

June 15, 1943.

A. A. KUCHER
REFRIGERATING APPARATUS

2,321,687

Filed Oct. 30, 1939

4 Sheets-Sheet 1

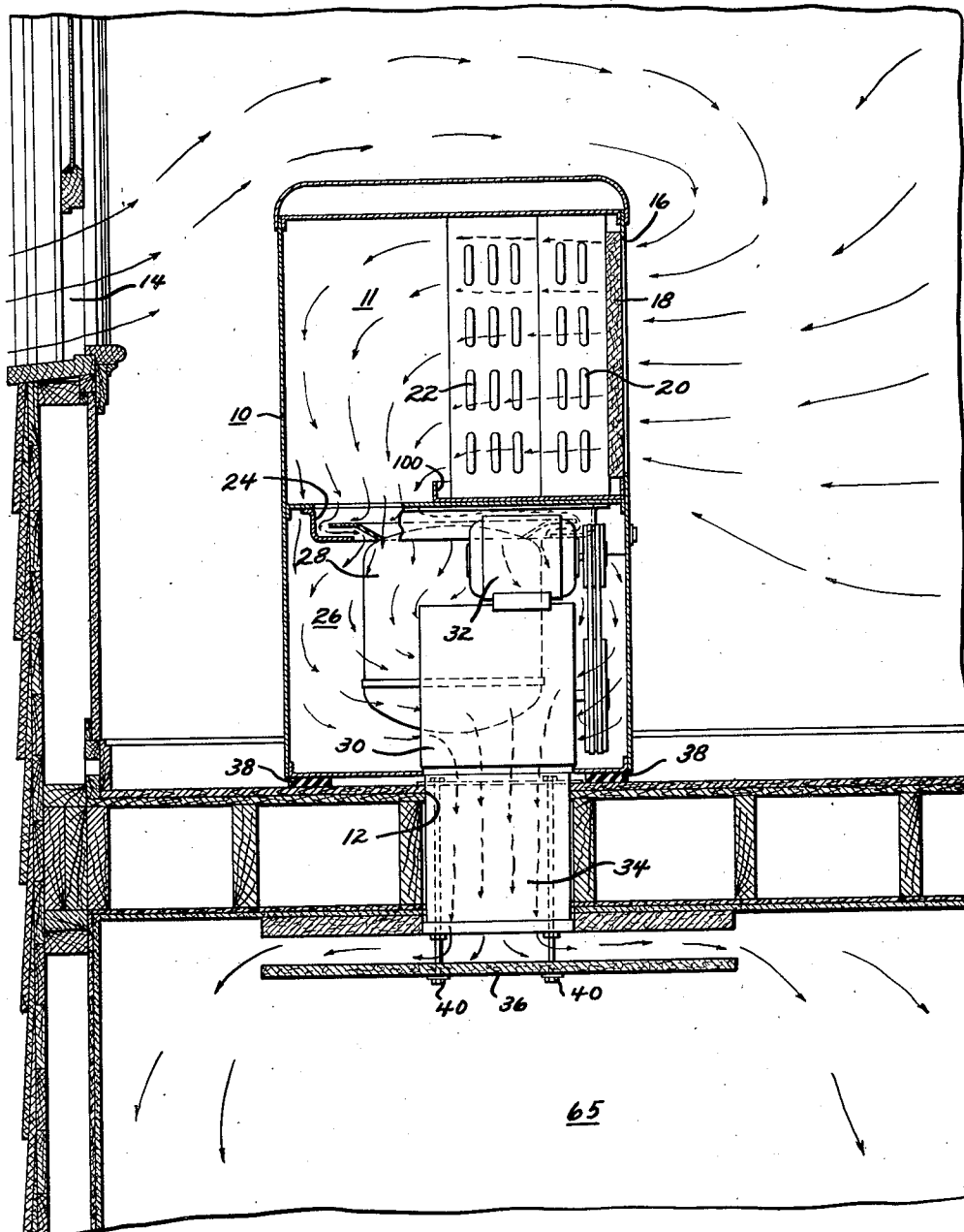


Fig. 1

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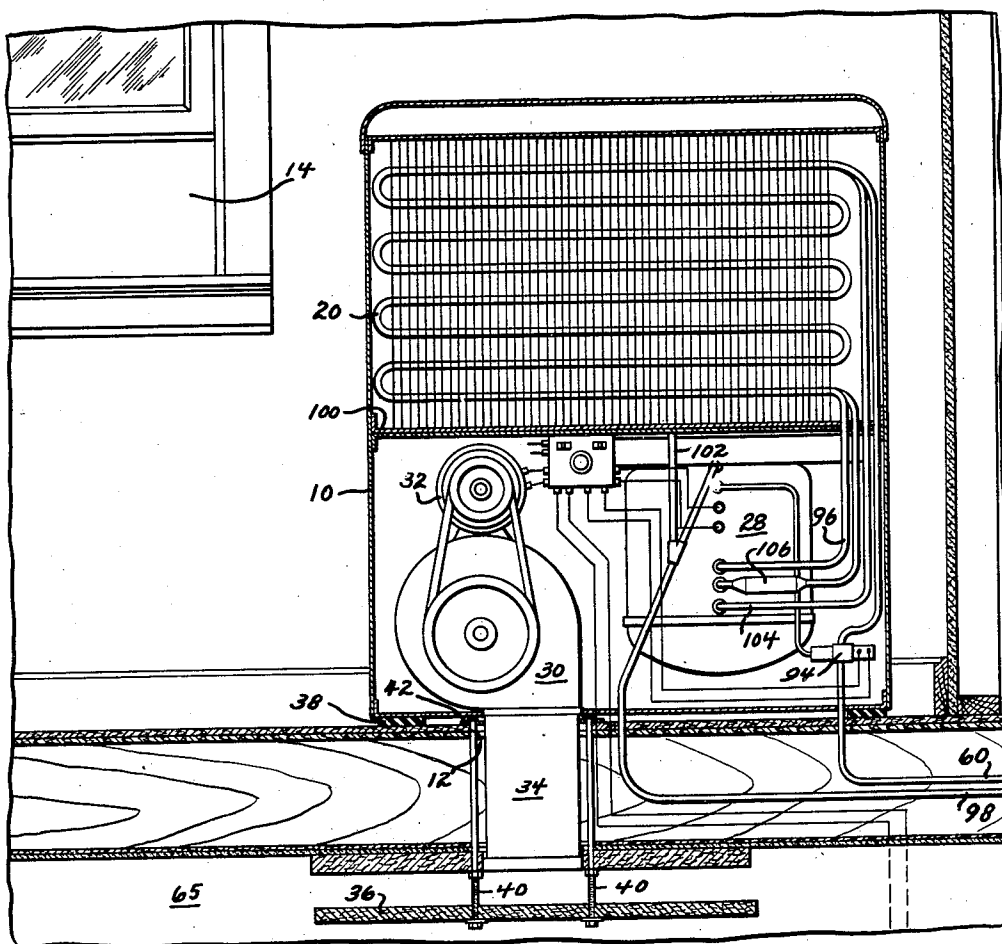


