

Oct. 8, 1946.

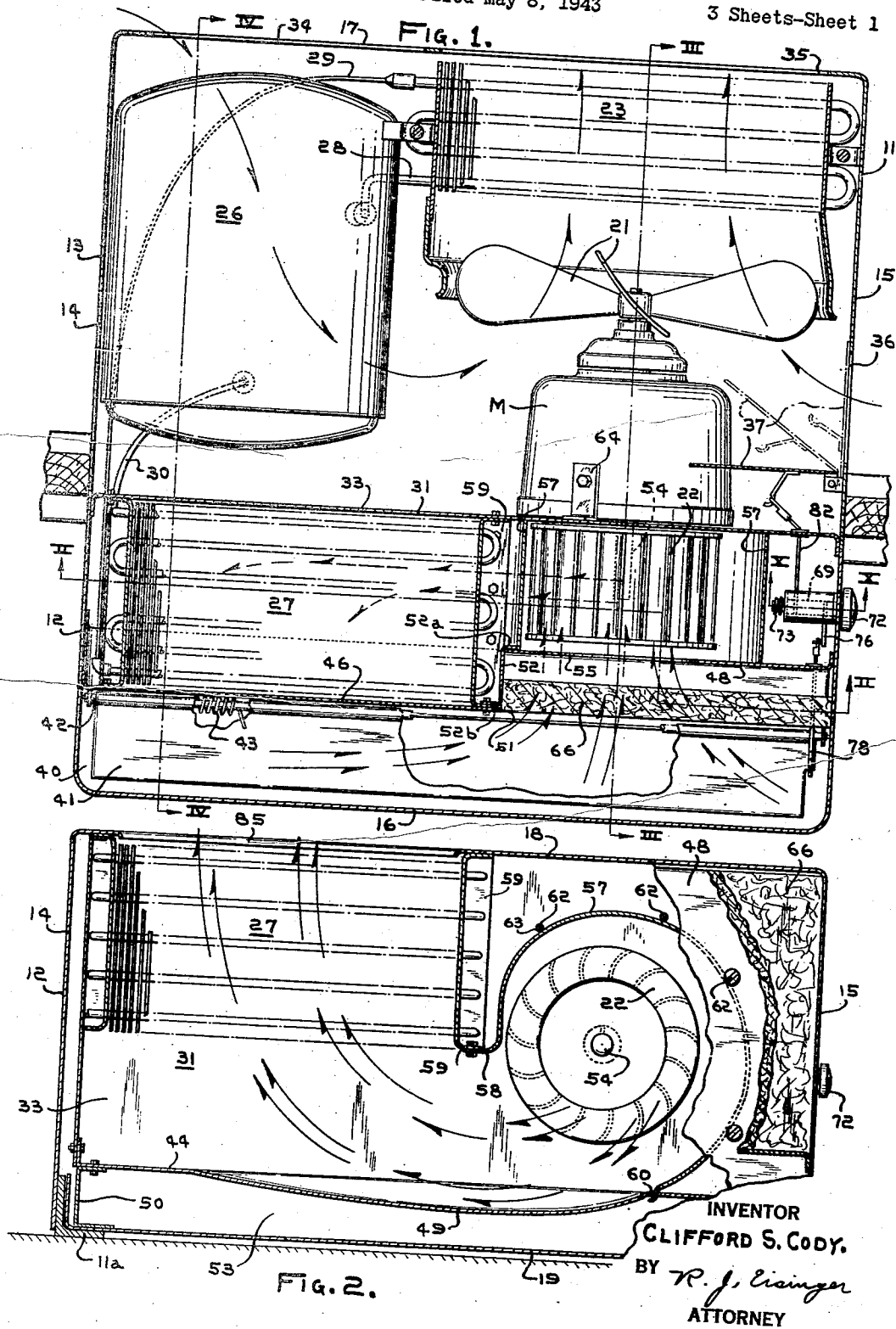
C. S. CODY

2,408,973

AIR CONDITIONING APPARATUS

Filed May 8, 1943

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

