

April 20, 1943.

P. B. MOORE

2,317,104

AIR CONDITIONING

Filed Dec. 17, 1941

4 Sheets-Sheet 1

Fig. 1

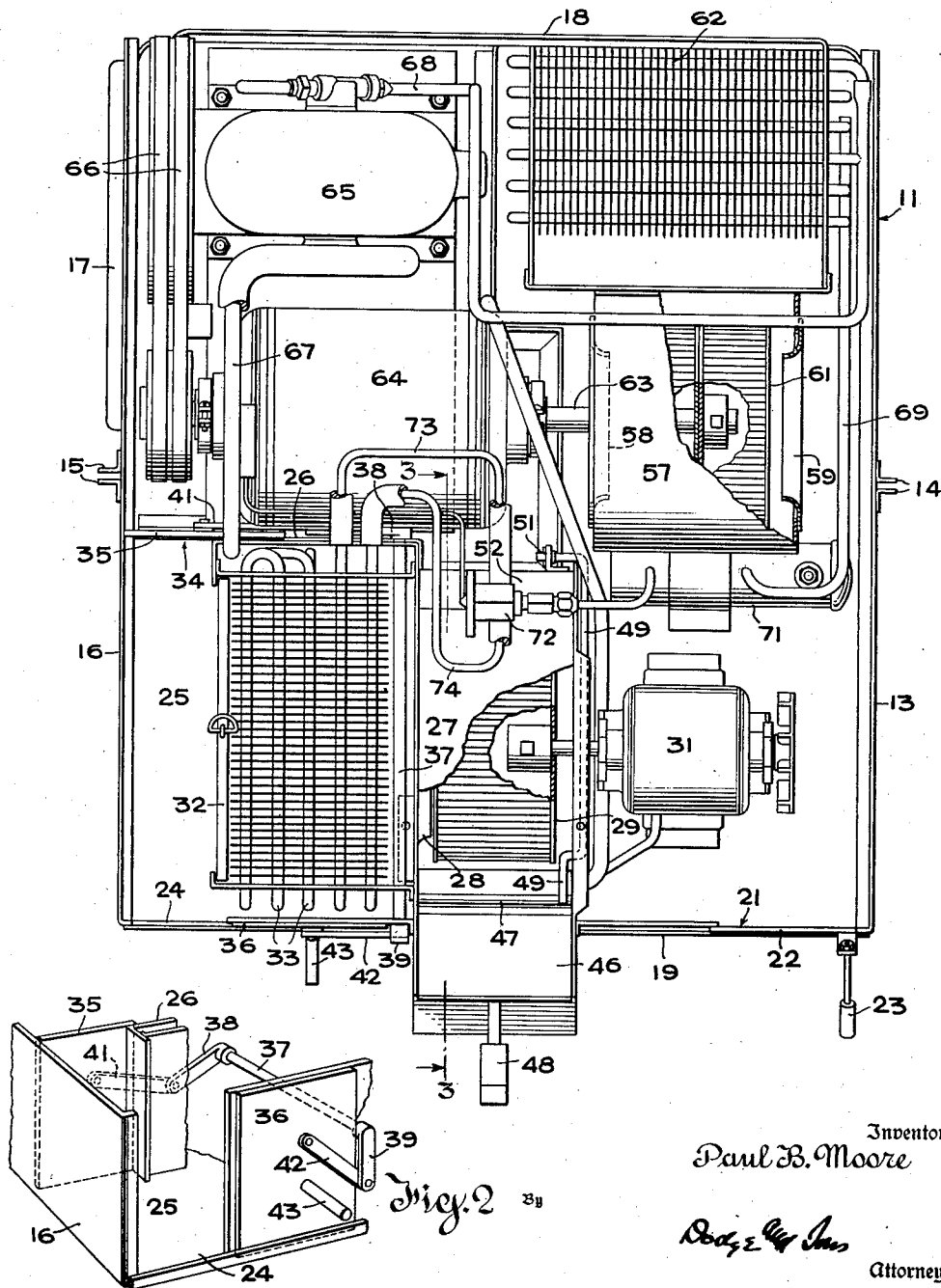


Fig. 2

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Fig. 3

