

SPECIFICATION

Air conditioning apparatus

- 5 The present invention relates to casings for interior units of split type air conditioning apparatus.

Split type air conditioning apparatus is constructed with exterior and interior units. The exterior unit includes a compressor for compressing refrigerant and a condensor for condensing the refrigerant while the interior unit includes an evaporator which acts as a heat exchanger for evaporating the refrigerant fed from the exterior unit and a fan for circulating air in the room through the heat exchanger. These units are, of course, interconnected and together complete a refrigerant circuit.

- Fig. 1 shows the approach used by the prior art for the formation of the case for the interior portion of air conditioning apparatus. The interior unit is substantially divided into upper and lower compartments by an L-shaped separator. The upper compartment is defined between a top wall, an arcuate rear wall and a separator and serves as a fan casing. A fan is disposed therein so that it lies along the arcuate rear wall. The configuration of the arcuate rear wall is important since it affects the fan's efficiency and is usually a spiral or scroll. One end of the separator which opposes the arcuate wall and one end of the arcuate rear wall adjacent the fan cooperate with the fan to form blower ducts. These are also important for fan efficiency. In such a conventional interior unit, careful adjustment of the relationship between the separator and the arcuate rear wall must be carried out to achieve the desired fan efficiency after assembly of the unit because the arcuate rear wall and the separator are separate parts. In spite of the ability to adjust these parts, uniformity of fan efficiency for each assembled interior unit is not always attained.

The present invention seeks to overcome these problems. According to the present invention there is provided a casing for an air conditioning apparatus comprising:

- an integrally moulded outer housing having a front panel with a plurality of apertures, a pair of opposite first side walls connected to said front panel and a pair of opposed top and bottom walls connected to said front panel and first said side walls, respectively, an integrally moulded, one piece inner housing adapted to fit inside said outer housing and comprising an upper wall and two outer side walls, a first vertical separator wall spaced inwardly from one side wall so as to extend substantially parallel with said one side wall, a curved wall member positioned between the other side wall and said first separator wall and spaced between said upper wall, and defining a fan chamber, said curved wall

having top and bottom edges, said top edge being connected to the front edge of said upper wall and extending rearwardly and downwardly therefrom, a horizontal separator

- 70 wall positioned between said other side wall and said first separator wall and beneath said curved rear wall for separating the area within said inner housing into separate fan and heat exchange chambers, said horizontal separator including a flat portion having front and rear edges, an upstanding projection extending from said rear edge substantially along the whole length of said rear edge, a flap portion extending downwardly at a predetermined angle from said front edge, and a plurality of spaced apart rib members connected to and extending between the upstanding projection and the bottom edge of said curved wall, and a removable rear wall. In this manner, adjustment of the relationship between the curved rear wall and the separator to achieve the desired fan efficiency is no longer required and the same fan efficiency is achieved for each unit.

- 90 One embodiment of the present invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a cross-sectional view of a conventional prior art type interior unit for an air conditioner;

Figure 2 is an exploded perspective view of an interior unit for a split type air conditioner according to the present invention;

- 100 Figure 3 is a cross-sectional view of the interior unit apparatus shown in Fig. 2,

Figure 4 is a perspective view, partly in vertical section, of the main body of the casing shown in Fig. 2;

- 105 Figure 5 is a perspective view of a drain pan disposed in the interior unit shown in Fig. 2; and

Figure 6 is a perspective view, partly in section, of a separator and a drain gutter attached to the main body shown in Fig. 4.

- As indicated previously, Fig. 1 shows a prior art casing design in which a plurality of separately manufactured casing pieces are joined together and thereafter adjusted to form the fan housing.

Referring now to Fig. 2, the preferred exemplary embodiment of the present invention is shown.

- The interior unit generally indicated at 200 of a split type air conditioner is shown as being comprised of a main blower assembly 20, a front cover 22 and a rear panel 24. The front cover includes a panel member 30 in which an upper grille 26 for taking in air and a lower grille 28 for exhausting air are provided. An air filter (not shown) can be detachably mounted to the cover 22 behind upper grille 26. A plurality of parallel blades 32 for adjusting the direction of air flow are arranged over the lower grille.

The main blower assembly 20 includes a case member 34, in which a cross-flow fan 36 and an evaporator 38 which acts as a heat exchanger, are disposed. Case member 34 is an integrally moulded structure and may be moulded from a variety of moldable resins or plastics.