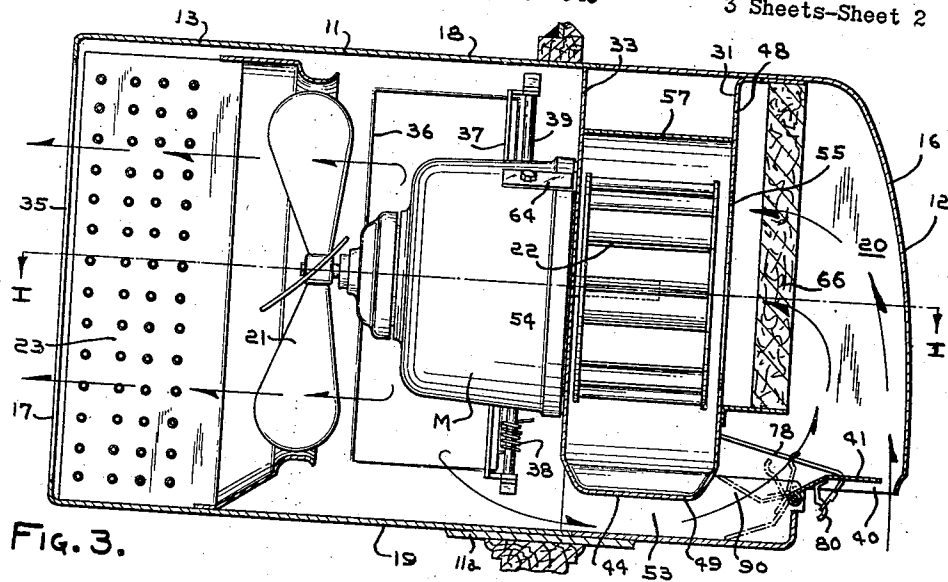


FIG. 3.

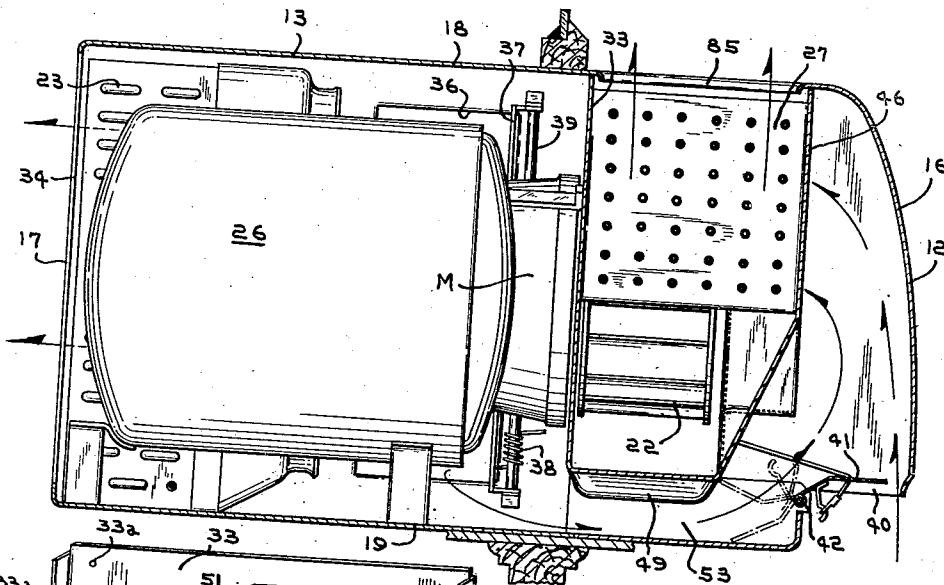


FIG. 4.

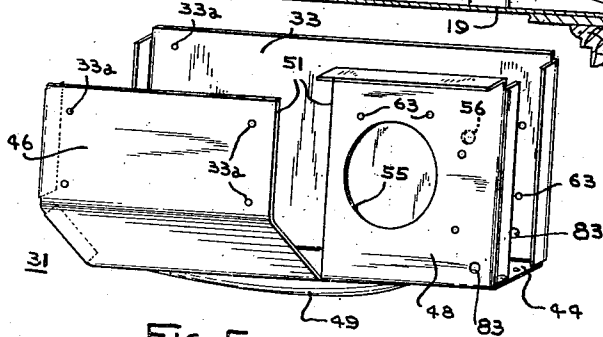


FIG. 5.

