air between the ceiling and the inner ceiling and below the inner ceiling.

[0008] In this air conditioning system, the air conditioner supplies the air to the space defined by the ceiling and walls, and the air is circulated. The air conditioning system includes the ceiling fan and the inner ceiling. The inner ceiling is separated from ceiling at the position adjacent to the ceiling fan and extends along the ceiling. Therefore, the air supplied to the space by the air conditioner is moved by the ceiling fan. Then, rotation of the ceiling fan circulates the air between the ceiling and the

inner ceiling and below the inner ceiling. Therefore, since the air circulation path is formed above and below the inner ceiling in the vicinity of the ceiling surface, by generating the air flow from the ceiling fan, the highly concentrated contaminants in the living area are quickly
5 diffused to dilute the concentration and promote the movement of the air, so that the ventilation efficiency of the room can be improved. Accordingly, the infection risk of viruses or the like can be reduced. Furthermore, this air conditioning system can be replaced with any air conditioning method.

10 [0009] (2) In (1) above, the air conditioning system may further include an inner wall separated from the wall and extending along the wall. Rotation of the ceiling fan may circulate the air between the wall and the inner wall, between the ceiling and the inner ceiling, and inside the inner ceiling and the inner wall. In this case, the ceiling fan circulates the air
15 between the ceiling and the inner ceiling, between the walls and the inner walls, and inside the inner ceiling and the inner walls. Therefore, the space between the ceiling and the inner ceiling, between the wall and the inner wall, and inside the inner ceiling and the inner wall can be used as the air circulation path, and as described above, since the ventilation
20 efficiency of the room can be improved by promoting the movement of the air, the infection risk can be reduced more reliably.

[0010] (3) In (1) or (2) above, the ceiling may include an air supply portion supplying the air from the air conditioner to the space between the ceiling and the inner ceiling and a exhaust portion exhausting the air
25 between the ceiling and the inner ceiling to an outside of the space. In this case, the area between the ceiling and the inner ceiling can be used

as the air supply/exhaust portion. Therefore, since contaminants can be exhausted from the area between the ceiling and the inner ceiling, the infection risk can be further reduced.

[0011] (4) In any one of the above (1) to (3), the air conditioning system may include at least one of: an ultraviolet irradiation device irradiating the air between the ceiling and the inner ceiling with ultraviolet rays; an air cleaning device cleaning the air between the ceiling and the inner ceiling; and a filter filtering the air between the ceiling and the inner ceiling. When the ultraviolet irradiation device is arranged between the ceiling and the inner ceiling, the air can be sterilized and disinfected by irradiating the area between the ceiling and the inner ceiling, which is the air circulation path, with the ultraviolet rays. Therefore, since the air circulating in the space can be sterilized and disinfected, the infection risk can be further reduced. When the air cleaning device is provided between the ceiling and the inner ceiling, the air in the area between the ceiling and the inner ceiling, which is the air circulation path, can be cleaned by the air cleaning device. Therefore, since the air circulating in the space can be cleaned, the clean air can be supplied to the space, and the infection risk can be further reduced. When the filter is arranged between the ceiling and the inner ceiling, the air in the area between the ceiling and the inner ceiling, which is the air circulation path, can be filtered by the filter. Therefore, since contaminants and the like can be captured by the filter, the infection risk can be further reduced.

[0012] (5) In (2) above, the wall may have an air supply portion supplying the air from the air conditioner to the space between the wall and the inner wall and a exhaust portion exhausting the air between the

wall and the inner wall to an outside of the space. In this case, the area between the wall and the inner wall can be used as the air supply/exhaust portion. Therefore, since contaminants can be exhausted from the area between the wall and the inner wall, the infection risk can be further reduced.