Turning now to Figs. 2 and 4, the latter showing a representative view of one end of the case member, it can be seen that case member 34 is comprised of an upper top wall 40 and side walls 42 and 43 which together form a box like structure. A motor 44, shown in Fig. 2, or other electrical or mechanical parts 46 are housed in an area surrounded by side wall 43 and another interior wall or vertical separator 48. Hereinafter, separator 48 will be referred to as the "first separator" 48. Double wall portions 50 and 52 are respectively provided on the inside surface of side wall 42 and first separator 48 with wall portions 50 and 52 being spaced from side wall 42 and separator 48 so that air chamber is defined therebetween.

The area defined between side wall 42 and first separator 48 is divided into an upper chamber 54 and lower chamber 56 by an inverted L-shaped separator 62, hereinafter called the "second separator" 62. Fan 36 is disposed in the upper chamber 54 and heat exchanger 38 is disposed in the lower chamber 56. Upper chamber 54 constitutes a fan casing with a curved rear wall 60 connected to top wall 40 at a portion 45 facing to front cover 22, side wall 42, first separator 48 and a second separator 62.

Second separator 62, which extends between side wall 42 and first separator 48, includes an upper flat portion 64 and a depending front extension wall portion 66. Air taken in through the upper grille 26 and the air filter is prevented from entering in the lower chamber 56 by wall portion 66. Instead, air is pulled into the upper chamber 54 by the fan 36. Flat portion 64 is stepped upwardly as shown at 64a, and a plurality of spaced apart ribs 68 are formed integrally with separator 62 and extend between the stepped portion 64a and the curved rear wall 60 so as to support one end of rear wall 60. Passages 69 lie between ribs 68 to interconnect spaces 54 and 56. Ribs 68 are formed when case member 34 is molded. Accordingly, the relative positions of stepped portion 64a and rear wall 60, and especially the region of the side wall 42 where rear wall 60 starts to curve, are fixed because of the integral design so that fan efficiency can be easily attained and maintained during the life of the apparatus.

A pair of openings 70 including guide slots 70a and a pair of holes 72 and 74 on opposite sides of opening 70, are provided on side walls 42 and first separator 48 and these openings are used to attach fan 34 to the

casing.

As shown in Fig. 4, a bearing 76 having a central hole 78 with a coaxial flange 80 is inserted in opening 70. Flange 80 is inserted in guide slot 70a. A metal retaining bracket 82 having U-shaped blades 82a and 82b, forming spring clips which engage in holes 72 and 74, respectively, is utilised to ensure the bearing 76 at side wall 42 and first separator 75 wall 48. Detents 84a and 84b provided on the outer surface of blades 82a and 82b retain the spring blades 82a and 82b in the holes 72 and 74. The U-shaped blades 82a and 82b of the bracket 82 serve as plate springs and absorb vibration transmitted by the shaft of fan 36 through bearing 76 during the rotation of fan 36. First separator 48 has an opening 83 through which one end of the fan shaft extends to connect to motor 44.

A drain guide 86 is also formed in lower chamber 56 when case member 34 is molded. A drain pipe 88, whose configuration is shown in Fig. 5 is disposed in the lower chamber 56 as indicated by a phantom line in Fig. 4. A nipple 90 having outlets 92a and 92b is provided beneath the outlet opening (Fig. 5) of drain pan 88. It is preferred to attach a drain hose 94 to one of the outlets 92a and 92b and to close off the other one of outlets. Drain guide 86 and drain pan 88 are both covered with a heat insulating material 100.

A drain gutter 102, formed as a V-shaped channel member having two opposing sides 102a and 102b, is attached to the lower edge of wall portion 66. As shown in Figs. 2 and 3, a plurality of ribs 104 are molded on the inner surface of one side 102a of the gutter 102, the ribs 104 extending toward the other side 102b but being spaced therefrom so that that lower end of flap portion 66 can fit within the space formed therebetween and be engaged by the inner surface of side 102b and ribs 104. A plurality of triangular shaped auxiliary ribs 106 are provided on top of each rib 104. One edge of each auxiliary rib 106 is parallel to flap portion 66 so as to lie there against and firmly secure drain gutter 102 thereto. The bottom of drain gutter 102 gradually descends or slopes from the mid portion toward each of its ends at which an opening 108 is formed for leading drained fluid produced during the cooling operation toward and onto drain guide 86 and ultimately into drain pan 88. The inner surface of flap portion 66 is covered with the heat insulating material 100.