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FIG. 7.

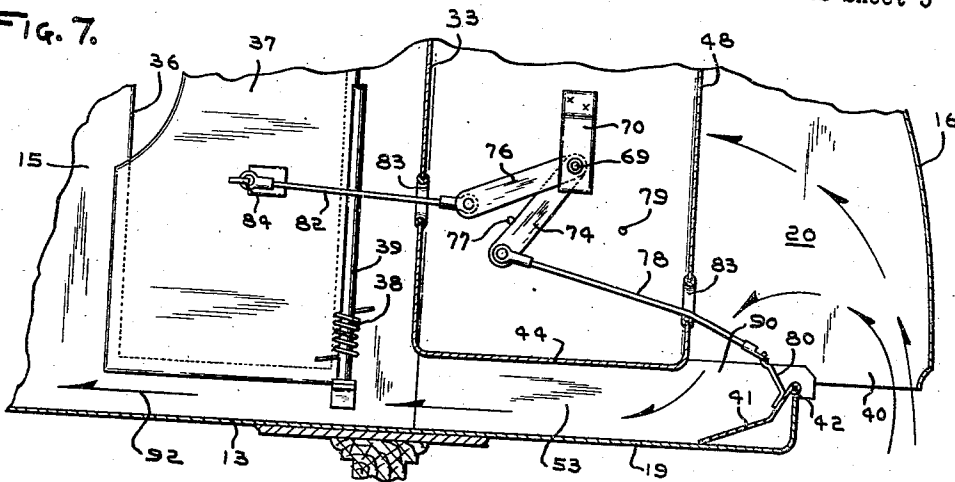


FIG. 6.

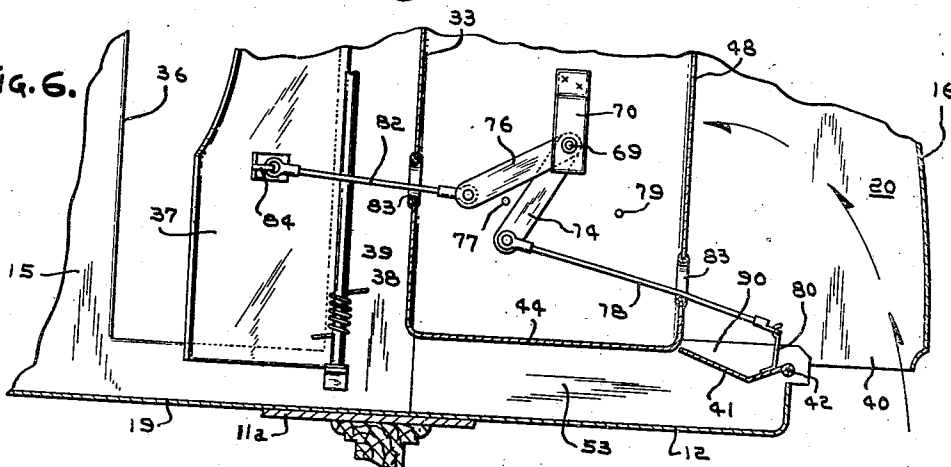


FIG. 8.

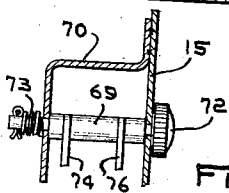
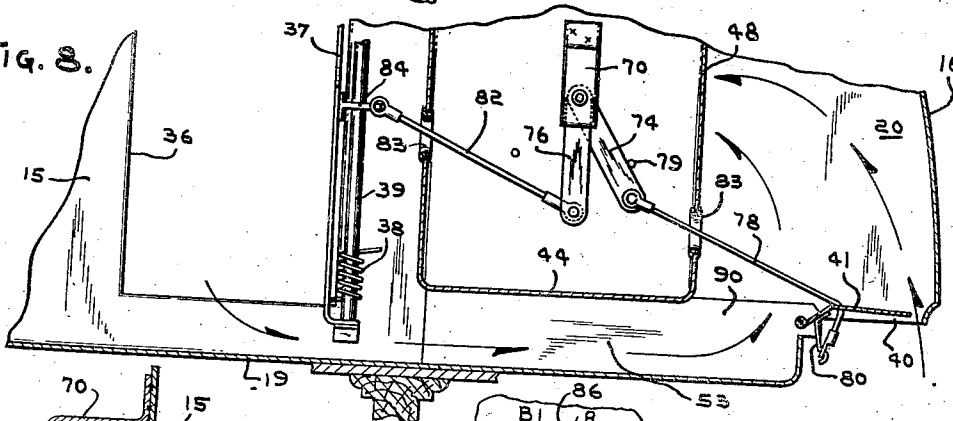
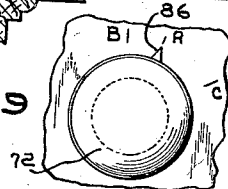