[0013] (6) In (2) or (5) above, the air conditioning system may include at least one of: an ultraviolet irradiation device irradiating the air between the wall and the inner wall with ultraviolet rays; an air cleaning device cleaning the air between the wall and the inner wall; and a filter filtering the air between the wall and the inner wall. When the ultraviolet irradiation device is arranged between the wall and the inner wall, the air can be sterilized and disinfected by irradiating the area between the wall and the inner wall, which is the air circulation path, with ultraviolet rays. Therefore, since the air circulating in the space can be sterilized and disinfected, the infection risk can be further reduced. When the air cleaning device is provided between the wall and the inner wall, the air in the area between the wall and the inner wall, which is the air circulation path, can be cleaned by the air cleaning device. Therefore, since the air circulating in the space can be cleaned, the clean air can be supplied to the space, and the infection risk can be further reduced. When the filter is arranged between the wall and the inner wall, the air in the area between the wall and the inner wall, which is the air circulation path, can be filtered by the filter. Therefore, since contaminants and the like can be captured by the filter, the infection risk can be further reduced.

[0014] According to the present disclosure, the infection risk can be reduced by diluting, capturing, and removing contaminants generated in

the room immediately after the contaminants are generated.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] FIG. 1 is a diagram schematically illustrating a space in which an air conditioning system according to a first embodiment is applied.

5 FIG. 2 is a diagram illustrating a state in which a rotation direction of a ceiling fan is changed in the space of FIG. 1.

FIG. 3(a) is a diagram schematically illustrating a space to which an air conditioning system according to a second embodiment is applied.

10 FIG. 3(b) is a diagram illustrating a state in which a rotation direction of a ceiling fan is changed in the space of FIG. 3(a).

FIG. 4 is a diagram illustrating Modified Example of the air conditioning system according to the second embodiment.

FIG. 5(a) is a diagram schematically illustrating a space to which an air conditioning system according to a third embodiment is applied.

15 FIG. 5(b) is a diagram illustrating a state in which a rotation direction of a ceiling fan is changed in the space of FIG. 5(a).

FIG. 6(a) is a diagram schematically illustrating a space to which an air conditioning system according to a fourth embodiment is applied.

20 FIG. 6(b) is a diagram illustrating a state in which a rotation direction of a ceiling fan is changed in the space of FIG. 6(a).

FIG. 7(a) is a diagram schematically illustrating a space to which an air conditioning system according to a fifth embodiment is applied.

FIG. 7(b) is a diagram illustrating a state in which a rotation direction of a ceiling fan is changed in the space of FIG. 7(a).

25 FIG. 8 is a diagram schematically illustrating a space to which an air conditioning system according to a sixth embodiment is applied.

FIG. 9 is a diagram schematically illustrating a space in which an air conditioning system according to a seventh embodiment is applied.

DETAILED DESCRIPTION

[0016] Hereinafter, embodiments of air conditioning systems according to the present disclosure will be described with reference to the drawings. In the description of the drawings, the same or corresponding elements are denoted by the same reference numerals, and overlapping descriptions are omitted as appropriate. In addition, the drawings may be partially simplified or exaggerated for easy understanding, and the dimensional ratios and the like are not limited to those described in the drawings.

[0017] (First Embodiment)

As illustrated in FIG. 1, an air conditioning system 1 according to this embodiment is installed in a building S. The building S is, for example, a new building, and the air conditioning system 1 is installed when the building S is constructed. However, the building S may be an existing building, and the air conditioning system 1 may be introduced into the existing building S. The building S has a room H, the room H is defined by a ceiling 2 and walls 3. The air conditioning system 1 includes, in addition to the ceiling 2 and walls 3, an inner ceiling 4 facing the ceiling 2 and an inner wall 5 facing the wall 3.

[0018] By controlling the air A flowing through the ceiling 2, the walls 3, the inner ceiling 4, and the inner walls 5, the air conditioning system 1 reduces the infection risk with viruses or the like of the person M staying in a space K inside the room H. As an example, the space K is an office space where the person M sits in a chair C and works at a desk B. However, the space K may not be the office space, and the use of the

space K can be changed as appropriate.

[0019] The air conditioning system 1 has an air conditioner 6 arranged, for example, outside the room H. The air conditioner 6 transmits the air A to the space K through a pipe 6b extending from the air conditioner 6.

5 The ceiling 2 has an air supply portion 2b, and the air supply portion 2b receives the air from the air conditioner 6 through the pipe 6b and supplies the air A to the space K.

