

INDOOR AIR-CONDITIONING UNIT WITH MULTIPLE AIR INTAKE INLETS

FIELD OF INVENTION

The present invention relates generally to indoor air conditioners. More specifically, it
5 relates to indoor air-conditioning units with multiple air intake inlets.

BACKGROUND

Air conditioners have become an essential requirement in houses and buildings not only in
hot humid weather countries but also in cold weather countries to supply conditioned air
10 into an interior space.

Different types of air conditioners are available in the market, which include single unit air
conditioners that house all their components in one unit, and split-system air conditioners
that consist of an indoor and an outdoor unit.

15 The air conditioner units typically includes a compressor for compressing an evaporated
refrigerant, a condenser for absorbing a heat from a compressed refrigerant and
discharging the heat to an atmosphere so that the refrigerant can be liquefied, an expansion
valve for reducing a pressure of the liquefied refrigerant and expanding the refrigerant, and
20 an evaporator for absorbing a heat from an air of a room and evaporating the refrigerant.

The devices are connected to each other by means of pipes which create a refrigerant
pathway. The refrigerant undergoes phase changes while being repeatedly circulated
through the pipes connecting the devices of the air conditioner to each other, thereby
25 absorbing the heat from the air of the room and discharging the heat to the atmosphere.

In the currently popular indoor air-conditioning systems, the cold air discharge louvers are
placed on a bottom portion of the front chassis of the indoor air-conditioning unit. The
cold air discharge louvers of the indoor units available in the market direct the cool air in
30 upper and downward directions of the room. Depending on the installation conditions,
there is possibility that users feel the direct cold air when sitting or standing in front of the
air conditioner. The direct blowing of cold air may sometimes be uncomfortable to the
persons inside the room.

The state of the art also reports indoor air-conditioning units that have cool air discharge louvers placed at the front upper portion of the chassis body of the indoor air-conditioning unit. The cold air flow near ceiling creates the effect of cooling down the surrounding ceiling and the walls of an interior of a building structure without causing direct air blow to the persons sitting inside, thus providing improved comfort to the persons. Due to the limitation of the slanting design with bigger top chassis area, the bottom air intake is reduced. Therefore it is vital to create multiple air intakes so that the airflow and performance of the air conditioner is not sacrificed due to the design changes.

SUMMARY

The present invention pertains to an indoor air-conditioning unit with front top discharge outlet for delivering cool air to a top area of an interior of a building structure when installed on a wall structure of the interior of the building structure.

The indoor air-conditioning unit includes a chassis body having a front portion, a back portion, a top portion, a bottom portion and pair of side portions. The chassis body of the indoor air-conditioning unit is provided with a first suction inlet having a number of louvers provided on the bottom portion of the chassis body, a second suction inlet provided near a bottom of the front portion of the chassis body, a third suction inlet provided on the top portion of the chassis body and a pair of fourth suction inlets provided on the pair of side portions of the chassis body for the purpose of receiving air from the surroundings.

A heat exchanger unit housed in the chassis body includes a front heat exchanger and a rear heat exchanger arranged in form of a V-shape. A first air guider and a second guider are positioned within the chassis body to guide the air flow within the chassis body. The first air guider directs the air received from the third suction inlet to the heat exchanger unit via a curved back portion of the first air guider. The air is passed through an air filter, positioned within the chassis body, before reaching a number of cooling fins associated with the heat exchanger unit for removing the dirt particles present in the air.

The air received through the first suction inlet and the second suction inlet passes through the air filter and reaches cooling fins associated with the heat exchanger unit for

transferring the heat of the air. The cool air generated by the heat exchanger unit is blown out with the help of a cross flow fan through an adjustable vane located near a top edge of the front portion.

- 5 The adjustable vane is horizontal and the ends of the adjustable vane are hinged to allow movement of the vanes in an upward and downward direction. Also the adjustable vane can change an angle of the vane for controlling the cold air delivery into the interior of the building structure.
- 10 These and other objects, features and advantages of the invention will be fully understood from the following detailed description of the invention and in view of the accompanying drawings.

BRIEF DESCRIPTIONS OF THE DRAWINGS

- 15 **FIG. 1** is a cross sectional view of an indoor air-conditioning unit, according to a preferred embodiment of the present invention;

- FIG. 2** is a part of the cross sectional view of the indoor air-conditioning unit showing the bottom louvers on the chassis body, according to a preferred embodiment of the present invention;
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- FIG. 3** is a perspective view of the indoor air-conditioning unit showing the fourth air suction inlet on the chassis body, according to a preferred embodiment of the present invention; and
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- FIG. 4** shows an air pathway of the indoor air-conditioning unit, according to a preferred embodiment of the present invention.

