

June 21, 1955

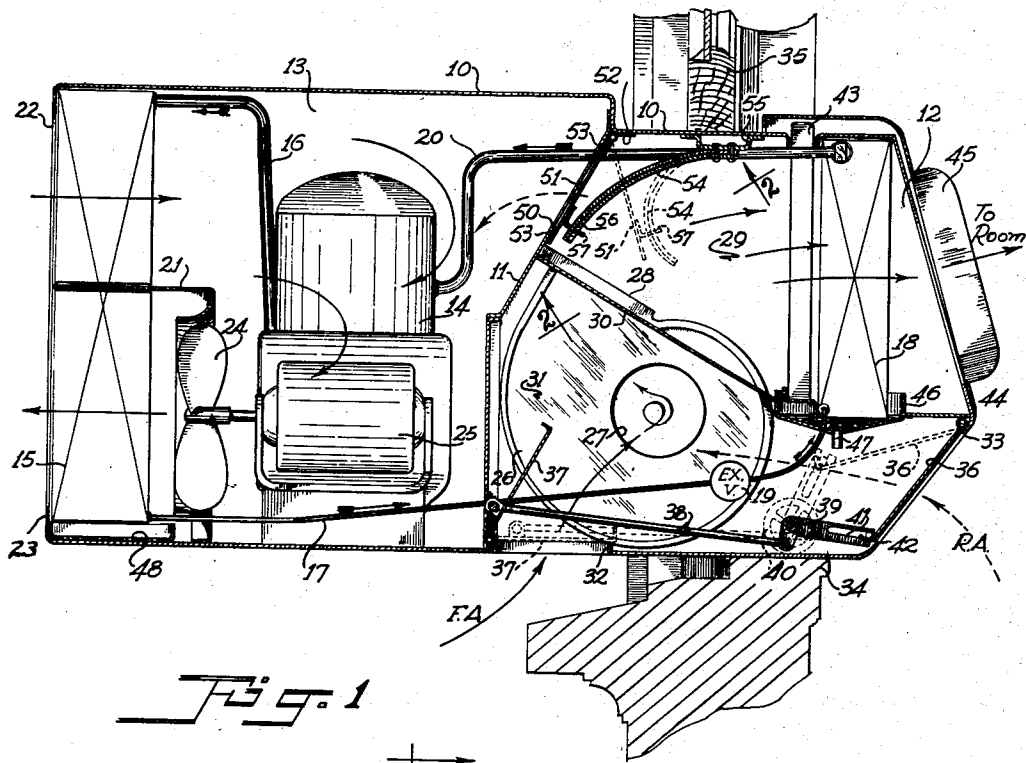
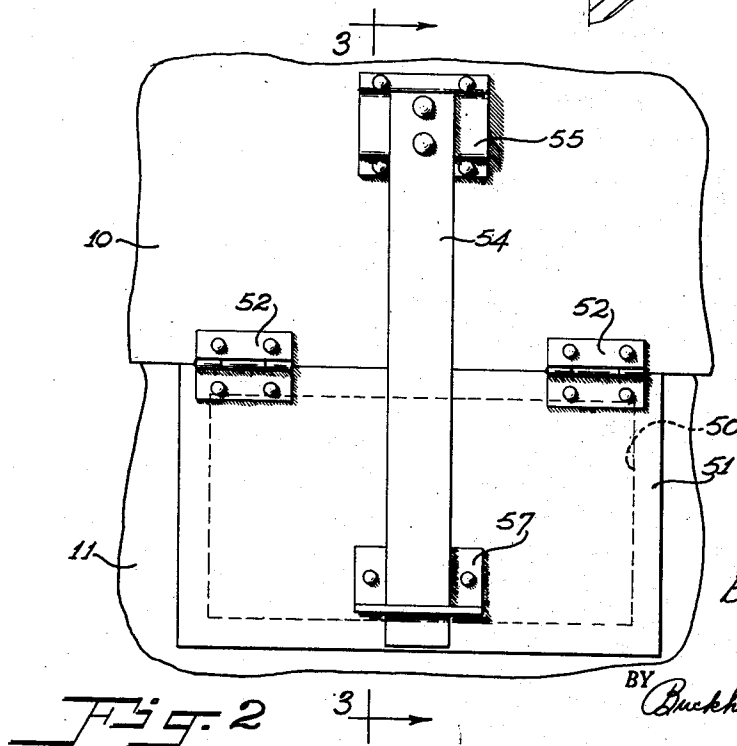
B. W. JEWELL