Fig. 2

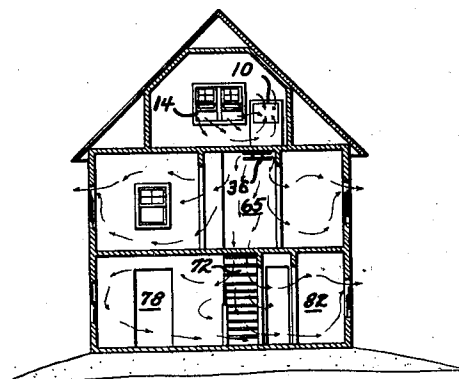


Fig. 7

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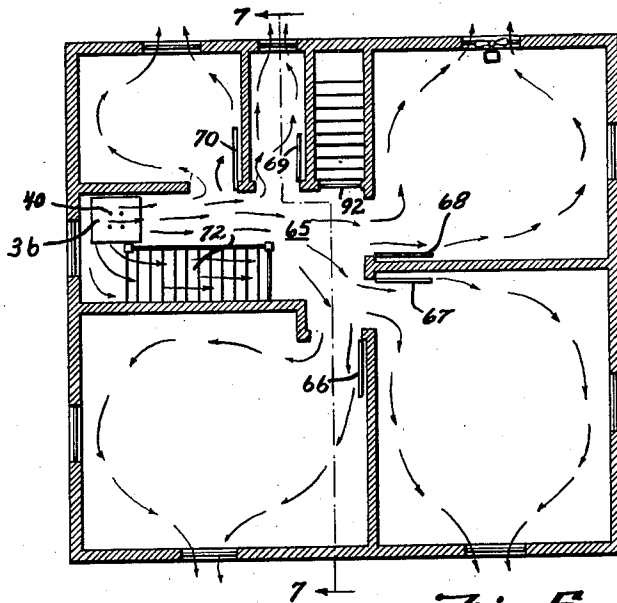


Fig. 5

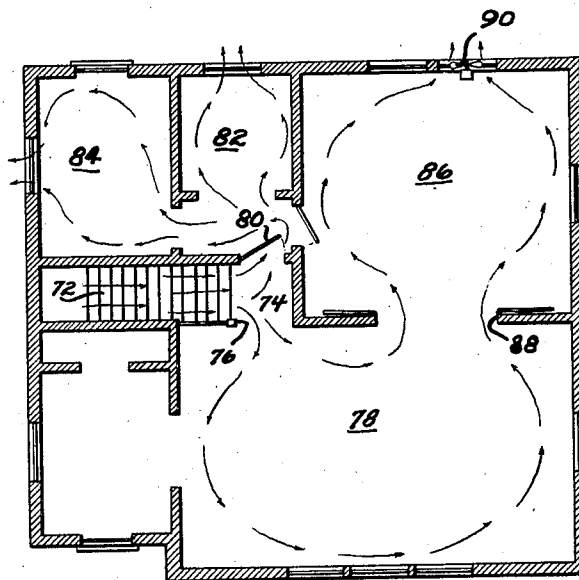


Fig. 6

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UNITED STATES PATENT OFFICE

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REFRIGERATING APPARATUS

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8 Claims. (Cl. 62—129)

This invention relates to refrigeration and more particularly to a simplified and improved air conditioning unit for use in private homes and the like.

Notwithstanding the fact that summer air conditioning for private homes is as desirable as winter air conditioning and notwithstanding the fact that a large variety of air conditioning units intended for summer air conditioning have been on the market for many years, very few home owners have been willing to pay the money and put up with the inconvenience necessitated by installation of these units. Besides being complicated and expensive many of the prior systems failed to satisfy the wants of the average person. The inexpensive units have either been incapable of distributing the conditioned air or have been incapable of supplying enough clean conditioned air.

One object of this invention, therefore, is to provide a simple method and apparatus capable of conditioning and distributing an adequate supply of air for private homes and the like.

The average home occupant fully realizes the importance of fresh air and is accustomed to having windows open during the summer season and is not willing to close the windows and breathe the same air all day long merely for the sake of having the air cooled.

One object of this invention, therefore, is to provide means for efficiently air conditioning a private home or the like without the necessity of closing all the windows and recirculating a large amount of foul air.

In the design of air conditioning units for use in private homes or the like it is also very important to keep the cost of the unit down and to provide means for efficiently distributing the conditioned air throughout the house without the necessity of installing expensive air ducts which cannot be installed without messing up the entire house.

It is a further object of this invention, therefore, to provide a low cost air conditioning unit capable of distributing conditioned air to all of the rooms in a private home.

It also frequently happens that prospective purchasers of air conditioning apparatus would be willing to buy conditioning apparatus during a hot spell provided they could obtain immediate relief. Another object, therefore, of this invention is to provide an air conditioning unit capable of conditioning an entire private home and capable of being installed and ready for use in a day or two.

Another object of this invention is to provide an air conditioning system which is economical to operate.

A further object is to provide an apparatus capable of conditioning and distributing large volumes of fresh unconditioned or conditioned air throughout the house.

