

April 9, 1957

R. R. GANNON
METHOD AND APPARATUS FOR CONDITIONING THE AIR
WITHIN A CLOSED SPACE

2,787,946

Filed Sept. 15, 1950

2 Sheets-Sheet 1

FIG. 1.

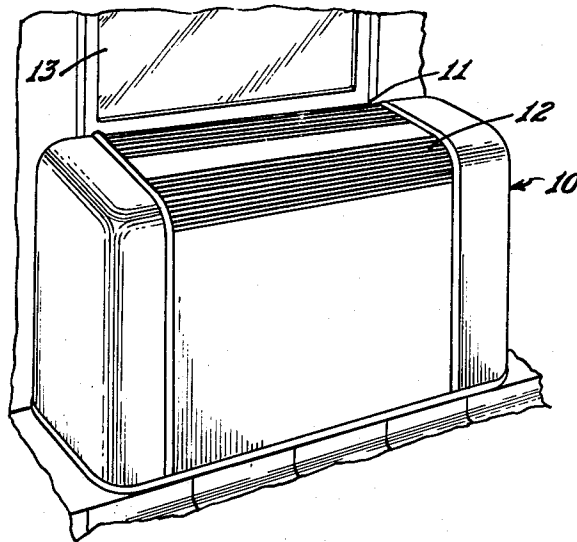
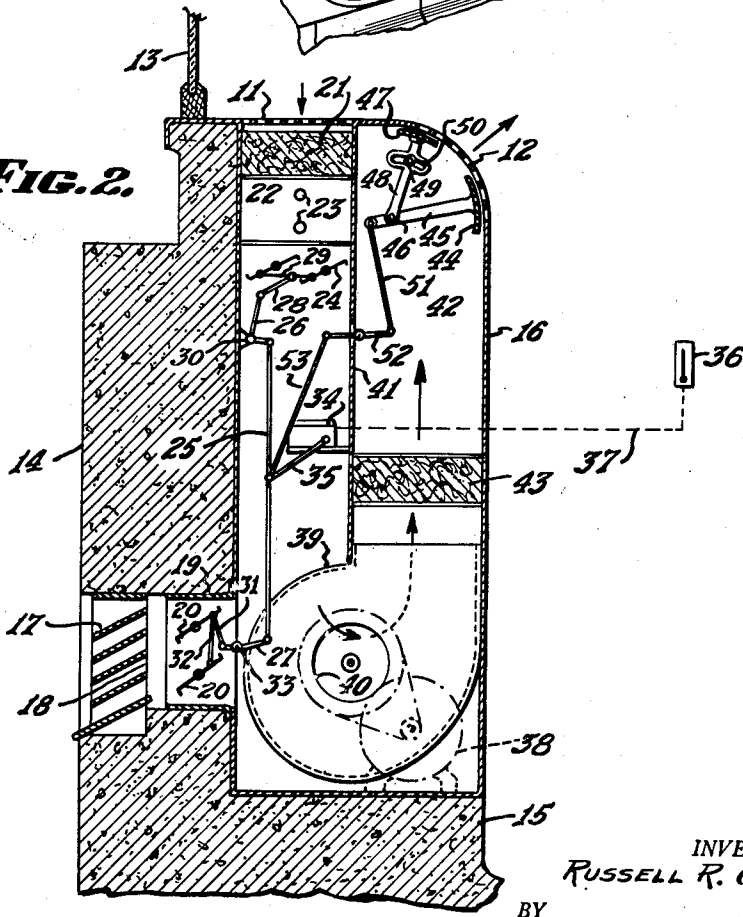


FIG. 2.