2,711,080

AIR CONDITIONING UNIT WITH OVERLOAD PROTECTION

Filed Oct. 29, 1951

2 Sheets-Sheet 1



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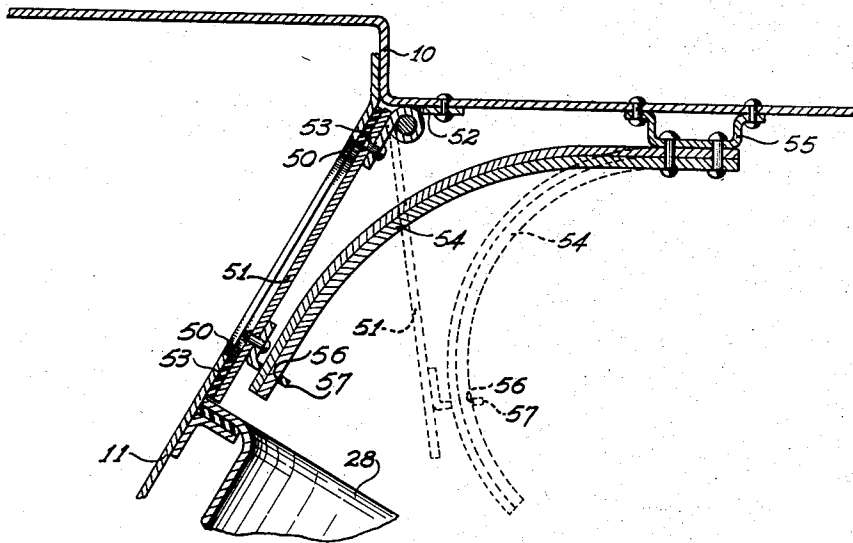


Fig. 3

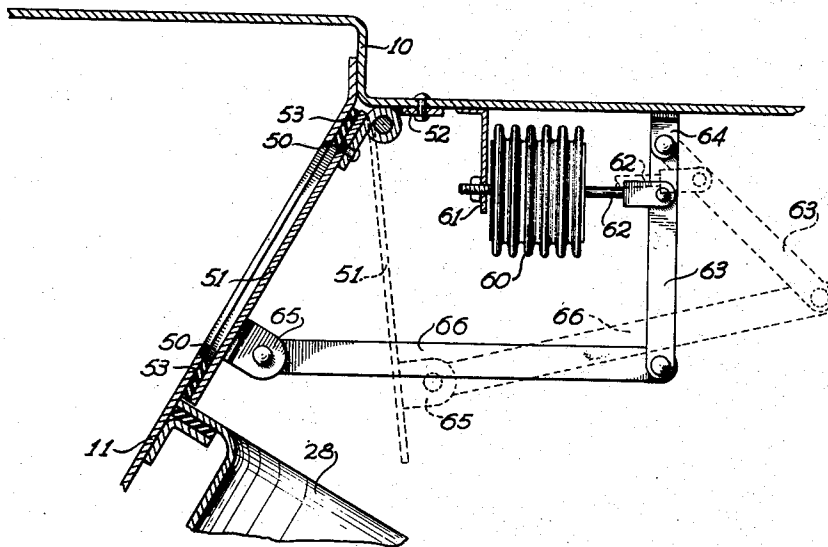


Fig. 4

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AIR CONDITIONING UNIT WITH OVERLOAD PROTECTION

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6 Claims. (Cl. 62—6)

