Feb. 28, 1950 E. S. DYBVIG 2,498,661

REFRIGERATING APPARATUS FOR WINDOW MOUNTINGS

Filed Oct. 29, 1945 3 Sheets-Sheet 1

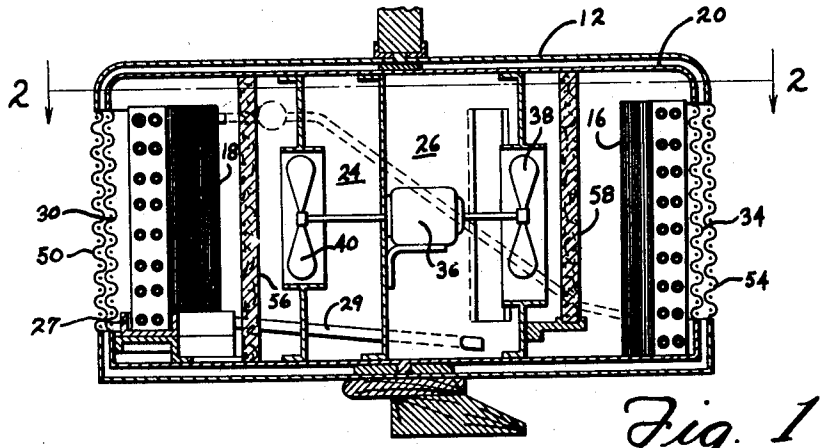
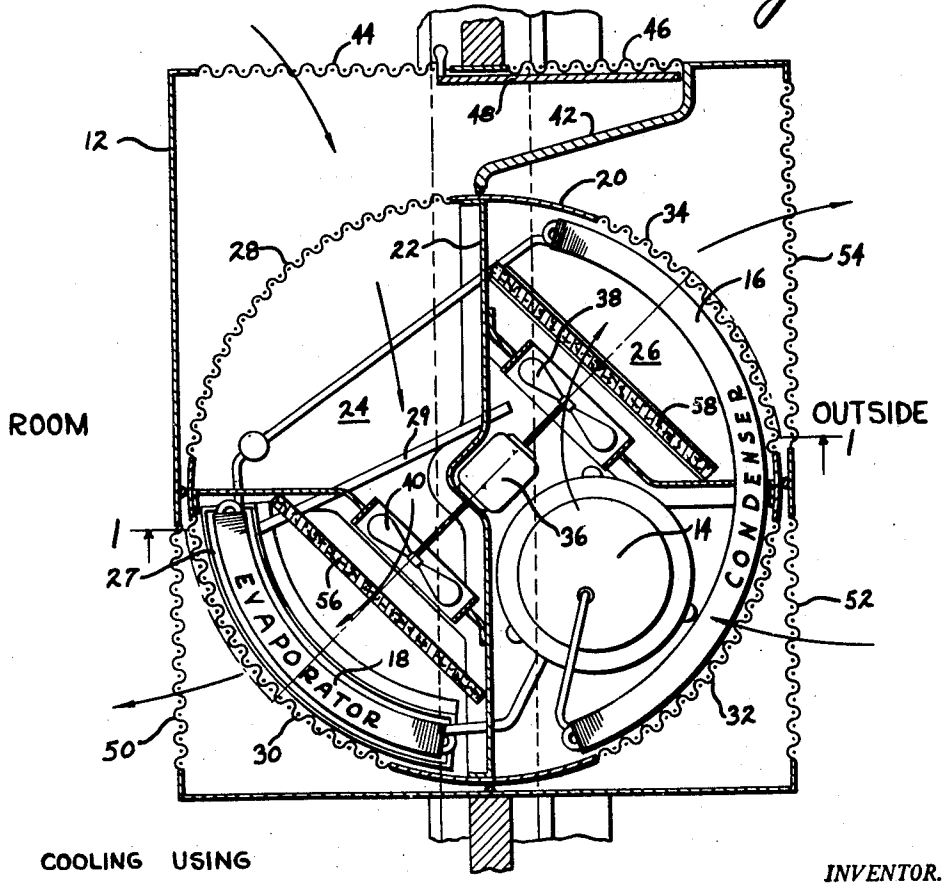


