DESCRIPTION
AIR-CONDITIONING INDOOR UNIT

TECHNICAL FIELD

The present invention relates to an air conditioning indoor unit.

BACKGROUND ART

In air conditioning apparatus, it is necessary to deliver the outlet air far in order to equalize the temperature distribution in an entire room. For example, in the air conditioner disclosed in patent document 1 (JP-A No. 2002-61938), a front sloping portion of a front panel has a shape that slopes gently toward the ceiling. When conditioned air blown out from an air outlet has been deflected toward the front sloping portion by an up and down air direction plate, the conditioned air is guided along the front sloping portion in the direction of the ceiling. As a result, the conditioned air can be delivered farther along the ceiling surface.

SUMMARY OF INVENTION

<Technical Problem>

However, in the air conditioner described above, in order to direct the conditioned air toward the front panel, the up and down air direction plate moves closer to the upper end portion of the air outlet and obstructs the air outlet, so pressure loss increases.

~~It is a problem~~Embodiments of the present invention ~~to~~ provide an air conditioning indoor unit that can guide outlet air in a predetermined direction without increasing pressure loss that much.

<Solution to Problem>

~~An air conditioning indoor unit pertaining to a first aspect of the present invention is an air conditioning indoor unit having a Coanda effect utilization mode that utilizes the Coanda effect to guide, in a predetermined direction, a flow of outlet air blown out from an air outlet, the air conditioning indoor unit comprising a first air direction adjustment plate, a second air direction adjustment plate, and a control unit. The first air direction adjustment plate is a movable adjustment plate that changes an up and down direction of the outlet air. The second air direction adjustment plate is disposed in the neighborhood of the air outlet and, when housed, has at least a front end portion housed in an indoor unit front portion outside a blowing path. The control unit controls postures of the first air direction adjustment plate and the second air direction adjustment plate. Furthermore, in the Coanda effect utilization mode, the control unit controls the postures of the first air direction adjustment plate and the second air direction adjustment plate in such a way that the second air direction adjustment plate assumes a posture in which it is spaced apart from the indoor unit front portion and the second air direction adjustment plate and the first air direction adjustment~~

~~plate form a predetermined angle to thereby change the outlet air to a Coanda air flow along an undersurface of the second air direction adjustment plate.~~

According to an aspect of the present invention, there is provided an air conditioning indoor unit having a Coanda effect utilization mode that utilizes the Coanda effect which is a phenomenon where, if there is a wall surface near the flow of a gas, the gas tends to flow in a direction along the wall surface even if the direction of the flow and the direction of the wall surface are different, to guide, in a predetermined direction, a flow of outlet air blown out from an air outlet, the air conditioning indoor unit comprising: a movable first air direction adjustment plate that changes an up and down direction of the outlet air; a second air direction adjustment plate that is disposed in the neighborhood of the air outlet and, when housed, has at least a front end portion housed in an indoor unit front portion outside a blowing path; and a control unit that controls postures of the first air direction adjustment plate and the second air direction adjustment plate, wherein in the Coanda effect utilization mode, the control unit controls the postures of the first air direction adjustment plate and the second air direction adjustment plate in such a way that the second air direction adjustment plate assumes a posture in which it is spaced apart from the indoor unit front portion and the height position of a rear end portion of the second air direction adjustment plate is lower than it is when operation is stopped and the second air direction adjustment plate and the first air direction adjustment plate form a predetermined angle to thereby change the outlet air to an obliquely upward Coanda air flow along an undersurface of the second air direction adjustment plate because of the Coanda effect.

In this air conditioning indoor unit, by executing the Coanda effect utilization mode, the outlet air whose air direction has been adjusted by the first air direction adjustment plate can be changed to a Coanda air flow which, because of the Coanda effect, flows along the undersurface of the second air direction adjustment plate positioned away from the indoor unit front portion. As a result, compared to a conventional configuration that generates an air flow along the front panel, it becomes possible for the outlet air to be guided in a predetermined direction with the air outlet remaining unobstructed. That is, the outlet air is guided in a predetermined direction in a state in which air resistance is kept low.