DETAILED DESCRIPTION

- 30 In the following detailed description, a reference is made to the accompanying drawings that form a part hereof, and in which the specific embodiments that may be practiced is shown by way of illustration. These embodiments are described in sufficient detail to enable those skilled in the art to practice the embodiments and it is to be understood that

the logical, mechanical and other changes may be made without departing from the scope of the embodiments. The following detailed description is therefore not to be taken in a limiting sense.

5 **FIG. 1** is a cross sectional illustrative view of an indoor air-conditioning unit (100), according to a preferred embodiment of the present invention. The indoor air-conditioning unit (100) for delivering cool air from a front upper portion when installed on a wall structure of an interior of a building structure has a chassis body (102), a heat exchanger unit (112), a first air guider (120), a second air guider (122), a cross flow fan (124), an air
10 filter (130) and a drain pan (132). The chassis body (102) has a front portion (136), a back portion (138), a top portion (140), a bottom portion (142) and pair of side portions (144). The bottom portion (142) of the chassis body (102) includes a first suction inlet (104) having a number of louvers (106), a second suction inlet (108) provided near a bottom edge of the front portion (136) for the purpose of receiving air from the surroundings. The
15 first suction inlet (104) is provided with the number of louvers (106) with the fins of the louvers (106) oriented at a certain angle. The louvers (106) of the first suction inlet (104) are attached at the bottom portion (142) of the chassis body (102).

In a preferred embodiment of the present indoor air-conditioning unit (100), the louvers
20 (106) are attached at an angle to the bottom portion (142) of the chassis body (102) to function as a primary air suction inlet for receiving air through the angled fins of the louvers (106). In addition, the louvers (106) of the first suction inlet (104) are tilted towards the front portion (136) of the chassis body (102) and angled upwards from the chassis body (102) for enabling optimum airflow through the first suction inlet (104).
25 Further the fins of the louvers (106) are arranged in an overlapping manner, adjacent to each other, for preventing view of an interior of the chassis body (102) by a person underneath the indoor air-conditioning unit (100).

FIG. 2 is a part of the cross-sectional view of a portion of the chassis body (102) of the
30 indoor air-conditioning unit (100) showing the bottom louvers (106) on the chassis body (102), according to a preferred embodiment of the present invention. Such an overlapping arrangement of the louvers (106) improves an external appearance of the chassis body (102) of the indoor air-conditioning unit (100). The number of louvers (106) and the size

of the first suction inlet (104) depends on the requirements and amount of air required to be drawn in through the louvers (106) for efficient operation of the indoor air-conditioning unit (100).

- 5 The second suction inlet (108) of the chassis body (102) includes an adjustable front louver (126) positioned on the front portion (136) of the chassis body (102). The adjustable front louver (126) is positioned adjacent to the louvers (106) of the first suction inlet (104). The adjustable front louver (126) of the second suction inlet (108) is positioned near the bottom edge of the front portion (136) of the chassis body (102). The adjustable
10 front louver (126) of the second suction inlet (108) is placed horizontally and parallel to the louvers (106) and a position or angle of the adjustable front louver (126) is controlled using an electric motor, which can be controlled using a remote controller.

- 15 The adjustable front louver (126) of the second suction inlet (108) has a curved shape and is provided near the bottom edge of the front portion (136) of the chassis body (102) to guide the air to the top side of a front heat exchanger (114) along a back side portion of the front portion (136) of the chassis body (102). The adjustable front louver (126) associated with the second suction inlet (108) provided at the front portion (136) of the chassis body (102) functions in form of a secondary air suction inlet for receiving air through the
20 adjustable front louver (126) and for guiding the air to the top side of the front heat exchanger (114).

- 25 The top portion of the chassis body (102) includes a third suction inlet (110). The third suction inlet (110) provided on the top portion (140) of the chassis body (102) includes a number of openings to draw air into the airflow circuit of the indoor air-conditioning unit (100). When the back portion (138) of the chassis body (102) of the indoor air-conditioning unit (100) is attached to the wall structure of the interior of the building, the openings of the third suction inlet (110) provided on the top portion (140) of the chassis body (102) and intakes air from the surroundings and guide the air to pass through a back
30 side of the first air guider (120) towards the rear heat exchanger (116). The air entering through the third suction inlet (110) provided on the top portion (140) of the chassis body (102) passes through the air filter (130) to reach the rear heat exchanger (116) and passes

through the cooling fins provided around the cooling tubes of the rear heat exchanger (116).

FIG. 3 is a perspective view of the indoor air-conditioning unit (100). The chassis body (102) of the indoor air-conditioning unit (100) includes the fourth air suction inlet (128) provided on the side portions (144), positioned near the back portion (138) of the chassis body (102) to receive air and to direct the air to an air flow circuit towards the heat exchanger unit (112). The fourth air suction inlet (128) increases the overall airflow towards the heat exchanger unit (112).

