# United States Patent [19]

**Bolton**

[11] **3,823,574**

[45] **July 16, 1974**


[54] **APPARATUS FOR OPENING EXHAUST AND VENT PORTS OF AN AIR CONDITIONING UNIT**


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[73] Assignee: **Carrier Corporation,** Syracuse, N.Y.



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[52] **U.S. Cl.** ..... **62/262,** 62/427, 98/94

[51] **Int. Cl.** ..... **F25d 23/12**

[58] **Field of Search** ..... 62/262, 427; 98/94, 94 AC



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*Attorney, Agent, or Firm*—J. Raymond Curtin; D. Peter Hochberg



[57] **ABSTRACT**

Apparatus for selectively opening the exhaust and vent ports in a wall between the condenser and evaporator sections of an air conditioning unit, the apparatus comprising hinged doors biased to port closing positions and an operating lever having an actuating arm extending from a rotatable shaft for selectively exerting torque on tabs extending from the doors to open the selected one of the doors.


**8 Claims, 4 Drawing Figures**

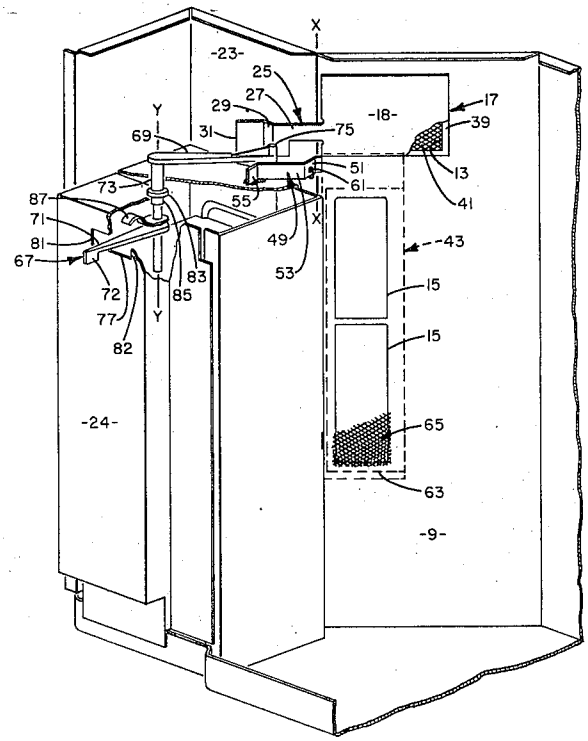
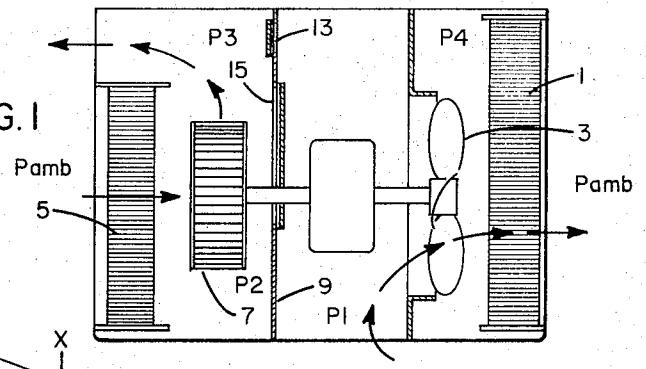