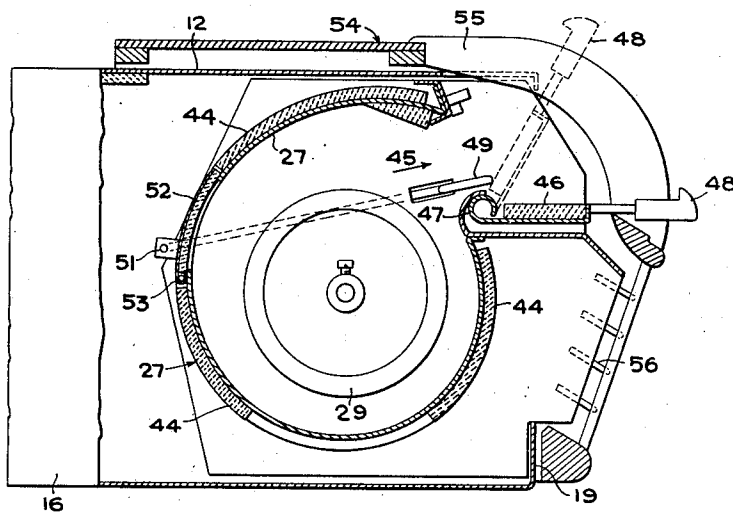
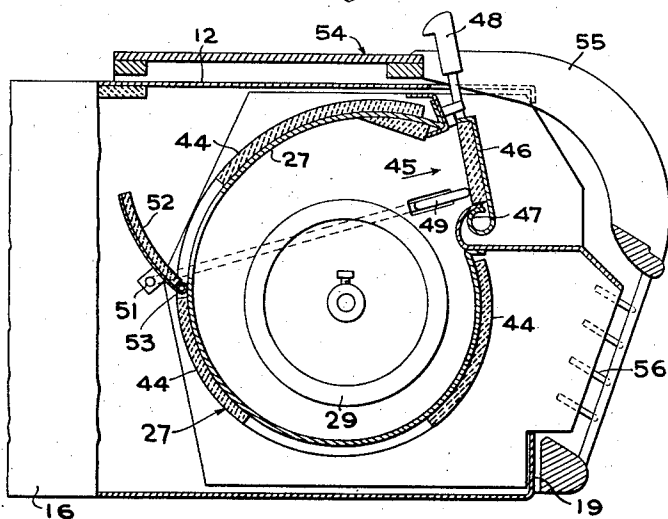


Fig. 4



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Fig. 5

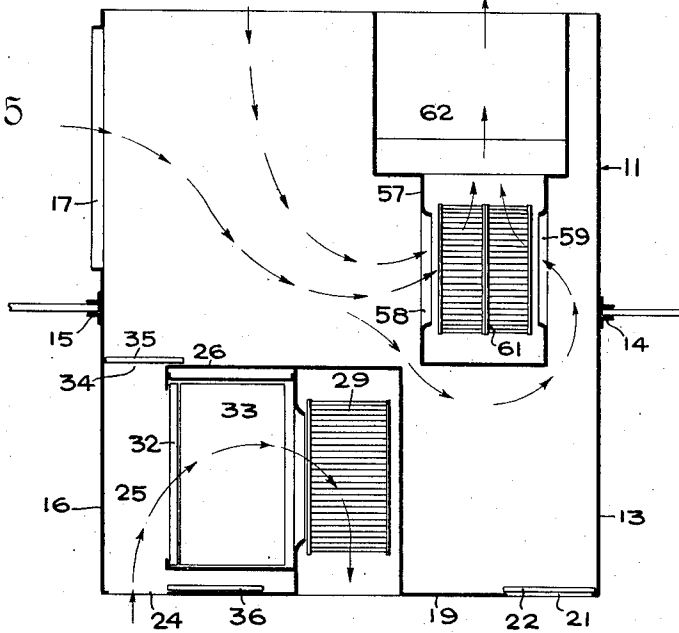
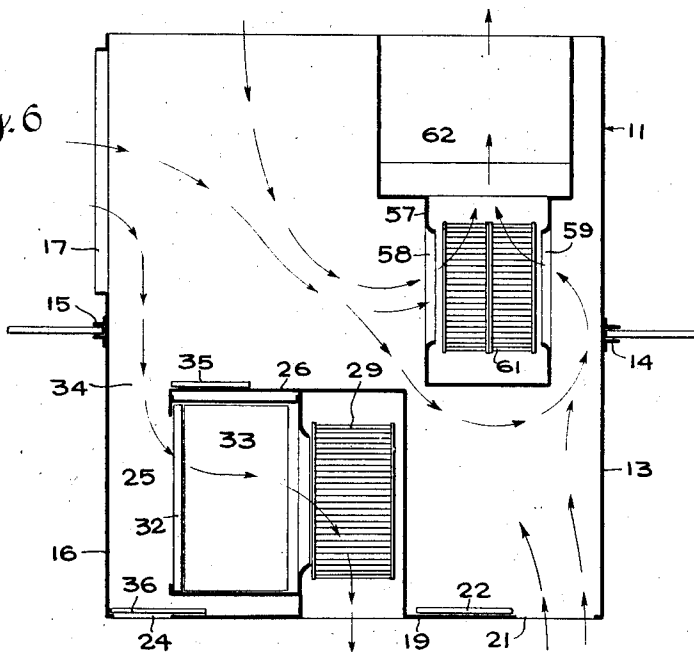