Fig. 1



COOLING USING
100% RECIRCULATED AIR

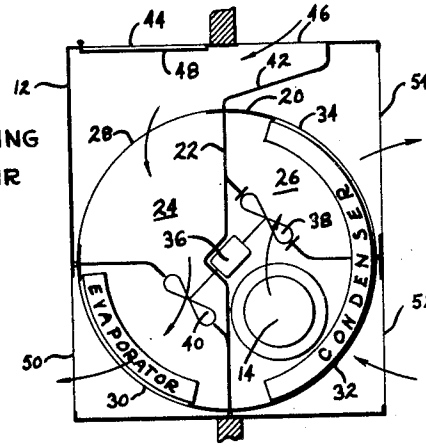
Fig. 2

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REFRIGERATING APPARATUS FOR WINDOW MOUNTINGS

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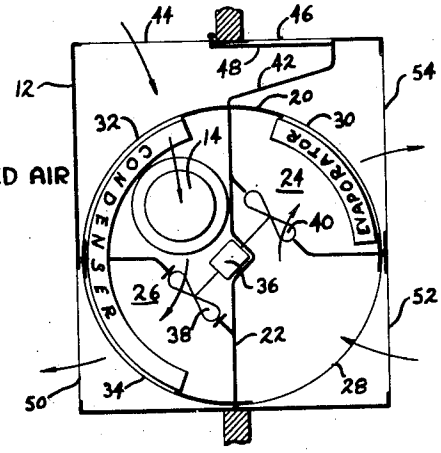


COOLING OR VENTILATING
100% OUTSIDE AIR

ROOM

OUTSIDE

Fig. 3

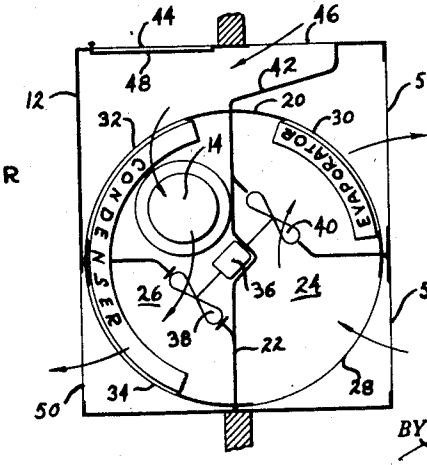


HEATING
100% RECIRCULATED AIR

ROOM

OUTSIDE

Fig. 4



HEATING
100% OUTSIDE AIR

ROOM

OUTSIDE

Fig. 5

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Feb. 28, 1950 E. S. DYBVIG 2,498,661