FIG. 1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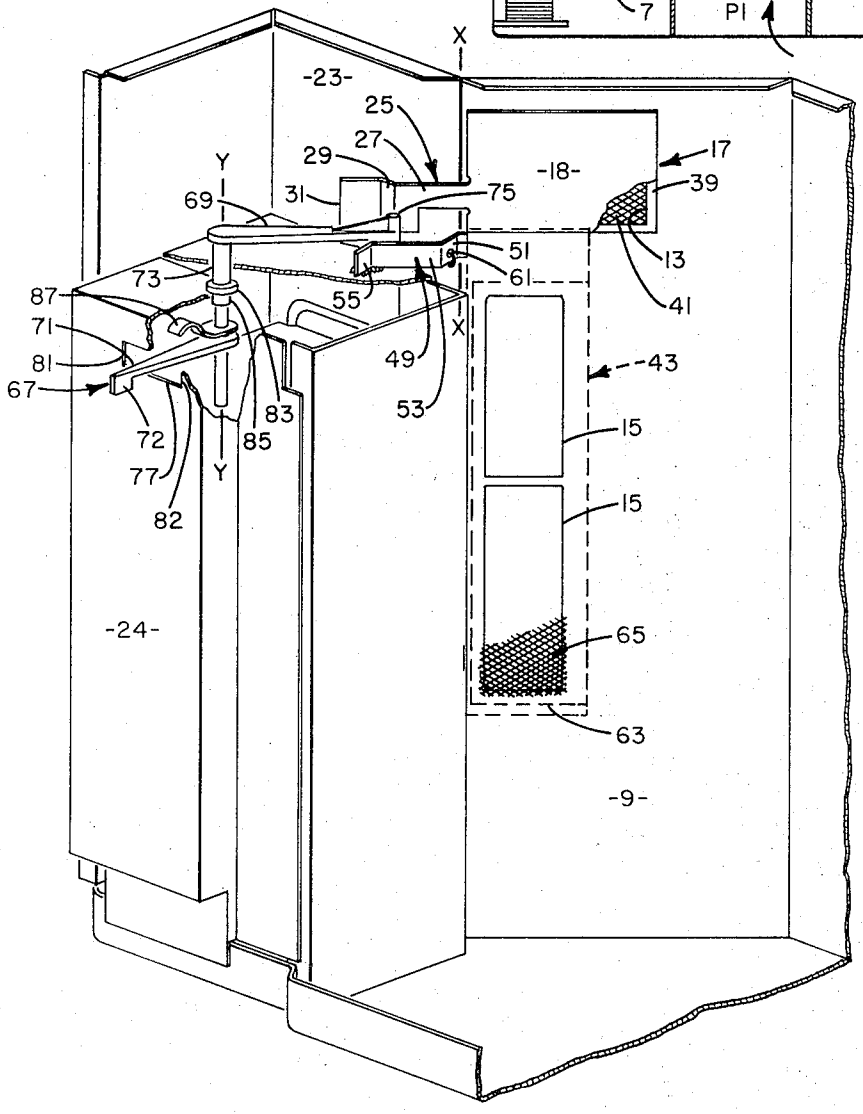
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FIG. 2

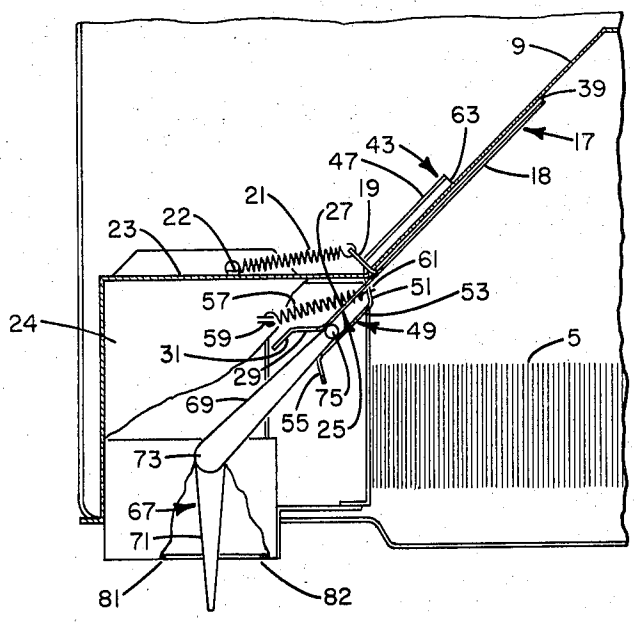
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FIG. 3