FIG. 10.

FIG. 9



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2,408,973

AIR CONDITIONING APPARATUS

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Application May 8, 1943, Serial No. 486,136

7 Claims. (Cl. 62—129)

1

My invention relates to air conditioning apparatus and, more particularly, to a self-contained air conditioning unit of the type adapted to be mounted on the window sill of a room.

One object of my invention is to produce an improved air conditioning unit of the type set forth.

Another object of my invention is to produce an air conditioning unit which, in addition to filtering, cooling, and dehumidifying the air in a room, also can be adjusted to exhaust air from the room or to introduce cooled, dehumidified and filtered outside air into the room.

Another object of my invention is to produce an air conditioning unit in which noise attendant upon operation of the unit is reduced.

A further object of my invention is to produce an air conditioning unit which can be adjusted to effect the various air flows above set forth by the manipulation of a single and easily accessible control knob or handle.

A still further object of my invention is to produce an improved and inexpensive construction.

A still further object of my invention is to produce an improved construction by which the cooling element and the fan coacting therewith and certain other parts of the apparatus constitute a sub-assembly which may be readily installed and removed as a unit.

These and other objects are effected by my invention as will be apparent from the following description and claims taken in connection with the accompanying drawings, forming a part of this application, in which:

Fig. 1 is a diagrammatic view partly in section and partly in plan of an air conditioning unit embodying my invention, the view being taken along line I—I of Fig. 3 and certain parts being omitted for clarity of illustration.

Fig. 2 is a section on line II—II of Fig. 1;

Fig. 3 is a section on line III—III of Fig. 1;

Fig. 4 is a section on line IV—IV of Fig. 1;

Fig. 5 is a perspective view showing details of internal construction;

Figs. 6, 7, and 8 are diagrammatic fragmentary views illustrating three positions of the dampers controlling the air flow;

Fig. 9 is a fragmentary view in front elevation showing a control knob for adjusting dampers of the apparatus; and,

Fig. 10 is an enlarged sectional view on line X—X of Fig. 1 showing details of construction.

Referring to the drawings in detail, there is shown in Fig. 1, an outer casing 11 which en-

2

closes an air conditioning unit and which, for convenience of illustration, is shown in outline only. So far as the present invention is concerned, any other suitable construction for housing the air conditioning unit and for mounting it in a window may be used; for example, the construction shown and described in the patent of E. R. Wolfert, No. 2,335,627, issued November 30, 1943, and assigned to the assignee of the present application. Also, any desirable well-known means for disposal of the condensate resulting from the operation of an air conditioning apparatus of this type may be employed. The constructions referred to being optional and forming no part of the present invention, they are neither shown nor described in detail. As shown, the outer casing 11 is mounted on tracks formed of angle irons 11a suitably secured to the bottom sill of a window. The sash of the window is adapted to rest on top of the casing 11 (Fig. 3). A front or inner portion 12 of the casing extends into the room and a rear or outer portion 13 thereof extends outside of the room. The casing is provided with side walls 14 and 15, front and rear walls 16 and 17, and top and bottom walls 18 and 19, some or all of which may be detachably secured to one another by any suitable means, not shown.