Referring back to **FIG. 1**, the front portion (136) of the chassis body (102) of the indoor air-conditioning unit (100) includes the adjustable vane (118), which is pivoted at the ends and is adjustable, for guiding the cold air to a top area of the interior of the building structure, where the indoor air conditioning unit (100) is attached. The position of the adjustable vane (118) is automatically controlled using a controller of the air conditioning unit (100) to direct the cool airflow. The chassis body (102) of the indoor air conditioning unit (100) further houses a first air guider (120) and a second air guider (122) positioned to guide the airflow within the chassis body (102). The adjustable vane (118) positioned at the upper part of the front portion (136) of the chassis body (102) guides the cold air to the top area of the interior of the building structure. The first air guider (120) and the second air guider (122) have curved shapes and are positioned to direct the cold air to the adjustable vane (118) and for guiding the cold air to the top area of the interior of the building structure.

The heat exchanger (112) has a front heat exchanger (114) and a rear heat exchanger (116) arranged in form of a V-shape. The hot air from the room is absorbed through the first suction inlet (104), second suction inlet (108), third suction inlet (110), and the fourth suction inlet (128) and guided to pass through the fins surrounding the heat transfer tubes (146) of the front heat exchanger (114) and the rear heat exchanger (116). The refrigerant passing through the tubes (146) at very low temperature cools the air passing through the fins of the front heat exchanger (114) and the rear heat exchanger (116), and the cross flow fan (124) directs the cool air to pass through a vane (118) provided at the top of the front portion (136) of the chassis body (102) of the indoor air-conditioning unit (100).

The air filter (130) is placed between the first suction inlet (104), second suction inlet (108), the front heat exchanger (114) and the rear heat exchanger (116). The air filter (130) has a curved shape covering the rear heat exchanger (116) and a bottom part of the front heat exchanger (114) for filtering out any dirt particles present in the air sucked in through the air inlets. Further, the curved shape of the air filter (130) enlarge an area of the air filter positioned between the first suction inlet (104), second suction inlet (108), the front heat exchanger (114) and the rear heat exchanger (116) and reduces the draft resistance or airflow resistance of the air filter (130). The drain pan (132) is positioned below the V-shaped heat exchanger unit (112). The dewdrops from the heat exchanger unit (112) are collected in the drain pan (132). The drain pan (132) is connected to a drainpipe for draining the collected water.

FIG. 4 shows an air pathway of the indoor air-conditioning unit (100), according to a preferred embodiment of the present invention. When attached on the vertical wall, the louvers (106) of the first suction inlet (104) and the adjustable front louver (126) of the second suction inlet (108) are positioned on the bottom portion (142) and the front bottom portion of the chassis body (102), respectively. The louvers (106) of the first suction inlet (104) are overlapping and are properly positioned at the bottom portion (142) of the chassis body (102) to provide a good appearance and the angle of the bottom louvers (106) are selected such that the interior of the chassis body (102) is kept hidden from the people at the interior of the building.

Further the adjustable front louver (126) with the curved shape directs the air sucked in from the interior of the building to a top portion of the front heat exchanger (114) through the air filter (130). The external curved shape of the adjustable front louver (126) forms a continuous surface with the external surface of the front portion (136) of the chassis body (102), when the indoor air-conditioning unit (100) in an off state. This improves the overall appearance of the indoor air-conditioning unit (100) and provides the appearance of existing normal indoor air-conditioning units with front adjustable louvers for blowing out cold air.

The third suction inlet (110) at the top portion (140) of the chassis body (102) of the indoor air-conditioning unit (100) includes the number of openings to receive air. The

openings faces the top of the interior of the building and sucks in air from the surroundings and guide the air to pass through the back side of the first air guider (120) towards the rear heat exchanger (116) through the air filter (130). The presence of the third suction inlet (110) increases the overall efficiency of the indoor air-conditioning unit (100) by drawing
 5 more air from the surroundings.

The fourth suction inlet (128) provided on the sides (144) of the chassis body (102) further increases the amount of air received through the air filter (130) to the heat exchanger, which in turn improves the overall efficiency of the indoor air-conditioning unit (100). The
 10 air received through the four suction inlets are then allowed to pass through the air filter (130) to remove any dirt particles and then through the front heat exchanger (114) and the rear heat exchanger (116). The heat exchanger unit (112) including the front heat exchanger (114) and the rear heat exchanger (116) transfers the heat from the refrigerant to the air received from the surroundings to cool the air. The received air through the air
 15 suction inlets are allowed to pass through the fins attached to the cooling tubes of the front heat exchanger (114) and the rear heat exchanger (116) to transfer the heat.