~~An air conditioning indoor unit pertaining to a second aspect of the present invention is the air~~In an embodiment, the above conditioning indoor unit ~~pertaining to the first aspect, further comprising~~ may further comprise a scroll that guides air-conditioned air to the air outlet. When

the control unit executes the Coanda effect utilization mode, the first air direction adjustment plate and the second air direction adjustment plate assume postures that satisfy a condition where an internal angle formed by a tangent to a terminal end portion of the scroll and the second air direction adjustment plate is greater than an internal angle formed by the tangent to the terminal end portion of the scroll and the first air direction adjustment plate.

In this air conditioning indoor unit, it becomes possible for the outlet air to be deflected to a large extent from the direction tangential to the terminal end portion of the scroll. Therefore, the outlet air is directed toward the ceiling surface and is delivered far along the ceiling surface.

~~An air conditioning indoor unit pertaining to a third aspect of the present invention is the~~ In an embodiment, in the above air conditioning indoor unit ~~pertaining to the first aspect or the second aspect, wherein~~ in the Coanda effect utilization mode, a front end portion of the second air direction adjustment plate points frontward and upward from a horizontal.

In this air conditioning indoor unit, even when the outlet air whose air direction has been adjusted by the first air direction adjustment plate is horizontal or a little downward, it becomes upward air because of the Coanda effect, so it is not necessary for the air just after passage through the air outlet to be forcibly directed upward. That is, the air direction is changed while pressure loss caused by the air resistance of the first air direction adjustment plate is suppressed.

~~An air conditioning indoor unit pertaining to a fourth aspect of the present invention is the~~ In an embodiment, in the above air conditioning indoor unit ~~pertaining to the third aspect, wherein~~ in the Coanda effect

utilization mode, the front end portion of the second air direction adjustment plate is positioned higher than the air outlet.

For example, in a case where the front end of the second air direction adjustment plate is in the blowing path, there is the potential for the Coanda air flow along the undersurface of the second air direction adjustment plate to interfere with the outlet air that has passed over the upper side of the second air direction adjustment plate so that the travel of the upward air flow is impeded.

In contrast, in this air conditioning indoor unit, the front end portion of the second air direction adjustment plate is positioned higher than the air outlet, so the generation of a strong air flow on the upper side of the second air direction adjustment plate is suppressed. Therefore, it becomes difficult for the upward guidance of the Coanda air flow to be impeded.

~~An air-conditioning indoor unit pertaining to a fifth aspect of the present invention is the~~In an embodiment, in the above air conditioning indoor unit ~~pertaining to any one of the first aspect to the fourth aspect, wherein~~ in the Coanda effect utilization mode, the height position of a rear end portion of the second air direction adjustment plate is lower than it is when operation is stopped.

In this air conditioning indoor unit, the rear end portion of the second air direction adjustment plate enters the upstream side of the traveling path of the outlet air whose air direction has been adjusted by the first air direction adjustment plate, so compared to a type where the rear end portion does not move, it becomes easy for a Coanda air flow resulting from the Coanda effect further on the upstream side to be produced.

~~An air-conditioning indoor unit pertaining to a sixth aspect of the present invention is the~~ In an embodiment, in the above air conditioning indoor unit ~~pertaining to any one of the first aspect to the fifth aspect, wherein~~ in the Coanda effect utilization mode, the front end portion of the second air direction adjustment plate projects outward from the air outlet.

In this air conditioning indoor unit, the front end portion of the second air direction adjustment plate projects outward from the air outlet, so the Coanda air flow reaches farther.

~~An air-conditioning indoor unit pertaining to a seventh aspect of the present invention is the~~ In an embodiment, in the above air conditioning indoor unit ~~pertaining to the sixth aspect, wherein~~ in the Coanda effect utilization mode, the second air direction adjustment plate is controlled to a posture in which it becomes further away from the indoor unit front portion heading frontward.

In this air conditioning indoor unit, the Coanda air flow travels away from the air inlet, so short-circuiting is prevented.