A further object is to provide an improved control arrangement for a 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 sectional view showing an air conditioning unit embodying features of this invention installed in the attic of a private home or the like;

Fig. 2 is a similar cross sectional view taken at right angles to the showing in Fig. 1;

Fig. 3 is a view partly diagrammatic showing the control system for the apparatus disclosed in Figs. 1 and 2;

Fig. 4 is a diagrammatic plan view showing the location of the air conditioning unit within the attic space of a typical home;

Fig. 5 is a diagrammatic plan view showing the distribution of conditioned air to the second floor rooms of a typical private home installation;

Fig. 6 is a view similar to Fig. 5 showing the distribution of the conditioned air to the first floor rooms of a typical private home;

Fig. 7 is a vertical sectional view taken on line 7—7 of Fig. 5 showing the distribution of air within the home; and

Fig. 8 is a diagrammatic sectional view showing a debris catching box used while installing the air conditioning apparatus disclosed in this application.

For purposes of illustration I have shown my improved system installed in a typical private home. As shown in Fig. 1 the air conditioning cabinet 10 rests directly on the attic floor over an opening 12 leading to the hall below. The air to be conditioned enters the attic through an open window 14 or any other suitable opening leading from the outside to the attic space. I have found that it is not necessary to provide any duct for conveying the air from the window to the cabinet. By not using any air duct for conveying the fresh air from the window to the cabinet, the cost of the unit is reduced. Furthermore, the air flowing through the attic

serves to ventilate the attic when no air duct is used. The desirability of attic ventilation depends on a number of factors such as the climatic condition and the house construction. The fresh air from the attic enters the conditioning cabinet 10 through inlet opening 16 provided in one side of the upper compartment 11 of the cabinet 10. A filter 18 is disposed directly in the air inlet 16 to filter the incoming air. The air passing through the filter 18 first flows in thermal exchange relationship with the water coil 20 and thereafter flows in thermal exchange relationship with the refrigerant evaporator 22 disposed adjacent the water coil 20. The cooled air leaving the compartment 11 flows downwardly through the passage 24 into the lower compartment 26 in which is mounted a water-cooled motor-compressor-condenser unit 28 and a blower 30 driven by motor 32. The conditioned air is discharged downwardly by the blower 30 through an air duct 34 which discharges the conditioned air against the upper surface of panel member 36 which is arranged to distribute the air along the second floor ceiling.

The air leaving the panel 36 has sufficient velocity to cause it to flow substantially horizontally until it strikes the vertical walls of the hall which are provided with door openings leading to the adjoining rooms. The conditioned air leaving the panel 36 builds up a pressure within the hall with the result that the conditioned air seeks to escape into the adjoining rooms. The second floor bedrooms may be conditioned by opening the bedroom door leading to the hall and opening one or more of the bedroom windows. Opening of a bedroom door alone without opening any of the windows will cause a certain amount of the conditioned air to flow into the room but for best results one or more of the windows should be opened. In Fig. 5 I have illustrated the flow of conditioned air through the bedrooms while these rooms are being conditioned. The amount of conditioned air entering each room may be controlled either by the amount the windows are opened or by controlling the amount which the bedroom door is opened. Thus, a room which is not in use and requires no conditioning may be closed off merely by closing the hall door leading thereto. As shown in Fig. 5, a portion of the conditioned air entering the second floor hall 65 is distributed to the second floor rooms through the doors 66, 67, 68, 69 and 70 and another portion of the air flows downwardly through the stairway 72 to the first floor hall 74 which, for purposes of illustration, has been shown as having an opening 76 leading to the living room 78 and another doorway 80 through which conditioned air is free to flow into the breakfast room 82, the kitchen 84 and the dining room 86. In the usual home, a doorway such as 88 leads from the living room to the dining room whereby some of the living room air is free to circulate directly into the dining room through the doorway 88.

The flow of air to the second floor rooms may be prevented by closing the doors leading from the second floor hall to the respective rooms. During the day time, for example, the doors would normally be kept closed; whereas, at night, these doors are left ajar sufficiently to allow the conditioned air to enter the rooms. In certain installations, it may be desirable to provide transoms or similar air passages from the hallway into the adjacent rooms so as to avoid the necessity of leaving the doors open. In

the average private home, however, the provision of these additional air passages is not necessary.