[0020] The air conditioning system 1 has a ceiling fan 7 provided on the ceiling 2. The ceiling fan 7 is also called a ceiling fan. The ceiling fan
10 7 has a bar-shaped portion 7b extending downward from the ceiling 2 and a rotating portion 7c rotating below the bar-shaped portion 7b. By rotating the rotating portion 7c in a predetermined direction, the ceiling fan 7 generates a downward flow F1 in which the air A flows downward from the rotating portion 7c.

15 [0021] As illustrated in FIG. 2, the ceiling fan 7 generates an upward flow F2 in which the air A flows upward toward the rotating portion 7c by rotating the rotating portion 7c in the direction opposite to the predetermined direction. The ceiling fan 7 can adjust a rotational speed of the rotating portion 7c. The air conditioning system 1 includes, for
20 example, the plurality of ceiling fans 7, and the plurality of ceiling fans 7 are aligned in a first direction D1. The first direction D1 is, as an example, the horizontal direction.

[0022] The ceiling 2 extends, for example, in the first direction D1 and a second direction D2 intersecting the first direction D1. The second
25 direction D2 is, for example, the horizontal direction perpendicular to the first direction D1. The walls 3 extend downward from both ends of the

ceiling 2 in the first direction D1. The room H has the pair of walls 3, and the pair of walls 3 face each other in the first direction D1. The wall 3 extends in the second direction D2 and a third direction D3 intersecting both the first direction D1 and the second direction D2. The third direction D3 is, for example, the vertical direction.

[0023] The inner ceiling 4 is provided at a position adjacent to the ceiling fan 7. The inner ceiling 4 is separated from the ceiling 2 by a certain distance T1 and extends along the ceiling 2. As an example, the certain distance T1 is 10 cm or more and 20 cm or less. For example, the inner ceiling 4 extends below the ceiling 2 in the first direction D1 and the second direction D2. As an example, the inner ceiling 4 extends parallel to the ceiling 2.

[0024] The inner ceiling 4 covers, for example, a portion of the ceiling 2 from the below. In this case, the inner ceiling 4 may cover the entire ceiling 2 in the second direction D2 or may cover a portion of the ceiling 2 in the second direction D2. The air conditioning system 1 has, for example, a plurality of inner ceilings 4. The plurality of inner ceilings 4 include, for example, a first inner ceiling 4b with which the inner walls 5 are connected and a second inner ceiling 4c with which the inner walls 5 are not connected. As an example, the first inner ceiling 4b is arranged at the end of the room H in plan view, and the second inner ceiling 4c is arranged at the place other than the end of the room H in plan view.

[0025] The inner wall 5 extends downward along the wall 3 from the end of the inner ceiling 4 in plan view. The inner wall 5 covers, for example, a portion of the wall 3 from the inside the room H. In this case, the inner wall 5 may cover the entire wall 3 in the second direction D2 or may

cover a portion of the wall 3 in the second direction D2. A lower end 5b of the inner wall 5 is separated from the floor U. As an example, the distance from the lower end 5b of the inner wall 5 to the floor U is 1.5 m or more and 1.7 m or less. In addition, the distance from the lower end 5b of the inner wall 5 to the floor U may be higher than a general height of an adult.

[0026] The inner wall 5 extends downward from the position close to the wall 3 of the inner ceiling 4 (first inner ceiling 4b). The inner wall 5 is separated from the wall 3 by a certain distance T2 and extends along the wall 3. As an example, the certain distance T2 is 10 cm or more and 20 cm or less. The inner wall 5 extends, for example, in the second direction D2 and the third direction D3 inside the wall 3 in plan view. As an example, the inner wall 5 extends parallel to the wall 3.

[0027] The air conditioning system 1 forms a circulation path R for the air A in the space K inside the room H. The circulation path R is formed outside the inner ceiling 4 and the inner wall 5 (on the side of the ceiling 2 and the wall 3) and inside the inner ceiling 4 and the inner wall 5. That is, the circulation path R is formed above and below the inner ceiling 4 and outside and inside the inner wall 5.