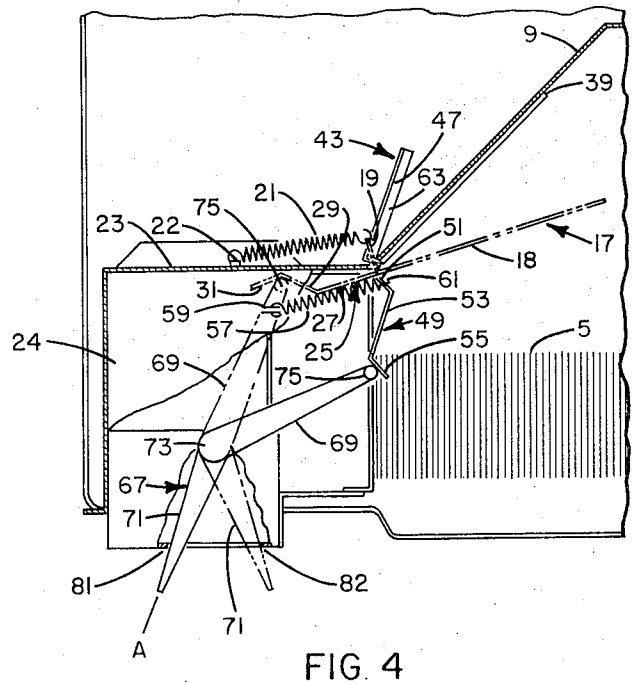
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FIG. 4

# APPARATUS FOR OPENING EXHAUST AND VENT PORTS OF AN AIR CONDITIONING UNIT

## BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to air conditioning units which are adapted to exhaust stale air from a room being served by the unit and alternatively to vent external air into the room. More specifically, the present invention relates to apparatus for selectively opening and closing exhaust and vent ports in room air conditioners having the foregoing capability.

2. Description of the Prior Art

Air conditioning units such as the so-called self-contained air conditioning units commonly used for residential and similar applications, generally include refrigeration circuits having an evaporator and a condenser. The unit is generally divided into an evaporator section and a condenser section, and the two sections are isolated from one another by a partition. The unit is normally mounted with the evaporator section being adjacent to the space being served by the unit and in communication with the air in that section, and the condenser section being in communication with external air such as outdoor air. Refrigerant flows through the refrigeration circuit and absorbs heat from the room air in the evaporator section causing the refrigerant therein to evaporate and flow towards the condenser section, where it gives up the absorbed heat to the ambient air flowing over the condenser. In addition to the capability of controlling the temperature of the air in the space being conditioned, it is often desirable to remove stale air from the space or to admit fresh, outdoor air to the space. This is accomplished in various air conditioning units by the provision of appropriately spaced ports in the unit which can be selectively opened and closed to control the flow of air to and from the conditioned space.

Ports of the aforementioned type can be located to make use of the pressure differentials which usually exist in air conditioning equipment of the kind described. Conventional self-contained air conditioning units include a blower wheel positioned adjacent to the evaporator for drawing room air over the evaporator coils and into the low pressure center of the blower wheel, from whence the air passes radially outwardly through the blower wheel to a high pressure region and back into the room. A fan is generally located adjacent to the condenser of the unit for drawing ambient air into the low pressure region created by the rotating fan blades, and for directing that air over the condenser coils for cooling the refrigerant within the coils. The condenser fan and the evaporator blower are usually in a generally opposing relationship on opposite sides of the partition dividing the unit into the condenser section and the evaporator section. The air pressure on the evaporator side of the partition in the region of the blower wheel is generally lower than the pressure on the opposite side of the partition because the partition is located closer to the blower wheel. Hence, the provision of a port between the fan and blower wheel would enable the admittance of outdoor air through that port into a room being conditioned. On the other hand, the region above the blower wheel normally has a very high pressure, and the provision of a port in the partition above the blower wheel would enable the passage of air out of the room and into the condenser section of the unit. The use of such ports is known in the art, as evidenced by U.S. Pat. No. 2,986,016 which issued on May 30, 1961 to Gillham et al.



In order to make effective use of the foregoing ports, it is desirable to open only one port at a time to obtain a sufficient flow of air therethrough. It is additionally desirable to incorporate port closing apparatus which necessitates neither an increase in the size of the unit nor a substantial modification of the components thereof. Likewise, it is desirable to keep the cost of such venting and exhaust apparatus as low as possible.

Prior mechanisms for opening and closing such vent and exhaust ports have often been relatively complex, requiring numerous parts and considerable skill in assembling these parts. Moreover, since it is important to maintain a port open once it has been decided to open that port, the employment of expensive and complicated friction devices has frequently been necessary. Also, mechanisms of the preceding type have tended to make access to the interior of the air conditioning units difficult, thus impeding repair work on the unit.