REFRIGERATING APPARATUS FOR WINDOW MOUNTINGS

Filed Oct. 29, 1945 3 Sheets-Sheet 3

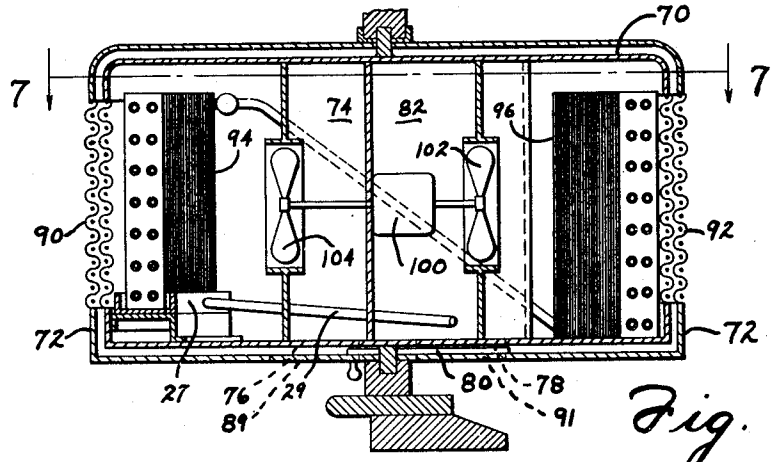


Fig. 6

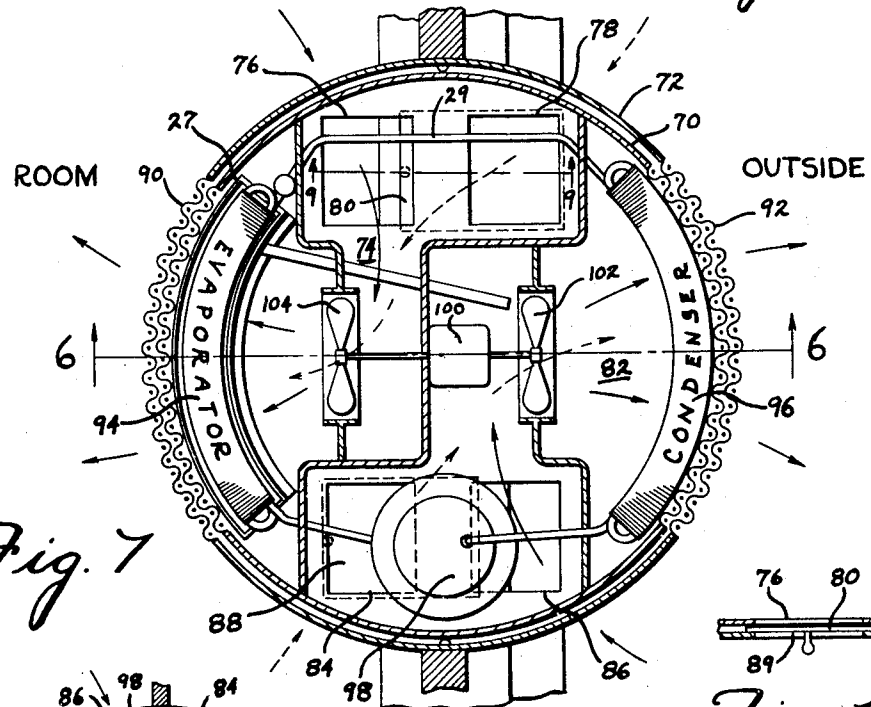


Fig. 7

Fig. 10

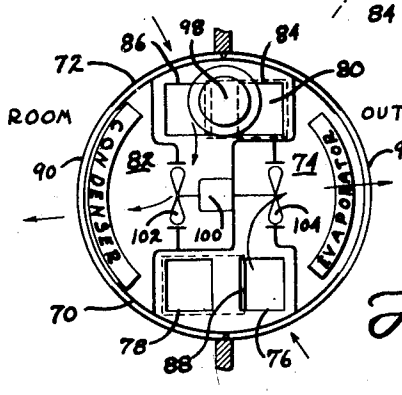


Fig. 8



Fig. 9

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Patented Feb. 28, 1950 2,498,661

UNITED STATES PATENT OFFICE

2,498,661

REFRIGERATING APPARATUS FOR WINDOW MOUNTING

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Application October 29, 1945, Serial No. 625,401

14 Claims. (Cl. 62—129)

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This invention relates to refrigerating apparatus and more particularly to an improved air conditioning unit.

One object of this invention is to provide an improved reverse heat flow air conditioning unit capable of heating or cooling either recirculated air, fresh air, or a mixture of both.

A further object of this invention is to provide a room air conditioning unit in which a conventional refrigeration system is mounted on a support which may be rotated so as to change over from heating to cooling or vice versa merely by rotating the support and in which dampers are provided for varying the ratio of fresh air to recirculated air discharged into the conditioned space.

Still another object of this invention is to provide a rotatable type of air conditioning unit having an evaporator compartment and a condenser compartment in which the ratio of fresh air to recirculated air entering each compartment may be varied independently of the other and independently of rotation of the unit.

A further object of this invention is to provide an improved type of air conditioning unit in which the air inlet openings are provided in the bottom wall of the air conditioning unit.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a vertical sectional view taken substantially on line 1—1 of Fig. 2 and shows the general arrangement of a preferred form of rotatable air conditioning unit;

Fig. 2 is a horizontal sectional view taken substantially on line 2—2 of Fig. 1 and shows the arrangement of the heat exchange elements and the air inlets and outlets;

Figs. 3 through 5 are diagrammatic views showing several of numerous different possible settings of the apparatus shown in Figs. 1 and 2;

Fig. 6 is a vertical sectional view taken substantially on line 6—6 of Fig. 7 and shows a modified cabinet arrangement in which the air inlets are provided in the bottom wall of the air conditioning cabinet;

Fig. 7 is a horizontal sectional view taken substantially on line 7—7 of Fig. 6;

Fig. 8 diagrammatically shows the apparatus shown in Fig. 7 when heating of the air is desired;

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Fig. 9 is a fragmentary sectional view showing the construction of one of the air controlling dampers and is taken substantially on line 9—9 of Fig. 7; and,

Fig. 10 is a fragmentary sectional view taken substantially on line 10—10 of Fig. 9 looking in direction of the arrows.