[0028] The air conditioning system 1 forms, for example, the plurality of circulation paths R including the downward flow F1 from the ceiling fan 7. The plurality of circulation paths R include a first circulation path R1 through which the air A passes below the ceiling fan 7, between the wall 3 and the inner wall 5, and between the ceiling 2 and the inner ceiling 4 due to the rotation of the ceiling fan 7 (rotating portion 7c) and a second circulation path R2 through which the air A passes below the ceiling fan

7, between the pair of inner ceilings 4, and between the ceiling 2 and the inner ceiling 4. For example, the first circulation path R1 is formed in the corner of the room H in plan view, and the second circulation path R2 is formed in a place other than the corner of the room H in plan view.

5 [0029] For example, the air conditioning system 1 forms the plurality of circulation paths R including the upward flow F2 to the ceiling fan 7. In this case, the plurality of circulation paths R include a third circulation path R3 through which the air A passes between the ceiling 2 and the inner ceiling 4 and between the wall 3 and the inner wall 5 due to the
10 rotation of the ceiling fan 7 and a fourth circulation path R4 through which the air A passes between the ceiling 2 and the inner ceilings 4 and between the pair of inner ceilings 4. For example, the third circulation path R3 is formed in the corner of the room H in plan view, and the fourth circulation path R4 is formed in a place other than the corner of the room
15 H in plan view.

[0030] For example, the ceiling fan 7 rotates the rotating portion 7c in the predetermined direction to generate the downward flow F1 during cooling by the air conditioner 6 and rotates the rotating portion 7c in the opposite direction to generate the upward flow F2 during heating by the
20 air conditioner 6. The rotation speed of the ceiling fan 7 (rotating portion 7c) in the predetermined direction is faster than the rotation speed of the ceiling fan 7 in the opposite direction. That is, the downward flow F1 is stronger than the upward flow F2. By generating the stronger downward flow F1 during cooling, the air flow itself can be applied to
25 the person M to allow the person M to feel cool with less energy. That is, even if the set temperature of the air A supplied to the space K is not

lowered, the high cooling effect can be obtained by applying the downward flow F1 to the person M. As a result, the high energy saving effect can be obtained.

[0031] By generating the weaker upward flow F2 during heating, since the air flow can be prevented from directly being applied to the person M, the body of the person M can be prevented from cooling. Furthermore, when the upward flow F2 is generated, since the air A directly enters from the ceiling fan 7 to a space between the ceiling 2 and the inner ceiling 4, heat accumulation on the ceiling 2 can be eliminated, and the efficiency of the air conditioning can be achieved.

[0032] Next, the functions and effects obtained from the air conditioning system 1 according to this embodiment will be described in more detail. In the air conditioning system 1, the air conditioner 6 supplies the air A to the space K defined by the ceiling 2 and the walls 3, and the air A circulates. The air conditioning system 1 is provided with the ceiling fan 7 and the inner ceiling 4. The inner ceiling 4 is separated from the ceiling 2 and extends along the ceiling 2 at a position adjacent to the ceiling fan 7. Therefore, the air A supplied to the space K by the air conditioner 6 is moved by the ceiling fan 7. Due to the rotation of the ceiling fan 7, the air A circulates between the ceiling 2 and the inner ceiling 4 and below the inner ceiling 4.

[0033] Therefore, since the circulation path R of the air A is formed above and below the inner ceiling 4 in the vicinity of the ceiling surface of the ceiling 2, by generating the air flow from the ceiling fan 7, highly concentrated contaminants in the living area can be quickly diffused to dilute the concentration, and by promoting the movement of the air A, the

ventilation efficiency of the room H can be improved. Therefore, the infection risk with viruses or the like can be reduced. Furthermore, in the air conditioning system 1, a general air conditioner can be used as the air conditioner 6. That is, the air conditioning system 1 can be replaced
5 with any air conditioning method.