~~An air-conditioning indoor unit pertaining to an eighth aspect of the present invention is the~~ In an embodiment, in the above air conditioning indoor unit ~~pertaining to any one of the first aspect to the seventh~~

~~aspect~~, ~~wherein~~ a lengthwise direction dimension of the second air direction adjustment plate is equal to or greater than a lengthwise direction dimension of the first air direction adjustment plate.

In this air conditioning indoor unit, the second air direction adjustment plate receives all of the outlet air whose air direction has been adjusted by the first air direction adjustment plate, so short-circuiting of the outlet air from the sides of the second air direction adjustment plate is prevented.

~~An air conditioning indoor unit pertaining to a ninth aspect of the present invention is the~~ In an embodiment, in the above air conditioning indoor unit ~~pertaining to any one of the first aspect to the eighth aspect~~, ~~wherein~~ the second air direction adjustment plate rotates about a predetermined rotating shaft. The rotating shaft is disposed in a place away from the blowing path.

In this air conditioning indoor unit, the second air direction adjustment plate assumes, by rotating, a posture in which the height position of its rear end portion is lower than it is when operation is stopped. Therefore, the rear end portion enters the upstream side of the traveling path of the outlet air whose air direction has been adjusted by the first air direction adjustment plate, so it becomes easy for a Coanda air flow resulting from the Coanda effect to be produced further on the upstream side.

~~An air conditioning indoor unit pertaining to a tenth aspect of the present invention is the~~ In an embodiment, in the above air conditioning indoor unit ~~pertaining to the first aspect~~, ~~wherein~~ the control unit has a downward blowing mode. The downward blowing mode is a mode in which front ends of the first air direction adjustment plate and the second air direction adjustment plate are pointed frontward and downward to thereby guide the outlet air downward.

In this air conditioning indoor unit, in the downward blowing mode, the air direction can be changed further downward. Particularly when the first air direction adjustment plate is pointed further downward than the direction tangential to the terminal end portion of the scroll, it is not easy to control the air direction with just the first air direction adjustment plate, but it becomes easy for a downward air flow to be generated because there is the second air direction adjustment plate.

~~An air conditioning indoor unit pertaining to an eleventh aspect of the present invention is the~~In an embodiment, in the above air conditioning indoor unit ~~pertaining to the first aspect~~, ~~wherein~~ the posture of the indoor unit front portion when operation is stopped and during operation is the same.

In this air conditioning indoor unit, by executing the Coanda effect utilization mode, the outlet air whose air direction has been adjusted by the first air direction adjustment plate can be changed to a Coanda air flow which, because of the Coanda effect, flows along the

undersurface of the second air direction adjustment plate positioned away from the indoor unit front portion. As a result, compared to a conventional configuration that generates an air flow along the front panel, it becomes possible for the outlet air to be guided in a predetermined direction with the air outlet remaining unobstructed. That is, the outlet air is guided in a predetermined direction in a state in which air resistance is kept low.

~~An air conditioning indoor unit pertaining to a twelfth aspect of the present invention is the~~ In an embodiment, in the above air conditioning indoor unit ~~pertaining to the first aspect~~, ~~wherein~~ in the Coanda effect utilization mode, a rear end of the second air direction adjustment plate enters a traveling path of the outlet air. As a result, in this air conditioning indoor unit, it becomes easy for a Coanda air flow resulting from the Coanda effect to be produced.

<Advantageous Effects of Invention>

In the air conditioning indoor unit pertaining to ~~the first aspect or the eleventh aspect~~ embodiments of the present invention, by executing the Coanda effect utilization mode, the outlet air whose air direction has been adjusted by the first air direction adjustment plate can be changed to a Coanda air flow which, because of the Coanda effect, flows along the undersurface of the second air direction adjustment plate positioned away from the indoor unit front portion. As a result, compared to a conventional configuration that generates an air flow along the front panel, it becomes possible for the outlet air to be guided in a predetermined direction with the air outlet remaining unobstructed. That is, the outlet air is guided in a predetermined direction in a state in which air resistance is kept low.