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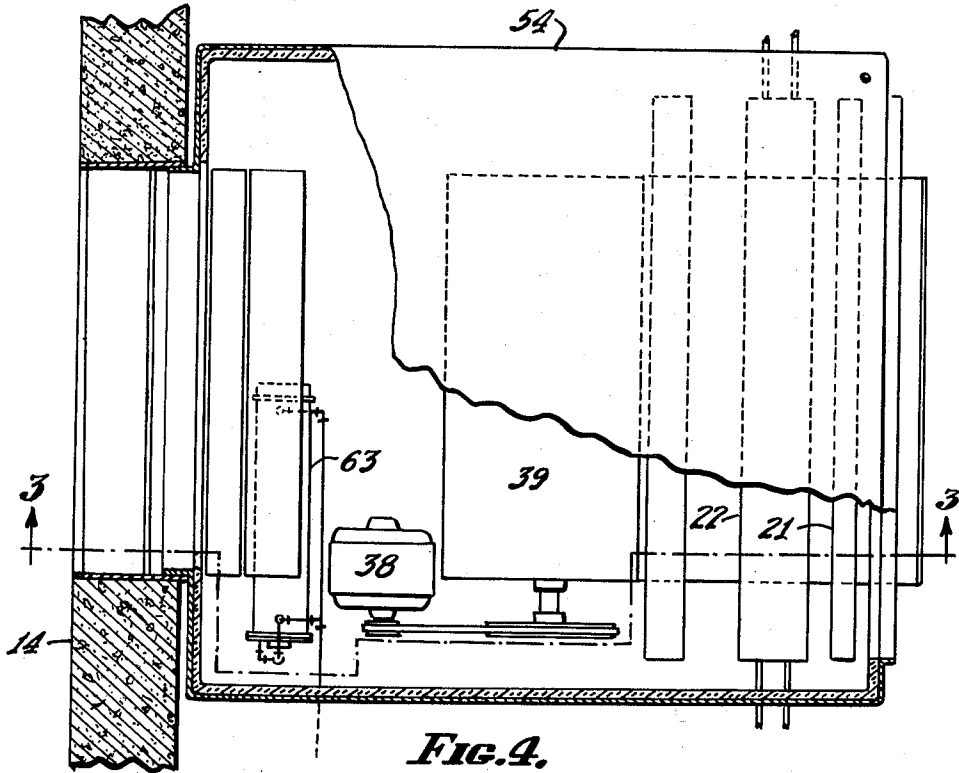


FIG. 4.

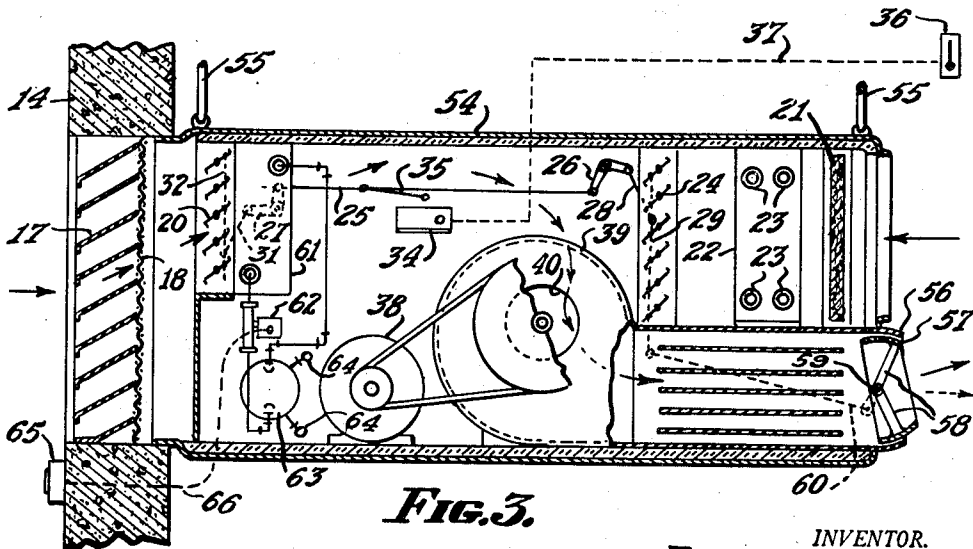


FIG. 3.

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METHOD AND APPARATUS FOR CONDITIONING THE AIR WITHIN A CLOSED SPACE

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Application September 15, 1950, Serial No. 184,961

8 Claims. (Cl. 98—38)

My invention relates to new and improved heating, ventilating and air conditioning units and methods.