[0034] In this embodiment, the air conditioning system 1 is provided with the inner wall 5 separated from the wall 3 and extending along the wall 3. Rotation of the ceiling fan 7 circulates the air A between the wall 3 and the inner wall 5, between the ceiling 2 and the inner ceiling 4, and
10 inside the inner ceiling 4 and the inner wall 5. In this case, the ceiling fan 7 circulates the air between the ceiling 2 and the inner ceiling 4, between the wall 3 and the inner wall 5, and inside the inner ceiling 4 and the inner wall 5. Therefore, the circulation path R of the air A between the ceiling 2 and the inner ceiling 4, between the wall 3 and the inner wall
15 5, and inside the inner ceiling 4 and the inner wall 5 can be used as the circulation path, and by promoting the movement of the air A as described above, the ventilation efficiency of the room H can be improved, so that the infection risk can be more reliably reduced.

[0035] (Second Embodiment)

20 Next, an air conditioning system 11 according to a second embodiment will be described with reference to FIGS. 3(a) and 3(b). FIG. 3(a) is a diagram illustrating the air conditioning system 11 in the case of generating the downward flow F1. FIG. 3(b) is a diagram illustrating the air conditioning system 11 in the case of generating the
25 upward flow F2. A portion of the configuration of the air conditioning system 11 is the same as a portion of the configuration of the air

conditioning system 1 described above. Therefore, in the following description, the configuration overlapping with the configuration of the air conditioning system 1 is used by the same reference numerals, and the description overlapping with the description of the air conditioning system 1 is omitted as appropriate.

[0036] The ceiling 12 of the air conditioning system 11 includes an air supply portion 13 supplying the air A from the air conditioner 6 between the ceiling 12 and the inner ceiling 4 and a exhaust portion 14 exhausting the air A between the ceiling 12 and the inner ceiling 4 to the outside of the space K. A pipe 16 extends from the exhaust portion 14 to the outside of the room H, and the air A of the exhaust portion 14 is exhausted to the outside of the building S through the pipe 16.

[0037] In the example of FIGS. 3(a) and 3(b), the exhaust portion 14 is arranged upstream of the air supply portion 13 in the circulation path R in the case where the downward flow F1 is generated, and the exhaust portion 14 is arranged downstream of the air supply portion 13 in the circulation path R in the case where the upward flow F2 is generated. However, the arrangement of the air supply portion 13 and the exhaust portion 14 is not limited to the examples illustrated in FIGS. 3(a) and 3(b).

[0038] FIG. 4 illustrates an air conditioning system 11A with the exhaust portion 15 that is Modified Example of the exhaust portion 14 of FIGS. 3(a) and 3(b). As illustrated in FIG. 4, the air conditioning system 11A may include the plurality of exhaust portions 15. For example, the exhaust portion 15 may be arranged on each of the upstream side and the downstream side of the air supply portion 13 in the circulation path R. Furthermore, the plurality of exhaust portions 15 may be switchable

between, for example, the downward flow F1 and the upward flow F2. In this case, the situation in which the air A supplied from the air supply portion 13 to the space K is exhausted immediately can be avoided, and the air conditioning can be allowed to be more efficient.

5 [0039] As illustrated in FIGS. 3(a), 3(b), and 4, in the air conditioning systems 11 and 11A according to the second embodiment, the ceiling 12 is provided with the air supply portion 13 supplying the air A from the air conditioner 6 between the ceiling 12 and the inner ceiling 4 and the exhaust portions 14 and 15 exhausting the air A between the ceiling 12
10 and the inner ceiling 4 to the outside of the space K. Therefore, the area between the ceiling 12 and the inner ceiling 4 can be used as the air supply/exhaust portion for the air A. Therefore, since contaminants can be exhausted from the area between the ceiling 12 and the inner ceiling 4, the infection risk can be further reduced.

15 [0040] Further, similarly to the ceiling 12, the wall 3 may have the air supply portion 13 and exhaust portions 14 and 15. That is, the air supply portion 13 and the exhaust portions 14 and 15 may be provided between the wall 3 and the inner wall 5. In this case, the area between the wall 3 and the inner wall 5 can be used as the air supply/exhaust portion for the
20 air A. Therefore, since contaminants can be exhausted from the area between the wall 3 and the inner wall 5, the infection risk can be further reduced.

[0041] (Third Embodiment)

25 Next, an air conditioning system 21 according to a third embodiment will be described with reference to FIGS. 5(a) and 5(b). The air conditioning system 21 includes an ultraviolet irradiation device

22 irradiating with ultraviolet rays V. The ultraviolet irradiation device 22 irradiates the air A between the ceiling 2 and the inner ceiling 4 with ultraviolet rays V. The air A is sterilized and disinfected by the irradiation of the ultraviolet rays V.