In the air conditioning indoor unit pertaining to ~~the second aspect~~ embodiments of the present invention, it becomes possible for the outlet air to be deflected to a large extent from the direction tangential to the terminal end portion of the scroll. Therefore, the outlet air is directed toward the ceiling surface and is delivered far along the ceiling surface.

In the air conditioning indoor unit pertaining to ~~the third aspect~~ embodiments of the present invention, even when the outlet air whose air direction has been adjusted by the first air direction adjustment plate is horizontal or a little downward, it becomes upward air because of the Coanda effect, so it is not necessary for the air just after passage through the air outlet to be forcibly directed upward. That is, the air direction is changed while pressure loss caused by the air resistance of the first air direction adjustment plate is suppressed.

In the air conditioning indoor unit pertaining to ~~the fourth aspect~~ embodiments of the present invention, the front end portion of the second air direction adjustment plate is positioned higher than the air outlet, so the generation of a strong air flow on the upper side of the second air direction adjustment plate is suppressed. Therefore, it becomes difficult for the

upward guidance of the Coanda air flow to be impeded.

In the air conditioning indoor unit pertaining to ~~the fifth aspect~~ embodiments of the present invention, the rear end portion of the second air direction adjustment plate enters the upstream side of the traveling path of the outlet air whose air direction has been adjusted by the first air direction adjustment plate, so compared to a type where the rear end portion does not move, it becomes easy for a Coanda air flow resulting from the Coanda effect further on the upstream side to be produced.

In the air conditioning indoor unit pertaining to ~~the sixth aspect~~ embodiments of the present invention, the front end portion of the second air direction adjustment plate projects outward from the air outlet, so the Coanda air flow reaches farther.

In the air conditioning indoor unit pertaining to ~~the seventh aspect~~ embodiments of the present invention, the Coanda air flow travels away from the air inlet, so short-circuiting is prevented.

In the air conditioning indoor unit pertaining to ~~the eighth aspect~~ embodiments of the present invention, the second air direction adjustment plate receives all of the outlet air whose air direction has been adjusted by the first air direction adjustment plate, so short-circuiting of the outlet air from the sides of the second air direction adjustment plate is prevented.

In the air conditioning indoor unit pertaining to ~~the ninth aspect~~ embodiments of the present invention, the second air direction adjustment plate assumes, by rotating, a posture in which the height position of its rear end portion is lower than it is when operation is stopped. Therefore, the rear end portion enters the upstream side of the traveling path of the outlet air whose air direction has been adjusted by the first air direction adjustment plate, so it becomes easy for a Coanda air flow resulting from the Coanda effect to be produced further on the upstream side.

In the air conditioning indoor unit pertaining to ~~the tenth aspect~~ embodiments of the present invention, in the downward blowing mode, the air direction can be changed further downward. Particularly when the first air direction adjustment plate is pointed further downward than the direction tangential to the terminal end portion of the scroll, it is not easy to control the air direction with just the first air direction adjustment plate, but it becomes easy for a downward Coanda air flow to be generated because there is the second air direction adjustment plate.

In the air conditioning indoor unit pertaining to ~~the twelfth aspect~~ embodiments of the present invention, it becomes easy for a Coanda air flow resulting from the Coanda effect to be produced.

BRIEF DESCRIPTION OF DRAWINGS

CLAIMS

1. An air conditioning indoor unit (10) having a Coanda effect utilization mode that utilizes the Coanda effect to guide, in a predetermined direction, a flow of outlet air blown out from an air outlet (15), the air conditioning indoor unit comprising:

a movable first air direction adjustment plate (31) that changes an up and down direction of the outlet air;

a second air direction adjustment plate (32) that is disposed in the neighborhood of the air outlet (15) and, when housed, has at least a front end portion housed in an indoor unit front portion outside a blowing path; and

a control unit (40) that controls postures of the first air direction adjustment plate (31) and the second air direction adjustment plate (32),

wherein in the Coanda effect utilization mode, the control unit (40) controls the postures of the first air direction adjustment plate (31) and the second air direction adjustment plate (32) in such a way that the second air direction adjustment plate (32) assumes a posture in which it is spaced apart from the indoor unit front portion and the second air direction adjustment plate (32) and the first air direction adjustment plate (31) form a predetermined angle to thereby change the outlet air to a Coanda air flow along an undersurface of the second air direction adjustment plate (32).