Fig. 6



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Fig. 7

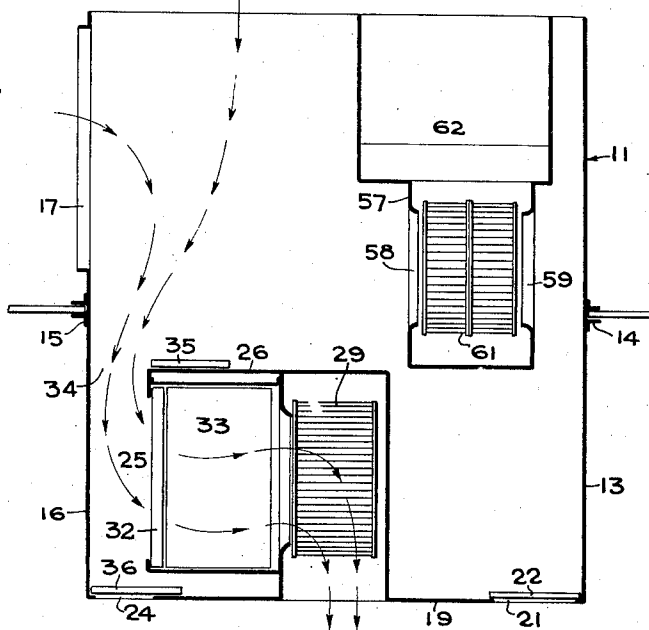
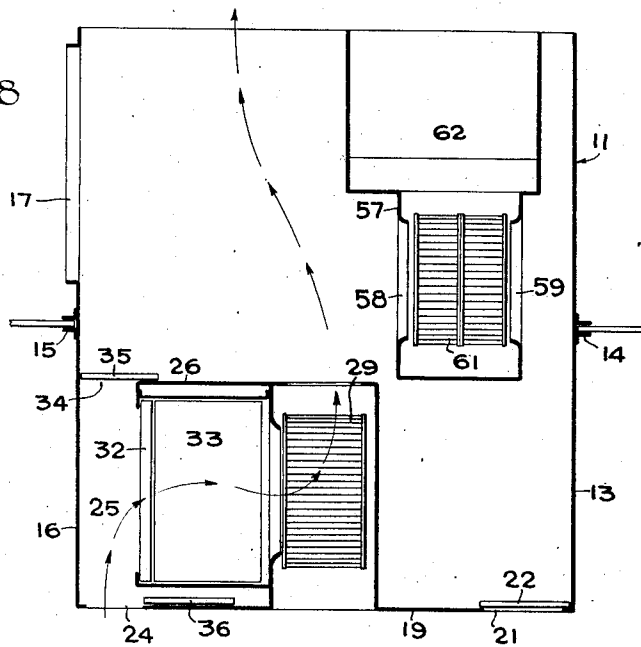


Fig. 8



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## UNITED STATES PATENT OFFICE

2,317,104

## AIR CONDITIONING

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Application December 17, 1941, Serial No. 423,393

6 Claims. (Cl. 62—129)

This invention relates to air conditioners and particularly to portable conditioners of the refrigerative type. The more important features of invention have to do with ventilation aspects and increase the utility of such conditioners for summer use and in even greater degree for winter use.

The larger portable conditioners as a rule are placed at a window with a window board for external air connections. Smaller types are mounted bodily on the window sill and project outward beneath the partly opened lower sash. Regardless of the location, such conditioners have a condenser which rejects heat and moisture (in the form of re-evaporated drip) to the outside air and an evaporator which cools and dehumidifies air drawn in whole or in part from the room. This air after such treatment is discharged into the room.