Reference is hereby made to my copending application Serial No. 167,803, filed June 13, 1950, now Patent No. 2,680,566 and entitled Air Conditioning Apparatus, System and Method, wherein I have disclosed and claimed some of the features disclosed herein and whereas I have disclosed some of the basic considerations and developments also utilized in the present invention.

It is an object of the present invention to provide an air conditioning unit adapted to be placed within the room to be conditioned and having conditioned air discharge means which automatically varies in response to the requirements of the room.

It is a further object of my invention to provide a unit which combines my automatically variable discharge means with means whereby the fresh air brought into the unit for eventual discharge into the room is not brought into direct contact with the steam heating coils, such fresh air being heated by mixture with air returned from the room and heated in the unit, the area of such mixing being remote from that area in which the return air is heated.

It is a further object of my invention to provide an air conditioning unit which is particularly adapted for use in those areas wherein the outside temperatures are extremely low.

A very important object of my invention is to provide a room unit in which the angle at which the air is discharged into the room from the unit varies with the temperature of the air being supplied into the room, the colder the supplied air, the steeper the angle (upwards) of discharge.

Another important object of my invention is to provide a unit for supplying conditioned air into a room in which unit there is provided means for regulating the velocity of air being supplied the room from the unit, the colder the supplied air the higher the velocity.

These and other objects and advantages of my invention will become apparent to one skilled in the art during the course of the following description with reference being had to the attached drawings, in which drawings like numerals are employed to designate like parts throughout the same, and in which—

Figure 1 is a perspective view of my improved air conditioning unit,

Figure 2 is a cross section view of my improved unit which parts shown in section and parts shown semidiagrammatically,

Figure 3 is a sectional view (taken on the line 3—3 of Figure 4) of a modified unit with parts in section and parts broken away, and

Figure 4 is a plan view of the unit shown in Figure 3, certain parts being shown in section and others diagrammatically.

The basic principle underlying my invention as disclosed in my copending application Serial No. 167,803,

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filed June 13, 1950, now Patent No. 2,680,566 and entitled Air Conditioning Apparatus, System and Method, incorporated the idea that the fresh air admitted into the unit for transfer to the room should not come into direct contact with the heating element of the unit, but rather, under those conditions which require its being heated, the heating of the fresh air should be accomplished simply by mixing it with air returned from the room, this latter air being heated if necessary. Such arrangement means that the only air coming into direct contact with the unit heating elements is air which is already at room temperature.

Although the unit disclosed in the instant specification also incorporates the basic principle above outlined, the instant invention is particularly directed to the idea that the air being discharged from the unit into the room to be conditioned, should be discharged from the unit at varying angles depending on the temperature of such discharged air, the colder the discharged air the steeper (upwardly) the angle of discharge. Also, the instant invention includes the idea of so relating the velocity of air discharged from the unit that the colder air is discharged at a greater velocity.

By the invention of the instant application, the cooler the air being discharged from the unit into the room, the greater its velocity and the steeper its angle of discharge. In this way the colder air, which has a tendency to fall to the bottom of the room, is forced across the room a greater distance before falling with the result that unwanted drafts are either eliminated or controlled so as to reduce their harmful effects to a minimum.

Referring to Figures 1 and 2 I have there shown a unit 10 provided with vents 11 through which air is returned to the unit from the room and with vents 12 through which conditioned air is discharged from the unit into the room. The unit is shown positioned beneath a window 13 and against the outside wall 14 of the building, this unit also being shown as resting on the floor 15 of the room. The unit casing is indicated at 16.

Fresh air from the out-of-doors enters the unit through a louver 17 provided in the wall 14, a screen 18 and a passageway 19 controlled by the dampers 20. Such fresh air is introduced into the unit near the lower portion thereof.

Air returned from the room enters the unit through the vents 11 and may be passed through a filter arrangement generally indicated at 21. This air is then passed into a heating chamber 22 having steam or hot water connections to the heating coil indicated at 23. The amount of heated return air passed from the chamber 22 is regulated by the dampers 24. The heating chamber 22 is located within the unit 10 at a relatively great distance from the fresh air inlet passage 19.