Within the casing 11, there is provided a refrigerating system which may be of a conventional compression type. It includes a condenser 23, a motor compressor unit 26 and an evaporator 27. The condenser and evaporator may both be of a conventional cross-finned type, and the motor compressor unit 26 may be of an enclosed type well known in the art. Blowers 21 and 22, driven by a motor M, provide flow of air over the condenser and the evaporator, respectively. The refrigerating system operates in the usual manner of such apparatus. The refrigerant is compressed in the motor-compressor unit 26 and discharged through a conduit 28 to the condenser 23. In the latter, the refrigerant is cooled by the air stream circulated through the condenser and is thereby condensed. The condensed refrigerant flows from the condenser to the evaporator through a tube 29 which has a small bore and considerable length and which is usually referred to as a capillary tube. As the refrigerant flows through the tube 29, its pressure is reduced. As the refrigerant flows, at reduced pressure through the several tubes of the evaporator, it absorbs heat from the air stream flowing through the evaporator and is thereby vaporized. The vaporized refrigerant then flows through a con-

3
duit 30 to the inlet of the motor-compressor unit 26, in which it is recompressed and recirculated.

The evaporator 27 is mounted in a U-shaped housing 31 which is best shown in Fig. 5, and which will be later on more fully described. It is sufficient to note at this time that the rear wall 33 of the housing 31 divides the casing 11 into inner and outer compartments, with the blower 21, the condenser 23 and the motor compressor unit 26 disposed in the outer compartment, which may be referred to as a machine room, and with the evaporator 27 and blower 22 in the inner compartment, which may be referred to as the cooling compartment and which extends toward or into the room. The back or outer wall 17 is provided with an inlet opening 34 registering with the compressor 26 and a discharge opening 35 registering with the condenser 23. The openings 34 and 35 may be provided with louvers (not shown). On the side wall 15 adjacent the blower 21 is another outside air inlet opening 36. The fan 21 draws air through the openings 34 and 36 and blows it against or through the condenser 23 and out through the opening 35. The opening 36 is controlled by a door or damper 37 which is constantly biased in closing direction by means of a spring 38 on the rod 39 on which the damper 37 is hinged in any suitable manner. Likewise, the inner or room end of the unit is also provided at the bottom with a room air inlet opening 40 controlled by a door or damper 41 hinged on a rod 42 and biased into a position closing the opening 40 by a spring 43 (Fig. 1). The structure and operation of the dampers 37 and 41 will also be hereinafter more fully explained.

To reduce the cost of manufacture and assembly, and to facilitate removal of the parts for replacement and repair, I have devised the housing 31 for conveniently and accessibly mounting the motor M, the fans 21 and 22, and the evaporator 27, as a unit, within the casing 11. The housing 31, which is best seen in Fig. 5, is preferably formed of a single blank of sheet metal having the desired strength. The blank is first cut and then bent into a U-shape to form a bottom wall 44, the rear wall 33 and a front wall made in two separate sections 46 and 48. The lower portion of the back wall 33 and the front wall sections 46 and 48 are bent (see Figs. 4 and 6) to merge with the dished portion 49 of the bottom wall 44. The housing 31 is supported within the casing 11 on brackets 50. The opening or space left between the juxtaposed vertical edges 51 of the front wall sections 46 and 48 is closed by a suitably-secured partition 52 one vertical edge of which is flanged and secured at 52a to the inside of the front wall section 48, and the other vertical edge of which is flanged and secured to the inside of the wall section 46 as at 52b. The machine and cooling compartments, on either side of the back wall 33 of the housing 31, are connected by an air passage 53 formed between the bottom 44 of the housing 31 and the bottom 19 of the casing 11.

In addition to serving as an air passage, as will be hereinafter described, the passage 53, by spacing the bottom 44 of the housing 31 from the bottom 19 of the casing 11, prevents cooling of the latter to or below the dew point and therefore prevents moisture condensation on the outer surface of the bottom 19 which would be obviously undesirable. Heretofore it has been necessary to insulate the bottom wall 19 with cork or the like

to prevent condensed moisture from collecting on the window sill and running down the wall of the room.

As best shown in Fig. 1, the evaporator 27 is positioned between, and suitably secured to, the rear wall 33 and the front wall section 46 of the housing 31 by screws or the like engaging apertures 33a while the fan 22 is positioned between the back wall 33 and the front wall section 48, and carried by the motor shaft 54, passing through an opening 56 in the back wall 33 of the housing 31. In the front wall section 48, there is provided an air inlet opening 55 which registers with the suction opening of the fan 22.