5 [0042] For example, the air conditioning system 21 includes the plurality of ultraviolet irradiation devices 22, and each of the plurality of ultraviolet irradiation devices 22 is arranged on the upper surface of the inner ceiling 4. As an example, the air conditioning system 21 is mounted on each of the first inner ceiling 4b and the second inner ceiling 10 4c. The air conditioning system 21 irradiates the air A between the first inner ceiling 4b or the second inner ceiling 4c and the ceiling 2 with ultraviolet rays V. The wavelength of the ultraviolet rays V is, for example, 100 nm or more and 400 nm or less, and as an example, is 100 nm or more and 280 nm or less. In this case, the ultraviolet rays V are 15 deep ultraviolet rays (UVC) and exhibit the high disinfection and sterilization effect against viruses and bacteria in the air A.

[0043] As described above, in the air conditioning system 21 according to the third embodiment, the ultraviolet irradiation device 22 is arranged between the ceiling 2 and the inner ceiling 4. Therefore, the air A can 20 be disinfected and sterilized by irradiating the area between the ceiling 2 and the inner ceiling 4, which is the circulation path R of the air A, with the ultraviolet rays V. Therefore, since the air A circulating in the space K can be disinfected and sterilized, the infection risk can be further reduced.

25 [0044] Further, the ultraviolet irradiation device 22 may irradiate the air A between the wall 3 and the inner wall 5 with the ultraviolet rays V.

The ultraviolet irradiation device 22 may be arranged between the wall 3 and the inner wall 5. In this case as well, since the area between the wall 3 and the inner wall 5, which is the circulation path R of the air A, can be irradiated with the ultraviolet rays V for disinfection and sterilization of the air A, the infection risk can be further reduced. Furthermore, in the third embodiment, the ultraviolet irradiation device 22 is arranged in the place separated from the person M (a place not visible to the person M) such as between the ceiling 2 and the inner ceiling 4 or between the wall 3 and the inner wall 5, the person M can be prevented from being exposed to the ultraviolet rays V. That is, the air A can be disinfected and sterilized in the place invisible to the person M by the ultraviolet irradiation device 22.

[0045] (Fourth Embodiment)

Next, an air conditioning system 31 according to a fourth embodiment will be described with reference to FIGS. 6(a) and 6(b). The air conditioning system 31 is provided with an air cleaning device 32 cleaning the air A. The air cleaning device 32 cleans the air A between the ceiling 2 and the inner ceiling 4. For example, the air conditioning system 31 includes the plurality of air cleaning devices 32, each of the air cleaning devices 32 is arranged on the upper surface of the inner ceiling 4.

[0046] As an example, the air cleaning device 32 is arranged above the first inner ceiling 4b, and the air cleaning device 32 is not arranged above the second inner ceiling 4c. However, the air cleaning device 32 may be arranged on the second inner ceiling 4c, and the location and number of the air cleaning devices 32 are not particularly limited.

[0047] As described above, in the air conditioning system 31 according to the fourth embodiment, the air cleaning device 32 is arranged between the ceiling 2 and the inner ceiling 4. Therefore, the air A in the area between the ceiling 2 and the inner ceiling 4, which is the circulation path R of the air A can be cleaned by the air cleaning device 32. Therefore, since the air A circulating in the space K can be cleaned, the clean air A can be supplied to the space K and the infection risk can be further reduced.

[0048] The air cleaning device 32 may clean the air A between the wall 3 and the inner wall 5. The air cleaning device 32 may be arranged between the wall 3 and the inner wall 5. In this case, the air cleaning device 32 can clean the air A in the area between the wall 3 and the inner wall 5 which is the circulation path R. Therefore, since the clean air A can be supplied to the space K, the infection risk can be further reduced.