The dampers 20 and 24 are connected by a linkage mechanism so that as the dampers 20 are opened, the dampers 24 are closed and vice versa. This linkage comprises a rod 25 having a pivoted connection at one end to one arm of a bell crank 26 and a pivoted connection at its other end to one end of a lever 27. The other end of the bell crank 26 is pivotally connected to a link 28, this link being connected to the operating rod 29 connecting the plurality of dampers 24. The bell crank 26 is pivotally mounted in the unit 10 as indicated at 30.

The other end of lever 27 has a connection with a link 31, this link 31 being operatively connected to the bar 32 for the dampers 20.

The lever 27 is pivotally mounted in the unit 10 as indicated at 33.

The linkage above described is operated by means of a pneumatic damper motor or the like 34 operatively connected to the rod 25 by means of the member 35. The motor 34 is controlled in its operation by means of the thermostat 36, the air line between the motor 34

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and thermostat 36 being indicated at 37. The thermostat 36 is, of course, located at a spot within the room which is representative of the average condition of the room or at some other point as desired.

Upward movement of the rod 25 in response to the pneumatic damper motor 34 and thermostat 36 results in the lever 27 being rotated counterclockwise as viewed in Figure 2 and the dampers 20 brought towards their open position. At the same time, the upward movement of rod 25 causes rotation of the bell crank 26 in a counterclockwise direction with the result that the dampers 24 are moved towards their closed position. Similarly, a downward movement of the rod 25 will produce clockwise rotation of the lever 27 and bell crank 26 with the result that the dampers 20 are moved towards their closed position and the dampers 24 towards their open position.

Mounted in the bottom of the unit 10 is the blower unit comprising a plurality of fans and a motor 38 which drives these fans. The fans, not shown, are enclosed within a housing 39 having end openings 40 through which the air passes into contact with the blower fans. This housing is shown as being fastened to the casing 16 and to a baffle 41 located within the unit so as to provide channels for the heated return air and for the discharge of the mixture of such heated return air and fresh air. The fresh air which enters the unit through the louver 17 and passageway 19 is thus mixed with the heated air from the chamber 22 (the amount of which is controlled by the dampers 24) in that portion of the unit which houses the blower fans, this mixing area being relatively remote from the heating chamber 22. This arrangement is generally similar to that shown and described in my copending application above designated.

The mixture of fresh air and hot air is blown through the passageway generally indicated at 42, a filter 43 being provided if desired. This air then leaves the unit through the vents 12.

As above mentioned, a principal feature of the present invention is the provision of means whereby the angle of discharge of the air from the unit and the velocity of such air are varied in accordance with the requirements of the room being conditioned. To this end I have provided a damper comprising a vent closing element 44 and an arm 45. This arm is pivotally mounted within the unit as indicated at 46. A second damper comprising a vent closing element 47 and an arm 48 is also pivoted at the point 46 but in such manner that the movements of arms 45 and 48 are independent of each other. The arm 48 and vent closing element 47 can be fixed in any desired position by means of the set screw 49 operating within the slot 50 provided in the unit. In this manner the vent closure element 47 may be set so as to close any desired number of vents 12 according to the teachings of experience. Once a particular position of the closure element 47 has been decided upon and the arm 48 fixed in position by the means 49—50, movement of the arm 45 and its closure member 44 will result in changing the number of vents 12 open for the passage of air therethrough.

The end of the arm 45 opposite from that which carries the element 44 is pivotally connected to a rod 51, this rod having a similar connection with one end of a lever 52. The other end of the lever 52 is pivotally connected to a rod 53, the rod 53 being fastened to the rod 25 above described.