The fan 22 is provided with a shroud 57 formed of resilient or nonresilient sheet metal, and extending transversely from the front wall section 48 to the back wall 33. One end 58 of the shroud 57 is bent and secured to the adjacent flange 59 of the housing of the evaporator 27 as best seen from Figs. 1 and 2. The other end of the shroud 57 is likewise bent to engage a slot 60 formed in the bottom wall of the housing, as best shown in Fig. 2.

The shroud 57, if made from nonresilient metal, may be rolled to the desired involute shape, and is retained in position by being made to abut against correspondingly arranged and transversely-disposed studs or bolts 62 which pass through suitably-spaced openings 63 in the front wall section 48 and the corresponding portion of the back wall 33. If the shroud 57 is formed of initially flat resilient sheet metal, the shroud is bent so as to fit within the spiral path defined by the bolts 62 and its tendency to flex into its original condition, causes it to abut against the tie bolts 62. The studs 62 constitute stops determining the shape of the shroud 57 and serve to draw the front wall section 48 and the back wall 33 snugly against the corresponding edges of the shroud 57, rigidly but detachably to secure the shroud and corresponding walls of the housing 31 together. This also provides a boxlike structure which affords adequate support for the fan 22 and the motor M. The motor M may be secured to the outer side of the wall 33 by any suitable means such as the brackets 64. A filter 66 is disposed across the front of the suction opening 55 and is secured in position by any suitable means in such manner that all air drawn by the fan 22 must pass through the filter.

The doors or dampers 37 and 41 are regulated by simplified means comprising a stud 69 journaled in aligning openings in a bracket 70 and the side wall 15 of the casing 11. The stud 69 is provided with a knob or handle 72 and a spring 73 provides resistance against unintended rotational movement. To the stud 69 is rigidly secured a bell crank having divergent arms 74 and 76. The arm 74 has connected to it one end of a flexible element 78, the other end of which is secured to the door 41, or to an extension hook 80 carried by the door 41. Similarly, the arm 76 has connected to it one end of another flexible element 82, the other end of which is likewise secured to the door 37 or to an extension hook 84 carried by the door 37. The flexible elements 78 and 82 pass through openings 83 in the walls 33 and 48 of the housing 31.

Operation

Assuming it is desired only to circulate the room air through the unit to cool and dehumidify the same, the knob 72 is adjusted so that the indicator 86 is at position A. In this position

5

of the knob 72, the arms 74 and 76 are in the position shown in Fig. 6, in which the door 41 closes the opening 90 of the passage 53, but in which the opening 36 is not obstructed by the door 37. Air from the room is now drawn through the opening 49 into the chamber 20, through the filter 66, through the fan 22, through evaporator 27, and out through grill opening 85 in the top of the unit back into the room. The path of movement of the air is clearly illustrated by the arrows in Figs. 1 and 2. In this position, the inlet 36 is open and the fan 21 draws outside air through the inlet 36 and the opening 34 and discharges it through the condenser 23 and opening 35.

When it is desired to exhaust air from the room, the knob 72 is turned until the indicator 86 is in position B. This moves the arms 74 and 76 in clockwise direction (as viewed in Fig. 7) to bring the door 41 into the position shown in Fig. 7, in which the openings 40 and 90 are both entirely unobstructed and in which the door 37 substantially closes the opening 36. The obstruction of the opening 36 causes the fan 21 to draw room air out through the openings 40 and 90 and the passage 53, as shown by the arrows 92 in Fig. 7. The air thus drawn is discharged past the condenser 23 and out through the opening 35. In its extreme clockwise position, as shown in Fig. 7, the arm 74 abuts against a stop 77 which limits its movement in that direction.

When it is desired to introduce outside air into the room, the knob 72 is turned until the index 86 is at position C. The arms 74 and 76 now appear as shown in Fig. 8. In this position, the openings 36 and 90 are entirely unobstructed and the door 41 closes a major portion of the opening 40. The fan 22 now draws outside air through the passage 53 and opening 90. The air thus drawn passes through the filter 66 and the evaporator 27 and out through the openings 85 into the room.