The invention set forth herein incorporates the basic arrangement for reversing the heat flow of the air conditioning unit disclosed and claimed in my copending application S. N. 520,435 filed January 31, 1944, now Patent No. 2,405,411, issued August 6, 1946, but differs therefrom in the arrangement for controlling the ratio of fresh air to recirculated air passing through the air conditioning apparatus. In the original rotatable reverse heat flow unit disclosed in said copending application, the unit was rotated not only when it was desired to convert the unit from a heating unit to a cooling unit or vice versa but also whenever it was desired to vary the amount of fresh air introduced in the room through the unit. In the arrangement shown herein, the unit is rotated only when it is desired to reverse the cycle.

The air conditioning unit shown in Figs. 1 through 5 of the drawing comprises a stationary cabinet 12 which is adapted to be supported in a window opening or any other suitable wall opening so as to have the one portion of the cabinet projecting into the outside atmosphere and the other portion of the cabinet projecting into the room or enclosure to be conditioned. The air conditioning apparatus comprises a conventional compressor 14, condenser 16 and evaporator 18 all mounted in a rotatable cabinet 20 which is disposed within the stationary cabinet 12 in the manner best shown in Fig. 2. A wall 22 separates the rotatable cabinet 20 into two separate compartments 24 and 26 which constitute the evaporator compartment and the condenser compartment respectively. Condensate collecting in the pan 27 may be disposed of in any suitable manner such as by the drain pipe 29 which conveys the condensate into the condenser compartment where it is evaporated and picked up by the condenser air stream. The evaporator compartment 24 is provided with an air inlet 28 and an air outlet 30 arranged as shown. The condenser compartment 26 is likewise provided with an air inlet 32 and an air outlet 34.

A fan motor 36 disposed within the condenser compartment 26 operates both the condenser fan 38 and the evaporator fan 40.

For purposes of illustration, the outer casing or cabinet 12 has been shown as having a rectangular shape whereas other shapes could be used without departing from the spirit of my invention. A wall 42 has been provided within the cabinet 12 so as to separate the air flowing through the condenser compartment 26 from the air flowing through the evaporator compartment 24. One end of the cabinet 12 is provided with a pair of air inlet openings 44 and 46 which are controlled by means of the slide damper 48 which may be adjusted so as to vary the ratio of recirculated air to fresh air admitted through these openings. A conditioned air outlet 50 has been provided in the front wall of the cabinet 12 as shown. The rear wall of the cabinet 12 is provided with air inlet and outlet openings 52 and 54 which are arranged as shown.

An air filter 56 has been provided for filtering the air flowing through the evaporator compartment 24, and a somewhat similar air filter 58 has been provided for filtering the air flowing through the condenser compartment 26. These filters are arranged adjacent the fans as shown so as to absorb some of the fan noise. I have shown all of the inlets and outlets protected by means of screens but it is obvious that decorative grills could be substituted for the screens in at least some of the openings.

With the apparatus arranged as shown in Fig. 2, 100% room air is circulated through the evaporator compartment and 100% outside air is circulated through the condenser compartment. By moving the damper 48 from the position in which it is shown in Fig. 2 to the position in which it is shown in Fig. 3, the apparatus no longer cools recirculated air but serves to cool fresh outside air and causes a positive pressure to be built up within the conditioned space whereby an amount of air corresponding to the amount to air introduced into the room through the opening 46 is required to escape from the room through various cracks and other openings in the walls of the room. By virtue of this fact, very little, if any, unfiltered air will seep into the room from the outside atmosphere. The damper 48 may be adjusted so as to vary from 0 to 100% the ratio of the inside air to outside air flowing through the conditioning unit. The conditioning apparatus may be manually controlled so as to turn on and off the cooling at will or it may be automatically controlled by means of a thermostat responding either to the room air temperature, the outside air temperature or a combination of both. The fan motor may be operatde even though the refrigeration is turned off so as to provide for circulation of the air. No controls have been shown, as controls of this type are now well-known.

When it is desired to convert the unit from a cooling unit to heating unit, casing 20 is rotated from the position in which it is shown in Figs. 2 and 3 to the position to which it is shown in Figs. 4 and 5 whereby all of the air discharged into the room is first required to flow through the condenser compartment 26.