2. The air conditioning indoor unit (10) according to claim 1, further comprising a scroll (17) that guides air-conditioned air to the air outlet (15), wherein when the control unit (40) executes the Coanda effect utilization mode, the first air direction adjustment plate (31) and the second air direction adjustment plate (32) assume postures that satisfy a condition where an internal angle formed by a tangent to a terminal end portion of the scroll (17) and the second air direction adjustment plate (32) is greater than an internal angle formed by the tangent to the terminal end portion of the scroll (17) and the first air direction adjustment plate (31).

3. The air conditioning indoor unit (10) according to claim 1 or claim 2, wherein in the Coanda effect utilization mode, a front end portion of the second air direction adjustment plate (32) points frontward and upward from a horizontal.

4. The air conditioning indoor unit (10) according to claim 3, wherein in the Coanda effect utilization mode, the front end portion of the second air direction adjustment plate (32) is positioned higher than the air outlet (15).

5. The air conditioning indoor unit (10) according to any one of claim 1 to claim 4, wherein in the Coanda effect utilization mode, the height position of a rear end portion of the

second air direction adjustment plate (32) is lower than it is when operation is stopped.

6. The air conditioning indoor unit (10) according to any one of claim 1 to claim 5, wherein in the Coanda effect utilization mode, the front end portion of the second air direction adjustment plate (32) projects outward from the air outlet (15).

7. The air conditioning indoor unit (10) according to claim 6, wherein in the Coanda effect utilization mode, the second air direction adjustment plate (32) is controlled to a posture in which it lies further away from the indoor unit front portion heading frontward.

8. The air conditioning indoor unit (10) according to any one of claim 1 to claim 7, wherein a lengthwise direction dimension of the second air direction adjustment plate (32) is equal to or greater than a lengthwise direction dimension of the first air direction adjustment plate (31).

9. The air conditioning indoor unit (10) according to any one of claim 1 to claim 8, wherein

the second air direction adjustment plate (32) rotates about a predetermined rotating shaft (321), and

the rotating shaft (321) is disposed in a place away from the blowing path.

10. The air conditioning indoor unit (10) according to claim 1, wherein the control unit (40) has a downward blowing mode in which front ends of the first air direction adjustment plate (31) and the second air direction adjustment plate (32) are pointed frontward and downward to thereby guide the outlet air downward.

11. The air conditioning indoor unit (10) according to claim 1, wherein the posture of the indoor unit front portion when operation is stopped and during operation is the same.

12. The air conditioning indoor unit (10) according to claim 1, wherein in the Coanda effect utilization mode, a rear end of the second air direction adjustment plate (32) enters a traveling path of the outlet air.

CLAIMS

1. An air conditioning indoor unit (10) having a Coanda effect utilization mode that utilizes the Coanda effect which is a phenomenon where, if there is a wall surface near the flow of a gas, the gas tends to flow in a direction along the wall surface even if the direction of the flow and the direction of the wall surface are different, to guide, in a predetermined direction, a flow of outlet air blown out from an air outlet (15), the air conditioning indoor unit comprising:

a movable first air direction adjustment plate (31) that changes an up and down direction of the outlet air;

a second air direction adjustment plate (32) that is disposed in the neighborhood of the air outlet (15) and, when housed, has at least a front end portion housed in an indoor unit front portion outside a blowing path; and

a control unit (40) that controls postures of the first air direction adjustment plate (31) and the second air direction adjustment plate (32),

wherein in the Coanda effect utilization mode, the control unit (40) controls the postures of the first air direction adjustment plate (31) and the second air direction adjustment plate (32) in such a way that the second air direction adjustment plate (32) assumes a posture in which it is spaced apart from the indoor unit front portion and the height position of a rear end portion of the second air direction adjustment plate (32) is lower than it is when operation is stopped and the second air direction adjustment plate (32) and the first air direction adjustment plate (31) form a predetermined angle to thereby change the outlet air to an obliquely upward Coanda air flow along an undersurface of the second air direction adjustment plate (32) because of the Coanda effect.