The door 41 is preferably made smaller than the opening 40 so that the fan 22 will continue to draw some room air through the opening 40 to be mixed with the outside air drawn through the passage 53, and the opening 90 (see arrows in Fig. 1). The mixed air is then passed through the filter 66 and the evaporator 27 and into the room in the direction of the arrows in Fig. 2. This arrangement tends to prevent noise and sudden change in the temperature of room air which otherwise may result if the door 41 were completely to close the opening 40 so that the entire suction of the fan 22 would be utilized to force outside air exclusively into the room.

It will thus be seen that I have devised a compact air conditioning unit of a balanced construction which can be adjusted by the mere turning of the knob 72 to one of the positions A, B, or C, not only to control the temperature and humidity of the room but also to produce the desired ventilation without noise and sudden changes in temperature. It will be seen from the above description, that this is accomplished by the simple arrangement of providing the openings 36, 40, and 90, and by controlling the three openings referred to by the doors 37 and 41. Also, it will be noticed that the position of the filter 66 with respect to the fan 22 and the evaporator 27 is such that the air, whether it be outside air introduced into the room, or whether it be circulated room air, must at all times pass through the filter 66 and the cooling and dehumidifying evaporator 27.

6

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What I claim is:

1. In a room air conditioning unit, a casing having an outer compartment and an inner compartment, a refrigerant condenser in said outer compartment, a refrigerant evaporator in said inner compartment, said evaporator being operatively connected to said condenser, there being a passage connecting said compartments, an opening leading from said outer compartment to the outside atmosphere, a room air inlet leading from a room to said inner compartment and a conditioned air outlet leading from said evaporator to said room, a blower for drawing room air through said room air inlet into contact with said evaporator and discharging it into the room through said conditioned air outlet, a damper for controlling the inner end of said passage and said room air inlet, and actuating means for said damper, said damper and said actuating means being so constructed and arranged that in one position of said actuating means said damper closes said room air inlet and in a second position of said actuating means said damper closes the inner end of said passage and in a third position of said actuating means, said damper is in nonclosing position with reference to said room air inlet and the inner end of said passage.

2. A window-mounted room cooler comprising a casing, a U-shaped member comprising front, rear and bottom walls and disposed transversely of the casing with said rear wall forming a partition between a front heat exchange compartment and a rear machine compartment, a heat exchanger disposed within said U-shaped member near one end thereof, a centrifugal fan wheel disposed within said U-shaped member near the other end thereof, a sheet metal shroud disposed at least partly around said fan wheel and cooperating with said U-shaped member to form a fan casing discharging air through said heat exchanger, said front wall having an inlet for said fan wheel, a compressor and a condenser in said machine compartment connected in refrigerant flow relation to said heat exchanger, a fan in said machine compartment for effecting flow of air over said condenser, and a motor in said machine compartment for driving both of said fans.

3. In a room air conditioning unit, a casing having a first compartment and a second compartment, a refrigerant liquefying unit arranged in said first compartment, a refrigerant evaporating unit connected to said liquefying unit and arranged in said second compartment, an outside air inlet for admitting air from the outside atmosphere to said first compartment, an air outlet leading from said first compartment for discharging air to the outside atmosphere, a first fan for drawing air through said outside air inlet into contact with said refrigerant liquefying unit and discharging it through said outlet, a room air inlet for admitting air from a room to said second compartment, there being a discharge opening leading from said second compartment for discharging air back to said room, a second fan for drawing room air through said room air inlet into contact with said evaporating

7
unit and discharging it into the room through said discharge opening, a passage connecting said compartments, and means for regulating the flow of outside air and room air into and through one or both of said compartments and through said passage, said means being so constructed and arranged that, in one position thereof, both of said inlets are open and said passage is closed whereby outside air is circulated through said first compartment and room air is circulated through said second compartment, while in a second position of said means, said room-air inlet and said passage are open and said outside-air inlet is sufficiently closed to cause at least a portion of the room air to be withdrawn by said first fan through said room-air inlet and said passage and to be discharged through said outlet, and in a third position of said means said outside-air inlet and said passage are open and said room-air inlet is sufficiently closed so that outside air is drawn by said second fan through said outside air inlet and said passage into contact with said evaporating unit and is discharged into the room through said discharge opening.