## SUMMARY OF THE INVENTION

An object of the present invention is to selectively exhaust air from a space being air conditioned or to vent fresh air to that space.

A more specific object of the invention is to adapt an air conditioning unit to exhaust stale air from a room being air conditioned and to vent fresh air into the room.

A still more specific object of the invention is to provide apparatus for selectively opening and closing vent and exhaust ports in a self-contained air conditioning unit, which apparatus is simple in construction, easy to operate, and economical to manufacture and install.

Other objects will be apparent from the description to follow and from the appended claims.

The preceding objects are achieved according to a preferred embodiment of the invention by the provision of a pair of pivotally mounted doors for selectively opening and closing the vent and exhaust ports in a self-contained air conditioning unit, and a very simple mechanism for alternatively opening one of the two doors. Each of the doors are spring biased to a port closing position, and each door has a tab to which force can be applied for exerting a torque on the door to open it. A rotatable operating lever selectively engages the tab of one of the two doors for effecting the opening of the door. The operating lever can advantageously comprise a rotatable shaft, a first or actuating arm extending from the shaft and between the tabs of the two doors, and a second or control arm extending from the shaft and including a manually accessible portion. The tabs are preferably so configured and biased that once the operating lever has been rotated a predetermined amount to open one of the doors, the tab acts to restrain the lever arm from returning to its initial position, whereby the door is held in its open position until the manually accessible portion is moved to release the tab.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic side view of a self-contained room air conditioning unit.

FIG. 2 is a partial pictorial view of a room air conditioner employing apparatus according to the invention,

portions having been cut away to reveal various components thereof.

FIGS. 3 and 4 are top elevations of the apparatus shown in FIG. 2 at different stages in the operation of the apparatus.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

The embodiment of the invention described below is adapted for use in a self-contained room air conditioning unit, although it is to be understood that the invention finds like applicability in other forms of air conditioning units. The air conditioning unit described below includes a wall or partition separating the unit into a condenser or outdoor section which communicates with the outdoor or external air, and an evaporator or indoor section which is in communication with the room being air conditioned. An exhaust port is defined in the foregoing wall at a position wherein the pressure on the evaporator side of the wall is greater than that on the condenser side of the wall, and a vent port is provided at a section of the wall where the pressure on the condenser side of the wall is higher than that on the evaporator side of the wall. Thus, air can be exhausted from the room to the outdoors through the exhaust port by virtue of the pressure differential existing there, while fresh air can be vented into the room by virtue of the pressure differential existing across the vent port. A pair of door are pivotally mounted adjacent to each of the ports for opening and closing the ports. A rotatable lever is provided having an arm for exerting force on the doors to effect the opening thereof, and a manually accessible arm for controlling the operation of the lever.

Referring now to the drawings, FIG. 1 shows in schematic form a self-contained room air conditioning unit having appropriately placed exhaust and vent ports. The unit includes a condenser section in which are located a condenser **1** and a fan **3** for directing ambient air over the condenser coils as indicated by the arrow, and an evaporator section including an evaporator **5** and a blower wheel or other fan **7** for drawing room air over the evaporator coils and directing that air back into the room as indicated by the arrow. The two sections of the unit are separated and isolated by a wall or partition **9.** The unit is adapted for installation in a room so that the evaporator section communicates with the room air while the condenser section communicates with the outdoor air. The condenser and evaporator are part of a conventional refrigeration circuit which also includes a compressor and an expansion device (not shown), with the evaporator serving to absorb heat from room air drawn over the evaporator coils by the blower, which then returns the cooled air back into the room. The heat absorbed by the refrigerant in the evaporator is thereafter transferred to the air being blown across the condenser coils by fan **3.** Partition **9** is located considerably closer to blower wheel **7** than to fan **3,** so that the pressure $P_2$ in the region of blower wheel **7** is less than pressure $P_1$ on the condenser side of partition **9.** Both of pressures $P_2$ and $P_1$ are suction pressures and are thus below the ambient pressure $P_{amb}$. The pressure $P_3$ above blower wheel **7** is higher than the ambient pressure and is also higher than the pressure $P_4$ above fan **3** because of the relative characteristics of the two air moving devices. An exhaust port **13** is defined in wall **9** between the region of pressure $P_3$ and the region of pressure $P_4$, so that when port **13** is opened air flows through the port into the condenser section. Similarly, a vent port **15** is defined in wall **9** between the region of pressure $P_2$ and the pressure of $P_1$ so that when port **15** is opened, air flows from the condenser section into the evaporator section and thereafter into the room. It is the means for opening and closing ports **13** and **15** which are the subject of the present invention.