2. The air conditioning indoor unit (10) according to claim 1, further comprising a scroll (17) that guides air-conditioned air to the air outlet (15),

wherein

the first air direction adjustment plate (31) has an inside arcuate surface (31b),

the second air direction adjustment plate (32) has an outside arcuate surface (32a), and

when the control unit (40) executes the Coanda effect utilization mode, the first air direction adjustment plate (31) and the second air direction adjustment plate (32) assume postures that satisfy a condition where an internal angle formed by a tangent to a terminal end

portion of the scroll (17) and a tangent to a front end of the outside arcuate surface (32a) of the second air direction adjustment plate (32) is greater than an internal angle formed by the tangent to the terminal end portion of the scroll (17) and a tangent to a front end of the inside arcuate surface (31b) of the first air direction adjustment plate (31).

3. The air conditioning indoor unit (10) according to claim 1 or claim 2, wherein in the Coanda effect utilization mode, a front end portion of the second air direction adjustment plate (32) points frontward and upward from a horizontal.

4. The air conditioning indoor unit (10) according to claim 3, wherein in the Coanda effect utilization mode, the front end portion of the second air direction adjustment plate (32) is positioned higher than the air outlet (15).

5. The air conditioning indoor unit (10) according to claim 1 or claim 2, wherein in the Coanda effect utilization mode, the front end portion of the second air direction adjustment plate (32) projects outward from the air outlet (15).

6. The air conditioning indoor unit (10) according to claim 5, wherein in the Coanda effect utilization mode, the second air direction adjustment plate (32) is controlled to a posture in which it lies further away from the indoor unit front portion heading frontward.

7. The air conditioning indoor unit (10) according to claim 1 or claim 2, wherein a lengthwise direction dimension of the second air direction adjustment plate (32) is equal to or greater than a lengthwise direction dimension of the first air direction adjustment plate (31).

8. The air conditioning indoor unit (10) according to claim 1 or claim 2, wherein

the second air direction adjustment plate (32) rotates about a predetermined rotating shaft (321), and

the rotating shaft (321) is disposed in a place away from the blowing path.

9. The air conditioning indoor unit (10) according to claim 1, wherein the control unit (40) has a downward blowing mode in which front ends of the first air direction adjustment plate (31) and the second air direction adjustment plate (32) are pointed frontward and downward to thereby guide the outlet air downward.

10. The air conditioning indoor unit (10) according to claim 1 or claim 2, wherein the posture of the indoor unit front portion when operation is stopped and during operation is the same.

11. The air conditioning indoor unit (10) according to claim 1 or claim 2, wherein in the Coanda effect utilization mode, a rear end of the second air direction adjustment plate (32) enters a traveling path of the outlet air.

12. The air conditioning indoor unit (10) according to claim 3, wherein the posture of the

indoor unit front portion when operation is stopped and during operation is the same.

13. The air conditioning indoor unit (10) according to claim 4, wherein the posture of the indoor unit front portion when operation is stopped and during operation is the same.

14. The air conditioning indoor unit (10) according to claim 5, wherein the posture of the indoor unit front portion when operation is stopped and during operation is the same.

15. The air conditioning indoor unit (10) according to claim 6, wherein the posture of the indoor unit front portion when operation is stopped and during operation is the same.

16. The air conditioning indoor unit (10) according to claim 3, wherein in the Coanda effect utilization mode, a rear end of the second air direction adjustment plate (32) enters a traveling path of the outlet air.

17. The air conditioning indoor unit (10) according to claim 4, wherein in the Coanda effect utilization mode, a rear end of the second air direction adjustment plate (32) enters a traveling path of the outlet air.

18. The air conditioning indoor unit (10) according to claim 5, wherein in the Coanda effect utilization mode, a rear end of the second air direction adjustment plate (32) enters a traveling path of the outlet air.

19. The air conditioning indoor unit (10) according to claim 6, wherein in the Coanda effect utilization mode, a rear end of the second air direction adjustment plate (32) enters a traveling path of the outlet air.