[0049] (Fifth Embodiment)

Next, an air conditioning system 41 according to a fifth embodiment will be described with reference to FIGS. 7(a) and 7(b). An air conditioning system 41 is provided with a filter 42 filtering the air A circulating in the circulation path R. The filter 42 may be a filter attached with an air cleaner. The air conditioning system 41 is provided with, for example, a plurality of the filters 42. The plurality of filters 42 include, for example, a first filter 42A arranged between the ceiling 2 and the inner ceiling 4 and a second filter 42B arranged between the wall 3 and the inner wall 5.

[0050] The filter 42 is arranged at a position separated from the air supply portion 2b of the ceiling 2. For example, the first filter 42A is arranged

between each of the first inner ceiling 4b and the second inner ceiling 4c and the ceiling 2. As an example, the first filter 42A is arranged upstream of the air supply portion 2b in the circulation path R. As an example, the second filter 42B is arranged near the entrance of the circulation path R between the wall 3 and the inner wall 5. As described above, the example of the arrangement positions of the filters 42 (the first filter 42A and the second filter 42B) has been described above, but the number and arrangement positions of the filters 42 are not limited to the above examples and can be changed as appropriate.

[0051] As described above, in the air conditioning system 41 according to the fifth embodiment, the filter 42 is arranged between the ceiling 2 and the inner ceiling 4. Therefore, the air A can be filtered by the filter 42 in the area between the ceiling 2 and the inner ceiling 4, which is the circulation path R of the air A. Therefore, since contaminants and the like can be captured by the filter 42, the infection risk can be further reduced. In the air conditioning system 41, the filter 42 is arranged between the wall 3 and the inner wall 5. Therefore, the air A can be filtered by the filter 42 in the area between the wall 3 and the inner wall 5, which is the circulation path R of the air A. As a result, the filter 42 can further reduce the infection risk.

[0052] Various embodiments of the air conditioning system according to the present disclosure have been described above. However, the present disclosure is not limited to the above-described embodiments, and can be modified as appropriate within a scope of the spirit described in the scope of the claims. That is, the function, configuration, shape, size, number, material, and layout of each unit of the air conditioning system according

to the present disclosure can be changed as appropriate within the scope of the spirit described above.

[0053] In the above description, the third embodiment provided with the ultraviolet irradiation device 22, the fourth embodiment provided with the air cleaning device 32, and the fifth embodiment provided with the filter 42 have been described. However, the air conditioning system may include two or more of the ultraviolet irradiation device 22, the air cleaning device 32, and the filter 42.

[0054] That is, the air conditioning system includes at least one of the ultraviolet irradiation device 22 irradiating the air A between the ceiling 2 and the inner ceiling 4 with ultraviolet rays V, the air cleaning device 32 cleaning the air A between the ceiling 2 and the inner ceiling 4, and the filter 42 filtering the air A between the ceiling 2 and the inner ceiling 4 may be provided. In addition, the air conditioning system includes at least one of the ultraviolet irradiation device 22 irradiating the air A between the wall 3 and the inner wall 5 with ultraviolet rays V, the air cleaning device 32 cleaning the air A between the wall 3 and the inner wall 5, and the filter 42 filtering the air A between the wall 3 and the inner wall 5 may be provided. Even in the case of these forms, the same functions and effects as those of the above-described embodiments can be obtained.

[0055] Hereinafter, further modified examples of the air conditioning system according to the present disclosure will be described. In the above-described embodiments, the air conditioning system 1 having the inner wall 5 has been described. However, as illustrated in FIG. 8, an air conditioning system 51 without the inner wall 5 may also be used.

The air conditioning system 51 has a shelf 55 instead of the inner wall 5. The shelf 55 is, as an example, a bookshelf.

[0056] The shelf 55 is arranged under the inner ceiling 4. The shelf 55 has a plurality of tiers 56 which are locations where items (for example, books) are placed. Among the plurality of tiers 56, the upper tier 56 has a back plate 57 and the lower tier 56 has no back plate 57. That is, the upper tier 56 does not penetrate in the first direction D1, and the lower tier 56 penetrates in the first direction D1.