FIG. **2–4** illustrate apparatus for controlling the opening and closing of ports **13** and **15.** The apparatus depicted enables the alternative opening of one of the ports and permits the closing of both ports; however, the apparatus is not adapted to open both ports simultaneously, since this would have the undesirable effect of simply circulating air between the ports rather than transferring air to and from the room being conditioned. An exhaust port door **17** has a portion **18** configured to cover and close exhaust port **13,** and is mounted for pivotal movement about an axis X—X by a tab **19** extending through port **13.** A tension spring **21** is hooked at one end to a hole in tab **19** and at its other end to a receptacle **22** in a wall portion **23** of the unit. Spring **21** functions to bias door **17** to a closed position in which it covers port **13.** Portion **23** of wall **9** is bent back from the plane of the wall to enable the unit to accommodate a control box **24** which contains the operating buttons or the like for the unit. A second tab **25** includes a first section **27** which is coplanar with portion **18,** a second section **29** which is bent back transversely to section **27** towards wall **23,** and a third section **31** which is generally parallel to section **27.** The function of tab **25** will be apparent from the description to follow. A gasket **39** fabricated from some suitable material such as urethane foam is advantageously applied to the door portion **18** engaging the wall surface surrounding discharge port **13** when the door is moved to its discharge port closing position. The engagement of gasket **39** and the port edge enhances the degree to which the door seals the port against the passage of air. In order to prevent any materials which could damage the air conditioning unit from passing through discharge port **13,** a filter **41** can be affixed across the port. Filter **41** may comprise a common filtering material such as fine mesh screen.

Vent port **15** is disposed between condenser fan **3** and blower **7** to take advantage of the previously described pressure differential existing in this area. A vent port door **43** is mounted for pivotal movement to open and close vent port **15.** Vent door **43** includes a vent port closing portion **47** which is dimensioned to shut port **15** to the passage of air therethrough, and a tab **49** which extends through the vent port. Tab **49** includes a first section **51** which is bent transversely to the plane of vent port closing portion **47,** a second section **53** which is bent from section **51** and is parallel to portion **47** and to section **27** of tab **25,** and a third section **55** which is generally parallel to section **51.** Tab **49** serves the same purposes as both of tabs **19** and **25** associated with door **17.** A tension spring **57** is connected at one of its ends to an appropriately formed tab **59** in the housing of the air conditioning unit, and at its opposite end to a hole **61** in section **51** of tab **49.** Spring **57** biases vent port door **43** to the vent port closing position about the same axis X—X as door **17** is pivotable. Furthermore, by applying a force to the upper face of tab **49** as viewed in the drawings, a torque tending to open

door 43 is exerted on this door. A gasket 63 fabricated from an appropriate material such as urethane foam is attached to door 43 for engaging the wall surface around vent port 15 when door 43 is in its port closing position. A filter 65 which can be in the form of a fine mesh screen is advantageously provided across vent port 15 for preventing potentially damaging materials from passing through vent port 15 into the evaporator section of the air conditioning unit.

In order to effect the selective opening and closing of the two ports, an operating lever 67 is provided in the unit. Lever 67 is preferably a unitary piece which can be fabricated from molded plastic, and comprises an actuating arm 69 engageable with tabs 25 and 39 of the two doors, and a control arm 71 having a manually engageable portion 72 for operating the apparatus. Arms 69 and 71 extend transversely from a rotatable shaft 73 having a longitudinal axis of rotation Y—Y which is parallel to the common axis of rotation X—X of exhaust port door 17 and vent port door 43.