Condenser cooling air is drawn from out of doors by a large fan and returned out of doors after accessions of heat from the compressor and condenser. Some of this heat is used to re-evaporate water drip from the evaporator and sprayed in one or another way into the condenser cooling air stream. It has been usual to provide a damper which can be opened temporarily to permit the large condenser air fan to draw smoke-laden air from the conditioned room, but this fan runs only when the compressor is in operation and refrigeration is effective.

Air to be conditioned is circulated in contact with the refrigerative evaporator by a smaller fan driven by a separate motor and capable of operation while the refrigerating machine is shut down. The last mentioned fan is the room air circuit fan. A damper has been provided to permit this fan to draw a minor but adjustable portion of its air supply from out of doors. According to the present invention a duplex damper arrangement is provided which permits this fan to draw air selectively from the room or from out of doors, or from the room with a minor proportion of out-door air. This damper can also be used to throttle the supply of room air when room air alone is furnished. The resulting slow air flow intensifies the dehumidification effected by the evaporator coil.

According to the present invention, the room air circuit fan discharges under control of a damper which has directional characteristics and which may be set to a fully closed position. In closed position this damper serves to open a

normally closed auxiliary fan discharge which leads out of doors.

Thus, in summer the room air circuit may be controlled to intensify dehumidification. It may deliver appropriate mixtures of cooled fresh air and room air with desired directional characteristics. It may be set to operate as an auxiliary pump-out. In winter when the compressor and condenser are shut down, the room air circuit fan may deliver fresh air or a mixture thereof with recirculated air always with desired directional characteristics, or it may be used to discharge foul or smoky air from the room. The added functions are secured without great additional complication of apparatus and without difficult manipulation, and since winter conditions subsist through the major portion of the year, the added functions reduce the demand for troublesome seasonal service in removing, storing and reinstalling the conditioner. The conditioner being useful, will stay in place the year around, no small advantage from the service aspect.

A preferred embodiment of the invention in a sill-mounted conditioner will now be described by way of example, reference being made to the accompanying drawings:

Fig. 1 is a plan view of the complete conditioner, with the top of the casing removed. The ornamental casing used to house the end of the unit which projects into the room is wholly omitted.

Fig. 2 is a perspective view of the damper mechanism which controls the supply of fresh and recirculated air to the room air fan.

Fig. 3 is a section on the line 3—3 of Fig. 1 showing the deflecting damper which controls discharge from the room air fan in its wide open (non-deflecting) position and the auxiliary discharge damper closed. In this view a portion of the ornamental casing appears in section.

Fig. 4 is a similar view showing the deflecting damper closed and the auxiliary discharge damper open.

Figs. 5 and 6 are air flow diagrams for summer operation, with the refrigerating circuit active.

Figs. 7 and 8 are similar diagrams indicating operation in winter and at other times when refrigeration is not required, and the room air circuit fan is used alone to perform various ventilating functions.

Referring first to Fig. 1, the entire mechanism is enclosed in a rectangular metal case generally indicated at 11. This is closed at its bottom to form a retaining pan for the water dripping from

the evaporator. This water flows to and is picked up by the condenser fan and sprayed against the condenser to be reevaporated, but the details to this end are not here claimed and hence need not be elaborated. The top 12 (see Figs. 3 and 4) of the case 11 is also closed except for an opening at the discharge of the room circuit fan.

The right hand side 13 is closed and carries guides 14 for the usual filler pieces (not shown) that close the space beneath the sash and at the right side of case 11. The left hand side carries similar guides 15 for a similar purpose and at 16 forward of these guides is closed whereas louvers 17 are provided to the rear of the guides. This portion of the case projects out of doors and the louvers serve to admit air but exclude rain and snow. The rear or outer end 18 of case 11 is open except for a metal mesh screen not clearly visible in the drawing.

The front wall 19 has air ports near each corner. Port 21 at the right is controlled by the normally closed sliding damper 22. This is the pumpout damper which may be opened manually by shifting handle 23 to admit smoky or foul room air to the condenser fan.

Port 24 to the left leads to room circuit chamber 25. This is separated from the remainder of the interior of housing 11 by partition 26 and the housing 27 of the room air fan which is connected with the partition 26 and with the top, bottom and front of casing 11. The housing 27 has the usual entrance eye 28 through which air enters the housing from the chamber 25.

The runner of the fan appears at 29 and is driven by an electric motor 31 located in the right front corner of the housing 11. It draws air from chamber 25 through removable filter 32, finned evaporator coil 33 and the eye 28 in fan housing 27.