In Fig. 5 I have shown a fan unit 90 located in a bedroom window, and in Fig. 6 I have shown a similar fan in a dining room window. While I have shown only two fan units 90, it is obvious that more of these units may be provided if, for any reason, difficulty is experienced in getting a sufficient volume of conditioned air into any of the rooms. These fan units are also convenient for windy days when the opening of the window would normally cause the relatively hot outdoor air to blow into the room.

In Fig. 7 I have shown a vertical sectional view of the home shown in Figs. 5 and 6. As shown in Fig. 7, outdoor air enters the attic space through the window 14, is picked up by the conditioning unit 10 in which the air is cooled, and is thereafter discharged into the second floor hall 65 from whence part of the air flows into the adjoining bedrooms and the remainder of the air flows through the stairway 72 into the first floor hall from whence the air circulates into the various downstairs rooms.

While this unit is intended primarily to condition fresh air only, it is apparent that it is capable of conditioning recirculated air also. As shown in Fig. 4, it would be possible to close the attic windows 14 and to open the attic door 92 whereby air from the second floor hall would be allowed to flow into the attic. Certain of the advantages of applicant's system would, however, be lost if the door leading to the attic were left open so as to cause air from the conditioned space to be recirculated. By virtue of applicant's improved system the supply of conditioned air to any one room may be discontinued by closing the door leading to the room. The closing of the door, however, does not prevent airing the room by opening the windows.

Inasmuch as all of the air being conditioned is fresh air, the same amount of conditioned air provides for greater comfort for a given cost than with the systems in which the air is recirculated.

As shown in Fig. 1, the air to be conditioned first flows in thermal exchange relationship with the water coil 20 and thereafter flows in thermal exchange relationship with the evaporator coil 22. Water is supplied to the water coil 20 through the water line 60 which may be connected to city mains or any other source of cold water. The flow of water in the line 60 is controlled by the valve 94, the operation of which will be described more fully hereinafter. The water leaving the coil 20 will be a number of degrees warmer than the water entering the coil but is still sufficiently cold so that it may be used in condensing the refrigerant in the refrigerating system. As shown in Figs. 2 and 3, the water leaving the coil 20 is supplied to the motor-compressor-condenser unit 28 through the pipe 96. The water flowing through the motor-compressor-condenser unit 28 serves to cool the same and serves to condense the refrigerant in the well-known manner. The water leaves the compressor through the discharge line 93 which may be connected to any convenient form of drain or to a lawn sprinkler system.

As shown in Fig. 2, the condensate collecting on the cooling coils 20 and 22 collects in the drip pan 100 which is provided with a drain 102 which, for purposes of illustration, has been shown as connected to the main drain pipe 98. The refrigerant which is vaporized in the evaporator