Heat exchanger 38 is supported in a tilted position between flap portion 66 and drain pan 88 in the lower chamber 56. A pipe 110 is connected to heat exchanger 38, and is used for conveying refrigerant. A support bracket 112 including a cutaway portion 112a for receiving the pipe 110 is disposed at each end of drain pan 88 so that heat

exchanger 38 is supported at its ends. Also at each end, an elongate retaining bracket 114 is detachably hinged to the flat member 64 by a hook 114a which engages in an opening 116 provided on flat portion 64. Each of the openings 116 may be formed after unit 34 is molded. Each bracket 114 has a key 114b designed to engage between portions of pipes 110, which protrude from the sides of the heat exchanger, to hold the bracket in place.

As shown in Fig. 2, a tube 116 is connected to one open end of pipe 110 at the lower side of heat exchanger 38 while a tube 118 is connected to the other open end of pipe 110, at the upper side of heat exchanger. Tube 116 transports the refrigerant to the heat exchanger from the condensor disposed in the exterior unit (not shown) while tube 118 transports refrigerant back to the compressor disposed in the exterior unit to complete the refrigerant cycle. Tube 116 extends upwardly from the lower end of pipe 110 to near the upper end of pipe 110 along heat exchanger 38. Both tubes 116 and 118 extend parallel to drain guide 86 with a curved part having a curvature of about 100mm. The tubes 116 and 118 are encased in heat insulating material 100. The continuations of tubes 116 and 118 also extend beneath drain guide 86 and drain pan 88.

Operation of the interior unit of the air conditioning apparatus described above is as follows. Warm air taken in through upper grille 26 by fan 36 is passed from upper chamber 54 to lower chamber 56 through passages 69. As the warm air passes through heat exchanger 38, its temperature is decreased and substantially cooled. Cooled air is thereafter blown out from the lower grille 28 as directed by the adjustable blades. Due to the temperature differences between inside and outside of flap portion 66, condensation occurs on the outside of the extension portion 66. Condensation is also produced by heat exchanger 38 and all the draining fluid is collected by drain pan 88 and finally lead out by hose 94.

To summarise, the preferred embodiment of the invention comprises, a fan casing for an interior unit of a split type air conditioner, including a curved rear wall integrally connected to a top wall and side walls and a separator including a flat portion extending generally parallel with the top wall and a flap portion extending downwardly at the front end of the flat portion. Accordingly, adjustment of the relationship between the curved rear wall and the separator for realising the desired fan efficiency is no longer needed and the same fan efficiency for each unit as manufactured in the factory is guaranteed.

While the invention has been described in connection with what is presently considered to be the most practical and preferred embodiment, it is to be understood that the invention

is not to be limited to the disclosed embodiment but on the contrary, is intended to cover various modifications and equivalent arrangements included within the scope of the appended claims.

CLAIMS

1. A casing for an air conditioning apparatus comprising:
 - an integrally moulded outer housing having a front panel with a plurality of apertures, a pair of opposite first side walls connected to said front panel and a pair of opposed top and bottom walls connected to said front panel and said first side walls, respectively,
 - an integrally moulded, one piece inner housing adapted to fit inside said outer housing and comprising an upper wall and two outer side walls, a first vertical separator wall spaced inwardly from one side wall so as to extend substantially parallel with said one side wall positioned between said other side wall and said first separator wall and beneath said curved rear wall for separating the area within and defining a fan chamber, said curved wall having top and bottom edges, said top edge being connected to the front edge of said upper wall and extending rearwardly and downwardly therefrom, a horizontal separator wall positioned between said other side wall and said first separator wall and beneath said curved rear wall for separating the area within said inner housing into separate fan and heat exchange chambers, said horizontal separator including a flat portion having front and rear edges, an upstanding projection extending from said rear edge substantially along the whole length of said rear edge, a flap portion extending downwardly at a predetermined angle from said front edge, and a plurality of spaced apart rib members connected to and extending between the upstanding projection and the bottom edge of said curved wall, and a removable rear wall.
2. A casing as claimed in claim 1 further including a drain gutter for collecting water, said drain gutter being attached along the bottom edge of said flap portion.
3. A casing as claimed in claim 2 wherein said drain gutter means includes a pair of opposed walls connected together by their bottom edges, one of said walls having a plurality of mounting projections integrally molded therewith and extending toward said other wall so as to define a gap therebetween whereby the bottom edge of said flap portion can be engaged therein to support said drain gutter.
4. A casing as claimed in claim 3 in which at least one of said projections includes an auxiliary rib so arranged that an edge face of the rib is substantially parallel with the outer surface of said flap portion.
5. A housing for an air conditioning unit substantially as herein described with refer-



- exchanger 38 is supported at its ends. Also at each end, an elongate retaining bracket 114 is detachably hinged to the flat member 64 by a hook 114a which engages in an opening 116 provided on flat portion 64. Each of the openings 116 may be formed after unit 34 is molded. Each bracket 114 has a key 114b designed to engage between portions of pipes 110, which protrude from the sides of the heat exchanger, to hold the bracket in place.