In partition 26 is a fresh air port 34 controlled by sliding damper 35. This damper is operated in special relation to the damper 36 which controls recirculated air port 24 by a linkage shown in Fig. 2. A rock shaft 37 has arms 38 and 39 at nearly 90° to each other. Arm 38 is connected by link 41 with damper 35 and arm 39 by link 42 to damper 36. A handle 43 is used to shift damper 36 horizontally in its guides. The damper 35 is capable of moderate over travel past its closing position.

Starting with damper 36 open, as shown in Fig. 2, damper 36 moves nearly closed while arm 38 and link 41 swing upward, to and slightly past alignment. This simply moves damper 35 idly beyond and back to its closing position. In the final closing motion of damper 36, damper 35 is drawn open at an increasing rate. Thus damper 36 first throttles recirculated air, then before it closes, starts fresh air damper 35 in an opening direction, and then closing rapidly opens damper 35 to the widest open position it reaches. The timing desired can be had by proper proportioning of the links and arms and the angularity of the arms.

As shown in Figs. 3 and 4, the housing 27 of the room circuit fan is of the snail shell type with sound deadening covering 44. The discharge port 45 is directed outward and slightly upward. A damper 46 pivoted at 47 on a horizontal axis may be swung upward by handle 48 from the open position shown in Fig. 3 and acts as a deflector to direct the discharging air upward, if desired. At its limit of upward motion (Fig. 4) it closes the discharge 45. As it arrives in this position

it engages and forces back a push rod 49 which is pivoted at 51 to auxiliary discharge damper 52. Damper 52 is mounted on a spring hinge 53 which normally maintains it closed but yields to permit the damper to open under the thrust exerted through rod 49.

In this way the fan which normally discharges into the room may be caused to discharge out of doors through casing 11.

The structure indicated at 54 as overlying the top 12 and front 19 of casing 11 is the ornamental casing which is simply applied over the casing 11 to conceal the same. It has louvers 55 in vertical planes which overlie the room air discharge, and horizontal louvers 56 which conceal the ports 21 and 24.

The housing 57 of the condenser fan is of the snail shell type and has two entrance eyes 58 and 59 and a double runner 61. The fan discharges through the finned condenser 62 which has shroud plates at its sides, as shown, to confine the air flow. The runner 61 is on the shaft 63 of the main motor 64 which also drives the compressor 65 through multiple V-belts 66 which run on grooved pulleys, as usual.

The compressor draws vaporous refrigerant through suction line 67, discharges it through the high pressure line 68 to condenser 62 in which the refrigerant is liquefied and from which it flows through line 69 to receiver 71.

From the receiver it flows through the automatic expansion valve 72 to the evaporator, through the two branches 73, 74.

As is usual in this art, control means are provided to stop both motors 31 and 64, run motor 31 alone or run both motors 31 and 64. Any switching mechanism permitting such operation can be used and no attempt is made to illustrate electrical connections in the drawings.

Operation can be traced as to air flow in the diagrams, Figs. 5 to 8.

Figs. 5 and 6 show conditioners with both motors running (refrigerative conditioning as in summer). In Fig. 5 the condenser air circuit is from out of doors over the compressor 65 to the fan 61 over the condenser 62 to out of doors. Fig. 6 shows how opening of damper 22 permits fan 61 to draw part of its air from the room.

Fig. 5 shows damper 35 closed and damper 36 giving 100% recirculation and Fig. 6 shows 36 closed and 35 open, giving 100% fresh air. Because of the linkage shown in Fig. 2, damper 36 can be partially closed before damper 35 opens. On humid days when temperature is not high, this setting is advantageous because it retards air flow and thus accents dehumidification at the expense of sensible cooling. The settings of dampers 35 and 36 are interdependent, but damper 22 can be opened and closed at will. It is opened (pump-out setting) to change the air in the conditioned room and should be closed except when this is needed.

Another pump-out setting is possible under summer conditions. With damper 22 open, as shown in Fig. 6, fan 29 can be set to discharge room air outward as shown in Fig. 8. This uses both fans to pump out foul air.

Figs. 7 and 8 show ventilating settings. Fan 61 is not running, the motor 64 being shut down. Damper 22 is maintained closed. In Fig. 7 damper 35 is open and 36 is closed. Damper 46 is in any of its open positions so fan 29 delivers fresh air to the room. Dampers 35 and 36 can be shifted to give desired mixtures of fresh and recirculated air. In Fig. 8 damper 35 is closed and

38 open. Damper 46 is in the closed position of Fig. 4 so that auxiliary damper 52 is open, causing fan 29 to discharge out of doors.