It will be noted that the damper 48 adjacent the openings 44 and 46 serves to control the admission of air to be conditioned irrespective of the position of the rotatable apparatus 20. Thus when the apparatus is set for supplying heat it is possible to heat either the fresh air, recirculated air or any desired mixture of both merely by properly setting the control damper 48.

In Figs. 6 through 10 I have shown a modified

arrangement in which the air inlet openings are provided in the bottom wall of the inner rotatable cabinet 70 and the outer stationary cabinet 72. For purposes of illustration I have shown the outer cabinet as being circular in shape whereas other shapes could be used without departing from the spirit of my invention.

It is generally recognzed that it is desirable to provide air inlets in the bottom wall of an air conditioning cabinet in preference to a side wall. This is particularly true of the outside air inlets since it is desirable to protect the outside air inlets from rain and snow. As best shown in Fig. 7 of the drawing, the evaporator compartment which has been designated by the reference numeral 74 is provided with a pair of inlet openings 76 and 78 which are arranged side by side so as to be controlled by means of a single damper 80 which is slidably disposed so as to control the ratio of fresh air to outside air in much the same manner as the damper 48 described herein above controls the ratio of fresh air to outside air introduced into the cabinet 12. The condenser compartment which has been designated by the reference numerals 82 is likewise provided with a pair of air inlet openings 84 and 86 which are controlled by a common damper 88. Thus it is apparent that the damper 88 may be shifted so as to vary the ratio of fresh air to room air which enters the condenser compartment. The stationary outer cabinet 72 is provided with openings (such as the openings 89 and 91 best shown in Fig. 9) in vertical alignment with the openings 76, 78, 84 and 86. The dampers 80 and 88 may be supported by the inner rotatable cabinet so as to rotate therewith or may be supported by the outer stationary cabinet, as shown in the drawings, in which case the dampers do not rotate with the inner cabinet. One of the advantages of the above described arrangement of air inlet openings is that the air conditioning apparatus may be used for exhausting room air at the same time that fresh air is being introduced through the unit into the conditioned space. By allowing a greater amount of fresh air to be introduced into the conditioned space than is exhausted therefrom, a positive pressure may be maintained within the conditioned space so as to prevent or at least reduce the infiltration of unfiltered unconditioned air into the conditioned space.

Fig. 7 shows the arrangement of the apparatus when cooling is required whereas Fig. 8 diagrammatically shows the arrangement of the apparatus when heating is required.

Reference numeral 90 designates the air outlet provided in the outer cabinet 72 on the room side whereas reference numeral 92 designates the corresponding outside air outlet. Reference numerals 94, 96, and 98 designate the evaporator, the condenser, and the compressor respectively of a conventional refrigeration system. The fan motor has been designated by the reference numeral 100 whereas the condenser fan has been designated by the reference numeral 102 and the evaporator fan by the reference numeral 104. The condensate disposal means is the same in both units and needs no further description.

By virtue of the construction and arrangement shown in the drawings, a single fan motor may be used for operating both fans and this one motor may be disposed within the condenser compartment with the result that any heat given off by the motor will not materially reduce the efficiency of the apparatus. Furthermore, the

arrangement of the fans is such that the end thrust on the fan shaft is substantially balanced since the fans propel air in opposite directions.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. In combination with a wall of a room having an opening therein, a stationary housing disposed within said opening, a cabinet disposed within said stationary housing, a refrigerating system including an evaporator and a condenser connected to said evaporator and mounted within said cabinet, means for flowing one stream of air in thermal exchange with said evaporator, means for flowing another stream of air in thermal exchange with said condenser, said stationary housing and said cabinet having a plurality of registering openings for the ingress and egress of said air streams, certain of said openings communicating with the inside atmosphere and other of said openings communicating with the outside atmosphere, means for rotatably mounting said cabinet within said stationary housing whereby the openings in said rotatable cabinet may be shifted into a different registry with the openings in said stationary housing, and damper means cooperating with certain of said openings for varying the ratio of outside air to inside air introduced into said stationary cabinet to form one of said air streams.

2. An air conditioning unit for a room comprising in combination, a cabinet having one portion adapted to project into the room and having another portion adapted to project into the outside atmosphere, means dividing said cabinet into a first fan compartment and a second fan compartment, fan means in each of said compartments, each of said fan compartments having inlet and outlet opening means, the inlet opening means of one of said compartments being located in the bottom wall of the compartment and adapted to communicate with the inside atmosphere and the outside atmosphere, means for varying the ratio of outside air to room air introduced through said opening means, means for transferring heat from the air flowing through one of said compartments to the air flowing through the other of said compartments, and means for interchanging the relative locations of said fan compartments.