The dew drops from the fins, which is generated during cooling of the air while passing through the fins during the cooling process, is collected in the drain pan (132). The cold air
 20 from the front heat exchanger (114) and the rear heat exchanger (116) is then blown out through the adjustable vane (118) positioned on the front portion (136) of the chassis body (102) by the cross flow fan (124) arranged between the front heat exchanger (114) and the rear heat exchanger (116). The adjustable vane (118) directs the cold air towards a top area of the interior of the building structure such as the room and enables uniform and efficient
 25 cooling of the area. In addition the present indoor air-conditioning unit (100) prevents the cold air from blowing out directly to the persons at the interior of the building structure, thereby providing enhanced comfort to the persons at the interior are of the building structure.

30 The foregoing description of the specific embodiments will so fully reveal the general nature of the embodiments herein that others can, by applying current knowledge, readily modify and/or adapt for various applications such specific embodiments without departing from the generic concept, and, therefore, such adaptations and modifications should and

are intended to be comprehended within the meaning and range of equivalents of the disclosed embodiments. It is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation. Therefore, while the embodiments herein have been described in terms of preferred embodiments, those
5 skilled in the art will recognize that the embodiments herein can be practiced with modification within the spirit and scope of the appended claims.

Although the embodiments herein are described with various specific embodiments, it will be obvious for a person skilled in the art to practice the invention with modifications.
10 However, all such modifications are deemed to be within the scope of the claims.

CLAIMS

1. An indoor air-conditioning unit (100) comprising:
 - a chassis body (102) having a front portion (136), a back portion (138), a top
 - 5 portion (140), a bottom portion (142) and plurality of side portions (144),
 - wherein the chassis body (102) includes:
 - a heat exchanger unit (112) comprising a front heat exchanger (114) and a
 - rear heat exchanger (116);
 - at least one vane (118) at the upper side of the front portion (136);
 - 10 a first air guider (120) and a second guider (122); and
 - a cross flow fan (124);
 - characterized in that the bottom portion (142) comprises a first suction inlet
 - (104) having a plurality of louvers (106).
- 15 2. The indoor air-conditioning unit (100) of claim 1 wherein the plurality of louvers
- (106) of the first suction inlet (104) functions in form of a primary air suction inlet,
- wherein the plurality of bottom louvers (106) of the first suction inlet (104) are
- titled towards the front portion (136) and angled upwards from the chassis body (102).
- 20 3. The indoor air-conditioning unit (100) of claim 1 wherein the plurality of louvers
- (106) are arranged in an overlapping manner.
4. The indoor air-conditioning unit (100) wherein the front portion (136) of the
- chassis body (102) comprises a second suction inlet (108) horizontally positioned above
- 25 the first suction inlet (104) near a bottom edge of the front portion (136).
5. The indoor air-conditioning unit (100) of claim 4 wherein the second suction inlet
- (108) at the front portion (136) is provided with an adjustable front louver (126),
- wherein the adjustable front louver (126) of the second suction inlet (108) has a
- 30 curved shape.
6. The indoor air-conditioning unit (100) of claim 1 wherein the top portion (140) of
- the chassis body (102) includes a third suction inlet (110).

7. The indoor air-conditioning unit (100) of claim 1 wherein the chassis body (102) includes a fourth air suction inlet (128) provided on the side portions (144).

8. The indoor air-conditioning unit (100) of claim 1 wherein at least one air filter (130) is placed between the first suction inlet (104), the second suction inlet (108), and the heat exchanger unit (112),

wherein the air filter (130) has a curved shape covering the rear heat exchanger (116),

wherein the curved shape of the air filter (130) enlarge an area of the air filter positioned between the first suction inlet (104), the second suction inlet (108) and the heat exchanger unit (112).

9. The indoor air-conditioning unit (100) of claim 1 wherein the vane (118) is horizontally arranged and is adjustable.

10. The indoor air-conditioning unit (100) of claim 1 wherein the first air guider (120) and the second guider (122) have a curved shape.

11. An indoor air-conditioning unit (100) comprising:

a chassis body (102) having a front portion (136), a back portion (138), a top portion (140), a bottom portion (142) and a plurality of side portions (144),

wherein the chassis body (102) includes:

a plurality of air suction inlets including a second suction inlet (108) provided at the front portion (136);

a third suction inlet (110) provided at the top portion (140); and

an air suction inlet (128) provided on the side portions (144);

a heat exchanger unit (112) comprising a front heat exchanger (114) and a rear heat exchanger (116);

at least one adjustable vane (118) provided on the front portion (136);

a first air guider (120) and a second guider (122) positioned within the chassis body (102); and

a cross flow fan (124) arranged between the front heat exchanger (114) and the rear heat exchanger (116).

12. The indoor air-conditioning unit (100) of claim 11 wherein the bottom portion (142) has a first suction inlet (104) having a plurality of louvers (106).