22 flows to the compressor through the low side vapor line 104. The compressed refrigerant is condensed within the motor-compressor-condenser unit 28 which also serves as a receiver for the liquid refrigerant. The liquid refrigerant leaving the receiver passes through a restrictor 106 on its way to the evaporator 22. The refrigerating system is placed in operation by plugging in the electric cord 110. A manual switch 112 is provided for starting and stopping the entire unit. Upon closing of the switch 112, the air circulating fan 30 is placed in operation and continues to operate as long as current is supplied to the fan motor 32. The compressor motor is under control of the outside thermostat 114 which operates the switch 116 leading to the compressor 28 and the solenoid 118 which controls the valve 94. The thermostat 114 may be a dry bulb thermostat, a wet bulb thermostat or a combination of both, such as an effective temperature thermostat, and is designed to close the switch 116 whenever the condition of the outside air requires conditioning before being discharged into the enclosure. Inasmuch as there may be times when it would not be necessary to further cool the incoming air even though the outdoor air is slightly higher than the desired indoor temperature, I have provided an indoor thermostat 120 for starting and stopping the refrigerating system 28 in response to the indoor conditions. The thermostat 120 is effective only when the main switch 116 is closed and is never effective for controlling the cooling of the air by the water coil 20. The thermostat 120 may be a dry bulb thermostat, a wet bulb thermostat or a combination of both such as an effective temperature thermostat. Energization of the solenoid 118 is controlled directly by the outdoor temperature controlled switch 116 and the manual switch 119 so that whenever the outdoor air temperature exceeds the desired indoor air temperature and the manual switch 119 is closed, the valve 94 is held open whereby cooling water flows through the cooling coil 20. By virtue of this arrangement, the hot outdoor air is permitted to enter the conditioned space without first being cooled at such times when the condition of the indoor air is such that the refrigerating system is not operating. The valve 94 is further under control of the bellows 122 which is operated in response to the head pressure within the motor-compressor-condenser unit 28. When the switch 119 is open the bellows 122 exercises sole control of the valve 122 and when the switch 119 is closed a high pressure in the bellows 122 causes the valve to open further than normally opened by the solenoid 118. The valve stem 95 is normally biased closed by the spring 97. The cabinet 10 is mounted on a rubber gasket or the like 38 which prevents the transmission of noise from the conditioning unit to the floor structure. The baffle 36 is mounted below the opening 12 by means of bolts 40 which depend from the plate 42 which frames the opening 12 and rests on the upper surface of the attic floor. By virtue of the above described arrangement, the entire unit may be installed merely by cutting the hole through the attic floor and the hall ceiling and mounting the panel in place. Normally, in cutting holes through plaster, it is very difficult to prevent plaster from getting onto the floors and being tracked around the house. In order to avoid scattering the plaster while installing my unit, I have devised a debris catching box 50 (see Fig. 8) which is supported adjacent the

ceiling by a telescoping shaft arrangement 52 projecting upwardly from base 54. The box is adjustably held in the elevated position by means of the thumb screw 56 during the entire cutting operation which takes place from the attic side. With such an arrangement, all of the plaster, lath, pieces of flooring, etc., is caught in the box 50 and no dust or plaster is permitted to fall to the floor below. The upper walls of the receptacle 50 are provided with a gasket 58 which engages the ceiling in a dust-proof manner. After the hole in the attic floor and the hall ceiling has been made and the dust has had a chance to collect in the receptacle 50, the receptacle 50 is removed and the ceiling panel 36 is inserted in place. This entire operation requires very little time and is done without scattering any plaster or the like onto the floors.

By virtue of the above described simplified methods and apparatus, an ample supply of conditioned fresh air is at all times available in all sections of the house. Furthermore, the apparatus is inexpensive, quick to install, and economical to operate.

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, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. In combination, a dwelling having a plurality of rooms, a hallway having openings leading to said rooms, windows in said rooms, a chamber adjoining said hallway and having an opening communicating with said hallway, means for admitting fresh air into said chamber, a self-contained air conditioning unit disposed within said chamber, said unit comprising a casing, an air inlet in said casing, attenuating means within said casing, an air outlet communicating with said opening, and blower means for flowing fresh air into said chamber, through said inlet, in thermal exchange with said attenuating means, into said hallway, into said rooms and thereafter out through said windows, said blower means comprising a first fan unit within said casing and a second fan unit in one of said windows.

2. In combination, a dwelling having a plurality of rooms, a hallway having openings leading to said rooms, windows in said rooms, an attic space above said hallway, a self-contained air conditioning unit mounted in said attic including a casing, a fresh air inlet in said casing, a conditioned air outlet through which conditioned air is discharged downwardly into said hallway from whence the air flows into said rooms and out through said windows, blower means for bringing fresh air in through said inlet and discharging conditioned air out through said outlet, a water coil adjacent said inlet for cooling the incoming fresh air, an evaporator arranged to further cool said air, refrigerant liquefying means for supplying liquid refrigerant to said evaporator, said refrigerant liquefying means including a heat dissipating portion, and means for flowing water leaving said water coil in thermal exchange with said heat dissipating portion.