3. Air conditioning apparatus of the self-contained type comprising in combination, a cabinet adapted to be supported in an opening in a wall with one portion of the cabinet projecting into the outside atmosphere and another portion projecting into the space to be conditioned, a refrigerating system including an evaporator and a condenser connected to said evaporator and mounted within said cabinet, means for flowing one stream of air in thermal exchange with said evaporator, means for flowing another stream of air in thermal exchange with said condenser, said cabinet having a plurality of openings for the ingress and egress of said air streams, means for movably mounting said cabinet whereby the points of ingress and egress of said air streams may be shifted, and means including a damper for varying the ratio of outside air to room air comprising one of said air streams.

4. Air conditioning apparatus of the self-contained type comprising in combination, a frame adapted for installation in an opening formed in one wall of an enclosure, a cylindrical housing supported in the frame for rotation about its axis, a partition dividing the interior of said housing into two chambers selectively registerable with the interior and exterior of the enclosure, means for changing the temperature of the air passing through one chamber, said housing having opening means for the passage of air through said chambers, the opening means for one of said chambers comprising two inlet openings adapted to be disposed on opposite sides of said wall during operation of the apparatus, and damper means cooperating with said openings for varying the amount of air entering said housing through each of said openings.

5. An air conditioning unit comprising a cylindrical housing having a partition dividing the interior of the housing into two chambers and having peripheral openings through the side wall thereof at opposite sides of the partition to enable the discharge of air from each chamber, an evaporator contoured to correspond to the radius of curvature of the side wall of the housing and supported in one chamber at the inner side of one of said openings, a condenser also contoured to correspond to the radius of curvature of said wall of the housing and positioned at the inner side of another of said openings, one of said chambers being provided with a pair of openings in the bottom wall thereof for the introduction of air into said chamber, one of said openings being adapted to communicate with the outside atmosphere and the other of said openings being adapted to communicate with inside atmosphere, damper means for varying the ratio of inside air to outside air introduced through said bottom openings, and refrigerant flow connections connecting said evaporator and said condenser.

6. In combination with a wall having an opening therein, a stationary housing disposed within said opening, a cabinet disposed within said stationary housing, means for rotatably supporting said cabinet within said housing, means dividing the cabinet into an evaporator compartment and a condenser compartment, an evaporator in said evaporator compartment, a condenser within said condenser compartment, a compressor, refrigerant flow connections between said evaporator, condenser, and compressor, a plurality of air outlet openings provided in the wall of said stationary housing, a plurality of complementary air outlet openings provided in the wall of said cabinet, said stationary housing having air inlet opening means provided in the bottom wall thereof in side by side relationship with the one portion of said inlet opening means arranged in communication with the outside atmosphere and the other portion of said inlet opening means arranged in communication with the inside atmosphere, said rotatable cabinet having two bottom air inlet opening means either of which may be moved in registry with the opening means provided in the bottom wall of said stationary housing by rotation of said cabinet.

7. An air conditioner for a room comprising a stationary casing having a first opening means for communication with the atmosphere outside of a room space and having second opening means for communication with the room space, refrigerating apparatus including an evaporator element and a condenser element, a support for

said apparatus, means carried by said support for circulating air over each of said elements, partitioned means cooperating with said support and said casing for separating the air flowing over said evaporator element from the air flowing over said condenser element so as to establish two air streams, means for movably mounting said support relative to said casing so as to shift said streams relative to said opening means, and means including a damper cooperating with said opening means for controlling the ratio of outside air to room air flowing over one of said elements.

8. Air conditioning apparatus for an enclosure comprising in combination, a stationary housing, said housing having opening means for the introduction of fresh air and recirculated air to be conditioned into said housing, damper means controlling the ratio of fresh air to recirculated air flowing through said opening means, a casing disposed within said housing, refrigerating apparatus comprising a heat absorbing element and a heat dissipating element disposed within said casing, means cooperating with said casing to form a plurality of air flow passages, said elements being disposed in separate air flow passages, a fan in each of said passages, said casing having a plurality of air openings constituting inlets and outlets for said passages and means for rotatably supporting said casing within said stationary housing so as to provide for realignment of said air flow passages with the opening means of said stationary housing.