The chief novelty in the present disclosure is the damper arrangement permitting full utilization of each of the two fans. However, there are other important details of arrangement. By connecting fan housing 27 to partition 26 and to the walls of casing 11 and by causing fan housing 57 to discharge through a shrouded condenser 62, it is unnecessary to subdivide casing 11 by elaborate partitions. Partition 26 is the only one required which is distinct from components of the refrigeration circuit and fan housings. This greatly simplifies construction and maintenance and increases accessibility. The space in chamber 25 to the left of filter 32 is available for insertion of accessory apparatus, such as, heater, humidifier, ozonizer, or the like. As the use of such devices has heretofore been known, they are neither claimed nor illustrated here.

The invention is adapted to floor mounted or "console" types of conditioner by modifications of arrangement within the skill of a mechanic. The window sill mounted type has been chosen for illustration because the shorter flow paths and absence of window board connections permit simpler flow diagrams. Basically, the air-flows in the two types are the same and they can be controlled in ways which are functionally identical.

I claim:

1. The combination with an air conditioner including a refrigerative evaporator and a fan for drawing air in contact with said evaporator and discharging it into a room; flow directing means controlling the discharge from said fan, said means being adjustable to vary the direction of discharge into the room and having a limiting position in which such discharge is closed; a normally closed damper controlling a secondary discharge from said fan leading to a point exterior to the room; and means operable by motion of the flow directing means to its closed position and effective in a limited motion range near said closed position to open said auxiliary damper from its normal closed position.

2. In an air conditioner the combination of air circulating means having an air discharge port; a pivoted deflector means controlling flow there-through, said deflector means being angularly adjustable to vary the direction of discharge and being movable to limiting position in which said discharge is closed; a relief damper which when open affords an auxiliary discharge for said air circulating means; means normally maintaining said relief damper closed; and means operable by motion of the deflector means to closed position, and effective in a limited motion range near said closed position to open said relief damper from its normal closed position.

3. The combination with an air conditioning coil, of a fan adapted to draw air in contact with said coil and discharge it into a space to be conditioned; damper means controlling the intake to said fan and arranged to open selectively intakes from the room and from out-of-doors, the parts being so arranged that the room intake will be substantially closed before the out-of-doors

intake starts to open; and means controlling the discharge from said fan and comprising a deflector for controlling the direction of discharge, said deflector being movable to a point at which such discharge is closed; a normally closed auxiliary discharge damper controlling flow to a point external to the room; and means operable by motion of said deflector to said closed position to open said auxiliary damper.

4. The combination of a conditioning coil; a fan for passing air in contact with said coil and delivering such air into a room; and independently operable damper means controlling the intake and discharge to and from said coil and fan, the intake damper means being operable to connect the intake to out-of-doors or to the room selectively and to throttle the room intake and the damper means controlling discharge including a main discharge damper having a flow directing characteristic and shiftable to a limiting closed position, a normally closed auxiliary damper controlling discharge to a point external to the room, and means controlled by the main discharge damper as it reaches closed position serving to open said auxiliary damper.

5. The combination of a room air conditioner of the refrigerative type including a condenser and an evaporator out of heat exchanging relation with one another; a condenser air fan for circulating outside air over the condenser; an evaporator air fan for circulating room air to be conditioned over the evaporator; damper means adjustable to an abnormal position in which it causes the condenser air fan to draw air at least in part from the room; damper means controlling the discharge from the evaporator air fan adjustable between at least two positions and so arranged that in the normal one of said positions it causes the evaporator air fan to discharge into the room, and in the abnormal one of which it causes the evaporator air fan to discharge outside the room; and independently operable damper means controlling flow of air to the evaporator fan and adjustable to cause it to draw air from the room or from out of doors.

6. The combination of a room air conditioner of the refrigerative type including a condenser and an evaporator out of heat exchanging relation with one another; a condenser air fan for circulating outside air over the condenser; an evaporator air fan for circulating room air to be conditioned over the evaporator; damper means adjustable to an abnormal position in which it causes the condenser air fan to draw air at least in part from the room; damper means controlling the discharge from the evaporator air fan adjustable between at least two positions and so arranged that in the normal one of said positions it causes the evaporator air fan to discharge into the room, and in the abnormal one of which it causes the evaporator air fan to discharge outside the room; and independently operable damper means controlling flow of air to the evaporator fan and adjustable to cause it to draw air from the room or from out of doors and to throttle variably flow from the room.

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