- As shown in Fig. 2, a tube 116 is connected to one open end of pipe 110 at the lower side of heat exchanger 38 while a tube 118 is connected to the other open end of pipe 110, at the upper side of heat exchanger. Tube 116 transports the refrigerant to the heat exchanger from the condensor disposed in the exterior unit (not shown) while tube 118 transports refrigerant back to the compressor disposed in the exterior unit to complete the refrigerant cycle. Tube 116 extends upwardly from the lower end of pipe 110 to near the upper end of pipe 110 along heat exchanger 38. Both tubes 116 and 118 extend parallel to drain guide 86 with a curved part having a curvature of about 100mm. The tubes 116 and 118 are encased in heat insulating material 100. The continuations of tubes 116 and 118 also extend beneath drain guide 86 and drain pan 88.

- Operation of the interior unit of the air conditioning apparatus described above is as follows. Warm air taken in through upper grille 26 by fan 36 is passed from upper chamber 54 to lower chamber 56 through passages 69. As the warm air passes through heat exchanger 38, its temperature is decreased and substantially cooled. Cooled air is thereafter blown out from the lower grille 28 as directed by the adjustable blades. Due to the temperature differences between inside and outside of flap portion 66, condensation occurs on the outside of the extension portion 66. Condensation is also produced by heat exchanger 38 and all the draining fluid is collected by drain pan 88 and finally lead out by hose 94.

- To summarise, the preferred embodiment of the invention comprises, a fan casing for an interior unit of a split type air conditioner, including a curved rear wall integrally connected to a top wall and side walls and a separator including a flat portion extending generally parallel with the top wall and a flap portion extending downwardly at the front end of the flat portion. Accordingly, adjustment of the relationship between the curved rear wall and the separator for realising the desired fan efficiency is no longer needed and the same fan efficiency for each unit as manufactured in the factory is guaranteed.

- While the invention has been described in connection with what is presently considered to be the most practical and preferred embodiment, it is to be understood that the invention

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CLAIMS

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 - 75 an integrally moulded outer housing having a front panel with a plurality of apertures, a pair of opposite first side walls connected to said front panel and a pair of opposed top and bottom walls connected to said front panel and first said side walls, respectively,
 - 80 an integrally moulded, one piece inner housing adapted to fit inside said outer housing and comprising an upper wall and two outer side walls, a first vertical separator wall spaced inwardly from one side wall so as to extend substantially parallel with said one side wall positioned between said other side wall and said first separator wall and beneath said curved rear wall for separating the area within
 - 90 and defining a fan chamber, said curved wall having top and bottom edges, said top edge being connected to the front edge of said upper wall and extending rearwardly and downwardly therefrom, a horizontal separator wall positioned between said other side wall and said first separator wall and beneath said curved rear wall for separating the area within said inner housing into separate fan and heat exchange chambers, said horizontal separator
 - 95 including a flat portion having front and rear edges, an upstanding projection extending from said rear edge substantially along the whole length of said rear edge, a flap portion extending downwardly at a predetermined angle from said front edge, and a plurality of spaced apart rib members connected to and extending between the upstanding projection and the bottom edge of said curved wall, and a removable rear wall.
- 100 2. A casing as claimed in claim 1 further including a drain gutter for collecting water, said drain gutter being attached along the bottom edge of said flap portion.
- 105 3. A casing as claimed in claim 2 wherein said drain gutter means includes a pair of opposed walls connected together by their bottom edges, one of said walls having a plurality of mounting projections integrally molded therewith and extending toward said
- 110 other wall so as to define a gap therebetween whereby the bottom edge of said flap portion can be engaged therein to support said drain gutter.
- 115 4. A casing as claimed in claim 3 in which at least one of said projections includes an auxiliary rib so arranged that an edge face of the rib is substantially parallel with the outer surface of said flap portion.
- 120 5. A housing for an air conditioning unit substantially as herein described with refer-

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ence to the accompanying drawings.

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