9. In combination, a wall having an opening therein, a stationary housing disposed within said opening with one portion projecting on one side of said wall and another portion projecting on the other side of said wall, an air conditioning unit disposed within said housing, means for mounting said unit for rotation within said housing, said unit comprising a rotatable casing having peripheral openings for the ingress and egress of air, means for circulating air to be conditioned into one of said openings and out through another of said openings, said housing having a pair of air inlets adapted to supply air to one of said openings, said inlets being arrange to supply air from opposite sides of said wall, and damper means carried by said housing for controlling the flow of air through said inlets.

10. A self-contained air conditioning apparatus comprising in combination, an outer casing, an inner casing, means separating said inner casing into a heat absorbing compartment and a heat dissipating compartment, means for transferring heat from said heat absorbing compartment to said heat dissipating compartment, said heat dissipating compartment having an air inlet opening and an air outlet opening, said heat absorbing compartment having an air inlet opening and an air outlet opening, said outer cabinet having a plurality of openings adapted to communicate with separate bodies of air, means for rotatably supporting said inner casing within said outer casing so as to shift the openings in said outer casing relative the opening in said inner casing, and damper means controlling the admission of air into said outer casing from one of said bodies of air.

11. A ventilator for a room comprising in combination, a cabinet having one portion adapted to project into the room and having another portion adapted to project into the outside atmosphere, a complete dividing wall means completely

dividing said cabinet into a first fan compartment and a second fan compartment, fan means in each of said compartments independently circulating the atmosphere therein, each of said fan compartments having first and second inlet openings in the bottom wall thereof adapted to communicate with the outside atmosphere and the inside atmosphere respectively, one of said fan compartments having a vertical wall portion provided with an outlet opening adapted to communicate with one of said atmospheres and the other of said fan compartments having a vertical wall portion provided with an outlet opening adapted to communicate with the other of said atmospheres, and closure means cooperating with said opening for varying the ratio of outside air to room air introduced into each of said compartments.

12. A ventilator for a room comprising in combination, a cabinet having one portion adapted to project into the room and having another portion adapted to project into the outside atmosphere, means dividing said cabinet into a first fan compartment and a second fan compartment, fan means in each of said compartments, each of said fan compartments having inlet opening means in the bottom wall thereof adapted to communicate with the outside atmosphere and the inside atmosphere, one of said fan compartments having an outlet opening adapted to communicate with one of said atmospheres and the other of said fan compartments having an outlet opening adapted to communicate with the other of said atmospheres, means for varying the ratio of outside air to room air introduced into each of said compartments, and means for transferring heat from the air flowing through one of said compartments to the air flowing through the other of said compartments.

13. A ventilator for a room comprising in combination, a cabinet having one portion adapted to project into the room and having another portion adapted to project into the outside atmosphere, means dividing said cabinet into a first fan compartment and a second fan compartment, fan means in each of said compartments, each of said fan compartments having first and second inlet openings in the bottom wall thereof adapted to communicate with the outside atmosphere and the inside atmosphere respectively, one of said fan compartments having an outlet opening adapted to communicate with one of said atmospheres and the other of said fan compartments having an outlet opening adapted to communicate with the other of said atmospheres, means for varying the ratio of outside air to room air introduced into each of said compartments, means for transferring heat from the air flowing through one of said compartments to the air flowing through the other of said compartments, and means for rotatably supporting said cabinet whereby the heated air may be discharged into either of said atmospheres.

14. A ventilator for a room comprising in combination, a cabinet having one portion adapted to project into the room and having another portion adapted to project into the outside atmosphere, a complete dividing wall means completely dividing said cabinet into a first fan compartment and a second fan compartment, fan means in each of said compartments independently circulating the atmosphere therein, each of said fan compartments having first and second inlet openings in the bottom wall thereof adapted to communicate with the out-

side atmosphere and the inside atmosphere respectively, one of said fan compartments having a vertical wall portion provided with an outlet opening adapted to communicate with one of said atmospheres and the other of said fan compartments having a vertical wall portion provided with an outlet opening adapted to communicate with the other of said atmospheres, and closure means cooperating with said openings for varying the ratio of outside air to room air introduced into each of said compartments, a refrigerating means including a vertical condenser means extending substantially entirely over one of said outlet openings and a vertical evaporating means

extending substantially entirely over the second outlet opening.

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