Actuating arm 69 includes at its end portion furthermost spaced from shaft 73, a cylindrical portion 75 which is engageable with the tab portions of exhaust door 17 and vent door 43. Control arm 71 is angularly displaced from actuating arm 69 so that when the vent and exhaust doors are in their closed positions, manually engageable portion 72 is centrally disposed in slot 77 in the exterior of control box 24. In other words, the foregoing elements are arranged such that when both doors are shut, control arm 71 is movable left or right as shown in FIGS. 2 and 3.

When both exhaust port door 17 and vent port door 43 are closed, cylindrical portion 75 of actuating arm 69 is in engagement with parallel sections 27 and 53 of the tabs of the two doors as indicated in FIG. 3. When control arm 71 is moved clockwise or to the left as indicated in the drawings to position A as indicated in FIG. 4, a force is exerted transversely to section 53 of tab 49 of the vent door, with the resulting torque causing door 43 to pivot about axis X—X to open vent port 15. When control arm 71 has been so moved to a predetermined extent, cylindrical portion 75 slides over section 53 onto section 55 as shown in FIG. 4. When this occurs, the apparatus remains in the condition shown in the drawing even after manual pressure is released from control arm 71. This is due to the configuration of tab section 55, which transfers the force exerted by spring 57 to operating lever 67 such as to apply a clockwise torque on shaft 73. This torque urges control arm 71 against a stop 81 which defines the end of slot 77. Thus, spring 57 biases vent door 43 to its closed position until cylindrical portion 75 slides onto tab section 55, after which door 43 is restrained from closing by virtue of the force applied to the tab by portion 75. When control arm 71 is moved counterclockwise or to the right as shown in the drawings, spring 57 biases door 43 to its vent port closing position after cylindrical portion 75 slides onto tab section 53, and if control arm 71 is released at this time, the vent door will automatically close.

The operation of exhaust port door 17 is similar to the operation of vent port door 43. Thus, as control arm 71 is moved counterclockwise or towards the right as shown in the drawings, cylindrical portion 75 of actuating arm 69 slides across section 27 of exhaust port door 17 and exerts a transverse force thereon. This action causes a clockwise torque to be exerted on door 17, and the door is rotated about axis X—X to an open position. Cylindrical portion 75 eventually slides from section 27 onto section 29, and finally reaches the juncture of sections 29 and 31 in tab portion 25. At this time, the various elements are in the positions shown by the phantom lines in FIG. 4. Until cylindrical portion 75 reaches the aforementioned juncture, spring 21 exerts a counterclockwise torque on door 17 and a clockwise torque on operating lever 67, so that release of control arm 71 would result in the automatic closing of exhaust port door 17. However, when cylindrical portion 75 reaches the juncture of sections 29 and 31, the torque exerted on operating lever 67 becomes a counterclockwise torque urging control arm 71 against stop 82 defining the right-hand end slot 77. The release of manual pressure on control 71 at this point does not result in the automatic closing of exhaust port door 17.

The location of operating lever 67 in control box 24 of the air conditioning unit facilitates the operation of the unit since all of the controls can be located in one portion of the machine. The extreme simplicity of the design of the apparatus for opening and closing the two ports in no way impairs the removal of control box 24 for repairs to parts in the box or in the region of the machine behind the box. Since actuating arm 69 is not attached to the two doors, operating lever 67 can be moved out of engagement with tabs 25 and 49 with ease.

The design of the elements of the apparatus for opening and closing the discharge and vent ports, and the relative location of these elements, make for a relatively simple construction of the apparatus. The springs can be stock items. Doors 17 and 43 can be stamped metal parts, appropriately treated thermo-plastic parts, or the like. Operating lever 67 can be a molded plastic part as indicated earlier, or can be an appropriately cast part. The doors, and their associated springs can be assembled at the same time that other items are attached to the frame of the unit. Operating lever 67 can advantageously be assembled to control box 24 before the box is attached to the unit. The assembly of lever 67 with the other components of the apparatus can be accomplished by inserting actuating arm 69 between tabs 25 and 49, and by locating shaft 73 in appropriate holes and slots in the frame of the unit. To this end, a series of collars 83 and 85 are provided for abutting mating surfaces in the unit, and a leaf spring 87 which can be integral with operating lever 67 is advantageously employed for cooperating with surfaces in control box 24 to hold shaft 73 in place. It is apparent from the foregoing that the assembly of this apparatus can be easily accomplished using conventional assembly methods, and that the incorporation of the apparatus in an air conditioning unit does not necessitate changing the dimensions of the unit.