As above described, when the rod 25 is raised upwardly the fresh air dampers 20 are moved toward their open position and the heated return air dampers are moved towards their closed position. At the same time, it is a particular feature of my arrangement that the upward movement of rod 25 also results in a similar movement of the rod 53. As this rod 53 is moved upwardly the lever 52 is rotated in a clockwise direction and the rod 51 thereby lowered. As the rod 51 is pulled downwardly

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by clockwise rotation of the lever 52, the arm 45 is rocked about its pivot 46 in a counterclockwise direction with the result that the vent closure element 44 is moved upwardly. Such movement of the element 44 results in a greater number of the vents 12 being closed by such element. Therefore it should be observed that when the fresh air dampers are moved towards their open position, this resulting in a greater proportion of the mixed air discharge through the passage 42 being composed of the fresh, cold air, the closure element 44 is actuated so as to close a greater number of the vents 12. Also, since the vents first closed by the element 44 are those which are located nearest the bottom of the unit, the angle at which the air is discharged into the room is made more steep. The reduction in the number of vents 12 left open for the passage of air therethrough also results in an increased velocity of the air passing through the exposed vents. Thus, this arrangement provides the following results: The colder the mixture of air to be discharged from the unit 10 into the room to be conditioned, the steeper will be the angle of discharge and the greater will be the velocity of the air so discharged.

By discharging the colder air at a steeper angle and a greater velocity, I am able to more precisely control the air within the room being conditioned so as to greatly reduce the unwanted drafts associated with conventional units when cool air is being discharged into a relatively warm room. When the room is relatively cool and the greater portion of the air being discharged into the room from the unit is composed of warm, return air the arrangement is such that the angle of discharge determined by the closure element 44 will be less steep and the velocity of the air passing through the vents will be slower than that above described. In this way larger quantities of slower moving warm air are admitted into the relatively cool room so as to return the room to the desired temperature as quickly as possible.

A modification of the present invention is disclosed in Figures 3 and 4. Because of the great degree of similarity between the unit of Figures 1 and 2 and that of Figures 3 and 4, I shall employ the same reference numerals to designate like parts wherever possible. The unit itself is indicated at 54, this particular unit being located above the floor and being supported by means of hanger elements 55. In this unit, as in the unit of Figures 1 and 2, return air is brought into the unit through the heating chamber 22 and past the dampers 24. Fresh, cold air from the out-of-doors is brought into the unit through the louver 17, screen 18 and past the dampers 20. The heated, return air and cold, fresh air are mixed in the general area of the blower housing 39 and discharged from the unit at the end of the passageway indicated at 56. The fresh air dampers 20 and return air dampers 24 are responsive to the pneumatic damper motor 34 and thermostat 36 in the same manner as described in connection with the unit of Figures 1 and 2.

In the unit shown in Figure 3 I have provided means for changing the angle at which air is discharged into the room, the change of angle being in accordance with the temperature of the room as above described. The means for effecting this change of angle comprises a cylindrical element 57 having a curved portion corresponding to the passage exit member 56. This member 57 is provided with a pair of braces 58 and is mounted for tilting movement in the unit on the axis indicated at 59. As is diagrammatically illustrated in Figure 3, one end of a brace member 58 is pivotally connected to a link 60 extending from one end of the member 29 to which the dampers 24 are fastened. This linkage connection is so arranged that when the dampers 24 are moved towards their closed position, at which time the dampers 20 are moved towards their open position and a relatively large amount of fresh air is being discharged by the blower fans, the member 57 is tilted upwardly so that the colder air is discharged at a steeper angle. Similarly, when the

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member 29 is so actuated that the dampers 24 are brought towards their open position and the dampers 20 towards their closed position, at which time the air being discharged into the room is relatively warm, the member 57 is tilted so as to make the angle of discharge less steep. In this manner I have again provided an arrangement for varying the angle at which the air is discharged into the room, said angle depending on whether or not the discharged air is relatively warm or relatively cool.

Although in the particular unit just described I have not provided means for narrowing the opening of the member 57 in response to the temperature of the air, it is to be understood that such an arrangement could be made and the teachings described in connection with the unit of Figure 2 also applied here. Even though I do not change the opening of the member 57, and consequently do not change the velocity of the air being discharged, it is still an important feature of my invention that I do provide for changing the angle at which the air is discharged.