4. In a room air conditioning unit, a casing enclosing air conditioning apparatus including a refrigerant liquefying unit and a refrigerant evaporating unit, said casing having an outside air inlet for admitting air from the outside atmosphere to said refrigerant liquefying unit, an air outlet leading from said refrigerant liquefying unit for discharging air to the atmosphere, a room air inlet for admitting air from a room to said refrigerant evaporating unit, and a conditioned air outlet leading from said evaporating unit for discharging air back to said room, a fan for drawing air through said outside air inlet into contact with said liquefying unit and discharging it to the atmosphere through said outlet, a fan for drawing room air through said room air inlet into contact with said evaporating unit and discharging it back into the room through said conditioned air outlet, a passage connecting said room air inlet with said outside air inlet and said outlet, and means for regulating the flow of outside air and room air into and through said casing comprising, a first damper for controlling said outside air inlet, a second damper for selectively controlling said room air inlet and the adjacent end of said passage, and actuating means for operating said dampers selectively to close or open said inlets or said passage.

5. In a room air conditioning unit, a casing having a first portion and a second portion, a first heat exchanger in said first portion, a second heat exchanger in said second portion, an outside air inlet for admitting air from the outside atmosphere to said first portion, an air outlet leading from said first portion for discharging air to the atmosphere, a room air inlet for admitting air from a room the air of which is to be conditioned to said second portion, a room air outlet leading from said second portion for discharging air to said room, a fan for drawing air through said outside air inlet into contact with said first heat exchanger and discharging it to the outside atmosphere, a fan for drawing room air through said room air inlet into contact with said second heat exchanger and discharging it back into the room through said room air outlet, a passage connecting said room air inlet with said outside air inlet and said outlet, and means for regulating the flow of outside air and room

air into or through said unit comprising a first damper for controlling said outside-air inlet, a second damper for selectively controlling said room-air inlet and the adjacent end of said passage, and actuating means for operating said dampers, said actuating means and said dampers being so constructed and arranged that in one position thereof, said inlets are open and said passage is closed, while in another position thereof said room-air inlet and said passage are open and said outside-air inlet is at least partly closed, and in still another position of said actuating means and said dampers, said outside-air inlet and said passage are open and said room-air inlet is at least partly closed.

6. In a room air conditioning unit, a casing enclosing air conditioning apparatus including a condenser and an evaporator, and means for causing room air to recirculate in contact with said evaporator, for causing outside air to cool said condenser, for causing outside air to come in contact with said evaporator and to flow into said room, or for causing room air to flow to the outside atmosphere comprising, inlet and outlet air openings for admitting air from or discharging air to the outside atmosphere, a fan for drawing air through said inlet opening into contact with said condenser and discharging it through said outlet, room-air inlet and outlet openings for admitting air from or discharging air to said room, a fan for drawing room air through said room-air inlet opening into contact with said evaporator and for discharging said air back into said room through said room outlet opening, there being a passage connecting said room-air inlet with said first-mentioned outlet, a shutter adapted at least partially to close said first-mentioned inlet opening, a second shutter adapted selectively at least partially to close said room air inlet opening or said passage, and means operatively connected to and actuating said shutters into their respective operative positions.

7. In a room air conditioning unit, a casing having an outer portion and an inner portion, a compressor and a condenser in said outer portion, said outer portion having an outside air inlet and an outlet for admitting air from and discharging air to the outside atmosphere, a blower for drawing outside air through said inlet into contact with said condenser and discharging it through said outlet, a U-shaped housing disposed transversely of said casing and having spaced inner and outer walls, with the outer wall of said housing separating said outer and inner portions of said casing, a cooling element connected to said condenser and carried between the inner and outer walls of said housing, the bottom of said housing being spaced from the bottom of said casing to form a passage connecting said inner and outer portions of said casing, there being a room air inlet for admitting air from a room to said inner portion of said casing and a room air outlet leading from said inner portion for discharging air back to said room, a second blower also carried between the inner and outer walls of said housing for drawing room air through said room air inlet into contact with said evaporator and discharging it into said room through said room air outlet, and dampers for controlling said inlets and said passage.

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