Several modifications to the embodiment described above can be used with the invention. For example, the embodiment described above contemplates the provision of springs for biasing the exhaust and vent doors to their closed positions, and an operating lever for overcoming the bias of the springs to open the doors. It is within the scope of the invention to bias the doors to their open positions, and to employ an operating lever for selectively closing the doors. Also, it is within the scope of the invention to incorporate but one of the two doors, in which case the construction and opera-

tion of the operating lever would accordingly be modified to work in conjunction with that one door.

The invention has been described in detail with particular reference to a preferred embodiment thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention.

I claim:

**1.** In an air conditioning unit having a casing, a partition dividing the unit into an evaporator section and a condenser section, an evaporator fan in the evaporator section of the unit and a condenser fan in the condenser section of the unit, the fans being disposed to create high and low pressure regions on the evaporator side of the partition, apparatus for selectively venting outdoor air to a space being conditioned or for exhausting from the space, said apparatus comprising:

means defining an exhaust port in a region of the partition where the pressure on the evaporator side is higher than the pressure on the condenser side;

an exhaust door for opening and closing said exhaust port;

means for mounting said exhaust door for pivotal movement between exhaust port opening and closing positions;

means defining a vent port in a region of the partition where the pressure on the evaporator side is lower than the region on the condenser side;

a vent door for opening and closing said vent port;

means for mounting said vent door for pivotal movement between vent port opening and closing positions; and

lever means for operating said exhaust and vent doors, said lever means including actuating means extending from a rotatable shaft for selectively engaging one of said exhaust and vent doors to apply torque thereto to effect the pivotal movement of said one door, and control means extending transversely from said shaft for rotating the shaft.

**2.** Apparatus according to claim **1** wherein the mounting means associated with each of said discharge and vent doors is located adjacent the respective discharge and vent ports, and said doors each include a port closing portion in the plane of the axis of pivotal movement of the door for covering the respective port and a second portion being engageable by said actuating means to effect the pivotal movement of the door.

**3.** Apparatus according to claim **1** and further including spring means for biasing said vent and exhaust doors to their respective port closing positions, wherein said lever means selectively applies torque to one of said vent and exhaust doors to open said one door against the force of said spring means.

**4.** Apparatus according to claim **3** wherein the spring means for biasing said vent and exhaust doors each comprise a tension spring connected at one end to the respective exhaust and vent door and at the opposite end to said partition.

**5.** Apparatus according to claim **1** and further comprising:

means for biasing said exhaust door to either the exhaust port opening position or the exhaust port closing position; and

means for biasing said vent door to the same of the port opening or closing positions as said exhaust door biasing means biases said exhaust door;

wherein said exhaust door mounting means and said vent door mounting means mount said doors for pivotal movement about parallel axes;

and wherein said rotatable shaft has a longitudinal axis of rotation parallel to the axes of pivotal movement of said doors, and said control means has a manually accessible portion, movement of said control means rotating said shaft to apply torque to a selected one of said doors against the biasing means associated with said one door.

**6.** Apparatus according to claim **1** and further including means for biasing at least one of said exhaust and vent doors to its respective port opening or port closing position; wherein:

said one door includes a port closing portion and a tab extending from said port closing portion, said tab including a first section engageable by said actuating means for effecting movement of said one door against the biasing means associated with said one door, and a second section transverse to said first section, said second section being engageable by said actuating means for maintaining said one door in the position to which said actuating means has moved said one door.

**7.** Apparatus according to claim **1** and further including means for biasing each of said exhaust and vent doors to one of their port opening or port closing positions; wherein:

each of said doors includes a port closing portion and a tab extending from said port closing portion, said tab having a first section engageable by said actuating means for effecting movement of said door against the biasing means associated with said door, and a second section transverse to said first section, said second section being engageable by said actuating means for maintaining said door in the position to which said actuating means has moved said door.

**8.** Apparatus according to claim **7** wherein the first sections of said tabs are located in a generally opposed relationship, and said actuating means comprises an arm disposed between said tabs for alternatively exerting torque on said tabs to selectively move one of said doors.

* * * * *