The unit of Figures 3 and 4 is provided with a modification which makes it particularly well suited for use in areas where the out-of-doors temperature becomes quite low, such as, for example, 10° F. below zero and colder. This modification comprises an arrangement wherein the very cold fresh air is subjected to an initial preheating step before it is mixed with the heated, return air. The pre-heating means comprises a heating unit 61 in which there is positioned a plurality of heating coils, these coils being filled with a liquid anti-freeze. This anti-freeze solution is pumped through the coils by means of a circulating pump and motor indicated at 62. This solution is heated by means of a heat exchanger generally indicated at 63, said heat exchanger being provided with steam lines indicated at 64. It is to be understood that the supply of steam for the heat exchanger 63 might be that same supply which provides the coils of the heat chamber 22. The arrangement is so set up that there is always a supply of live steam in connection with the exchanger 63. The motor 62, however, does not function at all times but rather, this motor is responsive to a thermostat located on the outside of the building and indicated at 65. This thermostat 65 will be so arranged that when the temperature gets to a certain temperature, for example, anything below 0° F., the motor 62 will be actuated. When this circulating pump and motor 62 is actuated, the hot anti-freeze solution is circulated through the coils located in the unit 61 with the result that air passed by the dampers 20 is subjected to a pre-heat. The connection between the thermostat 65 and circulating pump and motor is indicated at 66. It should be noted that even in this arrangement, the cold air is never brought into direct contact with steam or hot water coils and therefore the danger of bursting such coils, or the necessity of providing special coils, is eliminated. The pre-heat set-up here shown and described is necessitated by the fact that there must always be supplied a minimum of fresh air and in some instances, were it not for this pre-heating, even the minimum amount of air would be so cold as to render a proper mixture of it with heated return air impossible for comfort within the room. This problem I have solved by first subjecting the air to the preliminary heating just described. (The air, however, even after this preliminary heating, is still relatively cold.)

In its broadest aspects my present invention relates to the provision of a unit to be placed in a room in order to heat the room by air discharged from the unit at an angle varying with the temperature of the discharged air. Thus, if the room requires relatively cool air in order to properly condition it, the cool air will be discharged from the unit at a steeper, upward angle than would be the case if the room required relatively warm air. A related feature of my invention is the provision of means whereby the velocity of the air discharge from the unit may also

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be changed according to the temperature of the air discharged, the cooler the discharged air the higher the velocity. Such change in velocity is obtained by narrowing the opening when a higher velocity is desired. This invention also includes the incorporation with a unit of the type just generally described of means whereby extremely cold air taken into the unit from the out-of-doors may first be subjected to a preliminary heating of such a type that the cold air is never brought into direct contact with steam or hot water coils.

While it is true that in the preferred embodiment of the invention herein disclosed my unit is designed to incorporate the various features shown in my copending application Serial No. 167,803, filed June 13, 1950, and entitled Air Conditioning Apparatus, System and Method, it is to be understood that the various features developed by me and expressed herein are capable of being used in air conditioning units that do not conform to the teachings of my said copending application. The combination of the features of my copending application, however, with the features disclosed herein result in an improved air conditioning unit and method and such combination is also a part of the present invention.

It is also to be understood that the unit of the present invention may be incorporated in the "Night-Day System" disclosed in my said copending application.

As will be readily apparent to those skilled in the art, modifications may be made in my invention without departing from the scope and spirit thereof, and while I have shown my invention as embodied in certain structure for the purpose of illustration, I do not intend to be limited by such structure except insofar as it is specifically set forth in the subjoined claims. Having thus described my invention, what I claim as new and what I desire to protect by United States Letters Patent is:

1. In an air conditioning unit, means to supply said unit with fresh air from the out-of-doors, means to supply said unit with air from a room to be conditioned, means to heat said room air, a mixing chamber for said heated room air and for said fresh air, said chamber being located in said unit remote from said heating means, means to discharge air from said mixing chamber in a stream into said room, means to vary the angle of said stream with the horizontal upwardly thereof according to the temperature of the room air, the warmer the room air the colder the stream and the greater the angle, the fresh air supply means including dampers regulating the fresh air intake, the room air supply means to the unit including dampers regulating the room air intake, said fresh air and said room air dampers being connected by common linkage so that they open and close oppositely to one another, the discharge means and the velocity varying means comprising a common damper cooperating with a plurality of outlet vents provided in the units, said vents being disposed about an arcuate path, and linkage connecting said common damper with said first mentioned linkage, and means to vary the velocity of the discharged stream according to its temperature, the colder the stream the greater its velocity.