[0057] Therefore, a through hole 58 that penetrates in the first direction D1 in the lower tier 56, a space between the back plate 57 and the wall 3, and a space between the ceiling 2 and the inner ceiling 4 can be defined as circulation paths R. Therefore, since the downward flow F1 (or the upward flow F2) from the ceiling fan 7 can be circulated through the circulation path R, the same functions and effects as those of the air conditioning system 1 and the like can be obtained from the air conditioning system 51.

[0058] FIG. 9 illustrates an air conditioning system 61 according to Modified Example different from FIG. 8. The air conditioning system 61 includes a shelf 65 having a structure different from the shelf 55 described above. The shelf 65 has a storage unit 66 in which items are stored and the plurality of leg portions 67 supporting the storage unit 66. The storage unit 66 is provided below the inner ceiling 4, and the leg portion 67 extends from the storage unit 66 to the floor U.

[0059] In the air conditioning system 61, the circulation paths R can be defined between the plurality of leg portions 67, between the storage unit 66 and the wall 3, and between the ceiling 2 and the inner ceiling 4.

Therefore, since the downward flow F1 (or the upward flow F2) from the ceiling fan 7 can be circulated through the circulation path R, the air conditioning system 61 can obtain the same functions and effects as those of the air conditioning system 1 and the like described above.

5 REFERENCE SIGNS LIST

[0060] 1: air conditioning system, 2: ceiling, 2b: air supply portion, 3: wall, 4: inner ceiling, 4b: first inner ceiling, 4c: second inner ceiling, 5: inner wall, 5b: lower end, 6: air conditioner, 6b: pipe, 7: ceiling fan, 7b: bar-shaped portion, 7c: rotating portion, 11, 11A: air conditioning system,
10 12: ceiling, 13: air supply portion, 14, 15: exhaust portion, 16: pipe, 21: air conditioning system, 22: ultraviolet irradiation device, 31: air conditioning system, 32: air cleaning device, 41: air conditioning system, 42: filter, 42A: first filter, 42B: second filter, 51: air conditioning system, 55: shelf, 56: tier, 57: back plate, 58: through hole, 61: air conditioning
15 system, 65: shelf, 66: storage unit, 67: leg portion, A: air, B: desk, C: chair, D1: first direction, D2: second direction, D3: third direction, F1: downward flow, F2: upward flow, H: room, K: space, M: person, R: circulation path, R1: first circulation path, R2: second circulation path, R3: third circulation path, R4: fourth circulation path, S: building, T1, T2:
20 certain distance, U: floor, V: ultraviolet rays.

WHAT IS CLAIMED IS:

1. An air conditioning system installed in a space defined by a ceiling and a wall, comprising:

an air conditioner supplying air to the space;

5 a ceiling fan provided on the ceiling; and

an inner ceiling separated from the ceiling at a position adjacent to the ceiling fan and extending along the ceiling,

wherein rotation of the ceiling fan circulates the air between the ceiling and the inner ceiling and below the inner ceiling.

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2. The air conditioning system according to claim 1, further comprising an inner wall separated from the wall and extending along the wall,

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wherein rotation of the ceiling fan circulates the air between the wall and the inner wall, between the ceiling and the inner ceiling, and inside the inner ceiling and the inner wall.

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3. The air conditioning system according to claim 1 or 2, wherein the ceiling includes an air supply portion supplying the air from the air conditioner to the space between the ceiling and the inner ceiling and an exhaust portion exhausting the air between the ceiling and the inner ceiling to an outside of the space.

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4. The air conditioning system according to any one of claims 1 to 3, further comprising at least one of:

an ultraviolet irradiation device irradiating the air between the

ceiling and the inner ceiling with ultraviolet rays;

an air cleaning device cleaning the air between the ceiling and the inner ceiling; and

a filter filtering the air between the ceiling and the inner ceiling.

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5. The air conditioning system according to claim 2, wherein the wall has an air supply portion supplying the air from the air conditioner to the space between the wall and the inner wall and a exhaust portion exhausting the air between the wall and the inner wall to an outside of the space.

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6. The air conditioning system according to claim 2 or 5, further comprising at least one of:

an ultraviolet irradiation device irradiating the air between the wall and the inner wall with ultraviolet rays;

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an air cleaning device cleaning the air between the wall and the inner wall; and

a filter filtering the air between the wall and the inner wall.