3. In combination, a dwelling having a plurality of rooms, a hallway having openings leading to said rooms, windows in said rooms, an attic space above said hallway, a self-contained air conditioning unit mounted in said attic including a casing, a fresh air inlet in said casing, a conditioned air outlet through which conditioned air is discharged downwardly into said hallway

from whence the air flows into said rooms and out through said windows, blower means for bringing fresh air in through said inlet and discharging conditioned air out through said outlet, a water coil adjacent said inlet for cooling the incoming fresh air, an evaporator arranged to further cool said air, refrigerant liquefying means for supplying liquid refrigerant to said evaporator, said refrigerant liquefying means including a heat dissipating portion, means for flowing water leaving said water coil in thermal exchange with said heat dissipating portion, and means responsive to the outside temperature for starting and stopping the operation of said refrigerant liquefying means.

4. In combination, a dwelling having a plurality of rooms, a hallway having openings leading to said rooms, windows in said rooms, an attic space above said hallway, a self-contained air conditioning unit mounted in said attic including a casing, a fresh air inlet in said casing, a conditioned air outlet through which conditioned air is discharged downwardly into said hallway from whence the air flows into said rooms and out through said windows, blower means for bringing fresh air in through said inlet and discharging conditioned air out through said outlet, a water coil adjacent said inlet for cooling the incoming fresh air, an evaporator arranged to further cool said air, refrigerant liquefying means for supplying liquid refrigerant to said evaporator, said refrigerant liquefying means including a heat dissipating portion, means for flowing water leaving said water coil in thermal exchange with said heat dissipating portion, means responsive to the outside temperature for starting and stopping the operation of said refrigerant liquefying means, and means responsive to the inside air temperature controlling the conditioning of air by said evaporator.

5. In combination, a dwelling having a plurality of rooms, a hallway having openings leading to said rooms, windows in said rooms, an attic space above said hallway, a self-contained air conditioning unit mounted in said attic including a casing, a fresh air inlet in said casing, a conditioned air outlet through which conditioned air is discharged downwardly into said hallway from whence the air flows into said rooms and out through said windows, blower means for bringing fresh air in through said inlet and discharging conditioned air out through said outlet, an evaporator arranged to cool said air, refrigerant liquefying means for supplying liquid refrigerant to said evaporator, said refrigerant liquefying means including a heat dissipating portion, means for flowing water in thermal exchange with said heat dissipating portion, and means responsive to changes in the outside air temperature for controlling the cooling of the air by said evaporator.

6. In combination, a dwelling having a plurality of rooms at least some of which have wall openings and one of which is provided with openings leading to other of said rooms, a chamber adjoining said one room and having an opening communicating with said one room, a self-contained air conditioning unit disposed within said chamber, said unit comprising a casing, inlet means in said casing, a cooling means within said casing, an air outlet in said casing communicating with said opening, and blower means for flowing fresh air through said inlet means, in thermal exchange with said cooling means, into said one room and in sufficient volume to pass into said other rooms and thereafter to the outside atmosphere through openings leading from the interior of said dwelling to the exterior of said dwelling, said blower means comprising a first fan unit within said casing and a second fan unit arranged to exhaust air from one of said other rooms, said casing and said blower means being arranged to cooperate to cause all of the air passing through said inlet means to pass across said cooling means and be discharged directly through said opening into said one room.

7. In combination, a dwelling having a plurality of rooms one of which is provided with openings leading to other of said rooms, an attic space above said one room communicating through an opening with said one room, a self-contained air conditioning unit mounted in said attic space including a casing having outlet means communicating with said opening, blower means in said casing, an evaporator in said casing arranged to cool the incoming fresh air, refrigerant liquefying means in said casing for supplying liquid refrigerant to said evaporator, means for introducing fresh air into said casing, said blower means being constructed and arranged to move air through said inlet across said cooling means and discharge it into said one room in sufficient volume to cause the air to flow into said other rooms and thereafter to the outside atmosphere through openings in the walls of said rooms.

8. The method of conditioning air for a private home having an attic space above the rooms to be conditioned which comprises introducing only air from outside of said home into the attic and cooling said air in said attic, forcefully discharging the cooled air downwardly from the attic into one of said rooms, distributing the air from said one room through openings into adjoining room and exhausting air from said rooms into the outside atmosphere at a rate substantially equal to the rate at which the outside air is introduced into said attic.

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