2. The unit of claim 1 including means to vary the size of the discharged stream according to its temperature, the colder the stream the smaller its size.

3. A room air conditioning unit comprising means for drawing in outside air, means for withdrawing air from said room, means for heating only said room air, means for mixing said heated room air and outside air, a blower for moving said mixed air into said room, means controlling the proportion of heated room air and outside air being mixed, a thermostat located in said room for actuating said controlling means, means to vary the angle with the horizontal at which the mixed air is moved into the room, said last mentioned means being responsive to said thermostat so that the warmer the air within the room is the colder the mixed air being moved into the room is and the greater the angle with the horizontal, the fresh air

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supply means including dampers regulating the fresh air intake, the room air supply means to the unit including dampers regulating the room air intake, said fresh air and said room air dampers being connected by common linkage so that they open and close oppositely to one another, the discharge means and the velocity varying means comprising a common damper cooperating with a plurality of outlet vents provided in the units, said vents being disposed about an arcuate path, and linkage connecting said common damper with said first mentioned linkage, and means to vary the velocity of the mixed air being moved into the room, the colder the mixed air the greater the velocity, said velocity varying means also being responsive to said thermostat.

4. The unit of claim 3 including means to vary the size of the stream of mixed air being moved into the room, the colder the mixed air the smaller its size, said size varying means also being responsive to said thermostat.

5. That method of air conditioning a room by discharge of air into the room from a unit located therein which comprises the steps of drawing air from the room into the unit, drawing air from the out-of-doors into the unit, heating the air within the unit to the desired temperature, discharging the air into said room from said unit at an angle with the horizontal which is varied upwardly thereof according to the temperature of the discharged air, the cooler the discharged air the greater its angle of discharge with the horizontal, varying the velocity of the discharged air in accordance with its temperature, the cooler its temperature, the greater its velocity, and varying the size of the discharged stream of air in accordance with its temperature, the cooler its temperature the smaller its size.

6. That method of supplying warm air to a room which comprises the steps of drawing air from the room, passing the air so drawn over heating means, drawing fresh air from the out-of-doors, mixing said heated air with said fresh air in an area remote from said heating means, passing said mixture of heated air and fresh air into the room at an angle with the horizontal which is varied upwardly according to the temperature of the mixture, the cooler the mixture the greater the angle of passing, varying the velocity of the passed mixture of air according to the

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temperature of the mixture, the cooler the mixture the greater its velocity, and varying the size of the stream of air discharged into the room according to the temperature of the stream, the cooler the stream the smaller its size.

7. In an air conditioning unit, means to supply said unit with fresh air from the out-of-doors, means to supply said unit with air from a room to be conditioned, means to heat the air within the unit, means to discharge the heated air in a stream from the unit into the room, means to vary the angle of the discharged stream with the horizontal upwardly thereof according to the stream's temperature, the colder the temperature the greater the angle, means to vary the velocity of the discharged stream according to its temperature, the colder the stream the greater its velocity, and means to vary the size of the discharged stream according to its temperature, the colder the stream the smaller its size.

8. An air conditioning unit according to claim 1 and in which the unit is designed to be placed on the floor of a room beneath a window provided therein, said arcuately disposed outlet vents being positioned in the upper and forward end of the unit, and including inlet vents by means of which air from within the room is supplied to the unit, said inlet vents being located in the upper portion of the unit adjacent the rear end thereof so that said inlet vents are located beneath the said window, whereby said inlet vents catch down drafts from the window and prevent such down drafts entering the major portion of the room in which the unit is located.

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