My present invention comprises an improved air conditioning unit of the type adapted to be mounted in a window or other opening in a room. Such units are self-contained, which means in the art, that an entire air conditioning system is contained within the unit. Such systems are usually of the compressor, condenser, evaporator type, the compressor being driven by a motor, either hermetically sealed into a casting with the compressing elements or separately mounted and operatively connected to the compressing elements through a shaft, belt means, or the like. Units of this type are usually provided with partition means forming at least two compartments, one of said compartments being a condensing compartment in which the compressor and condenser are located, and the other of the said compartments comprising an evaporating compartment in which the evaporator is located. The condenser is usually traversed by a stream of exterior air which effects condensing of the hot, compressed gas to a liquid; the liquid then passing through a suitable conduit and orifice means into the evaporator where it expands into a gas at low pressure and low temperature to extract heat from a stream of air caused to traverse the evaporator, the gas then returning to the compressor for recompression. It is customary in such units to have blower means in the evaporator compartment and to provide several air inlet openings in the walls of the evaporator compartment, whereby the air traversing the evaporator may be drawn entirely from the room, or entirely from the exterior, or partially from either space. Likewise, it is customary in such units to provide interconnected dampers arranged to proportion the amount of room air recirculated over the evaporator and the amount of fresh air brought into the evaporating compartment. Such proportioning dampers serve to maintain a constant volume of air traversing the evaporator, the capacity of the blower means being such as to maintain a certain volume of air delivered to the room at a certain speed against the fixed resistance of the evaporator, filter and other elements of the evaporating compartment. A unit of this type is usually advertised at a rated capacity, meaning that it will deliver a stated volume of air at a stated temperature and humidity under conditions which have been selected as standard by the air conditioning industry.

Under normal conditions during the season when the units of this character are employed, the occupant of the room will be satisfied with the unit when the proportioning dampers have been set so as to allow a small proportion of fresh air to enter the unit to keep the atmosphere of the room fresh and clear by replacing normal leakage from the air conditioned space. However, on exceedingly hot or muggy days, or at times when the room air becomes exceedingly stale due to an increase in the number of occupants, some of whom may be smoking, the owner of the unit immediately notices a feeling of discomfort or the fouling of the room air, and attempts to rectify the situation by adjusting whatever adjusting means have been provided. It usually occurs to the owner to adjust the dampers so that the blower draws 100 percent fresh air

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through the conditioning compartment in order to get rid of the stale room air as fast as possible, or to adjust the dampers so that 100 percent recirculated air traverses the conditioning compartment in order to lower the temperature of the room as fast as possible. If the unit draws 100 percent fresh air, the load on the refrigerating system is immediately increased to a maximum, and if the outside temperature is abnormally high the compressor motor may be overloaded. On the other hand, if 100 percent recirculated air traverses the evaporator and the reason for discomfort is overcrowding of the room or relatively high humidity, the compressor motor may likewise be overloaded. Either obvious solution, therefore, has its limitations, hence many manufacturers have placed manually controlled exhaust dampers in such units. In some cases these exhaust dampers are interconnected with the proportioning dampers controlling the inlet to the conditioning compartment. If the exhaust damper is separately controlled, the operator of the unit may adjust its position independently of the proportioning inlet dampers and may accidentally set the exhaust damper correctly; however, this is extremely unlikely since the employer of a room air conditioning unit is not likely to be a refrigeration or air conditioning engineer. If the exhaust damper is interconnected with the proportioning inlet dampers, the best that can happen is that it will be positioned correctly for certain conditions, which conditions may or may not exist at the time when the employer of the unit adjusts the dampers.

In the present invention, it is recognized that the average employer of an air conditioning unit will, most of the time, position the proportioning inlet dampers correctly or nearly so, since it is obvious that if the room air is stale, more fresh air should be drawn in to freshen the stale air, and it is equally obvious that if the outside temperature is exceedingly high, the possibility of lowering the inside temperature would be greater if 100 percent recirculated air were passed over the evaporator. In the present invention, therefore, proportioning inlet dampers are provided which may be adjusted by the user of the unit to suit his taste or desires at the moment. However, if there were no exhaust damper, there would be a strong possibility under some conditions for the compressor motor to be overloaded, thereby causing the usual safety devices to stop the compressor motor and thus defeat the purpose of the unit. The owner immediately becomes annoyed by on-and-off cycling of the unit, his annoyance being partly justified in that cycling causes fluctuating temperatures and other physical discomforts, and partly psychological, since he thinks that the unit is incapable of taking care of the situations for which he purchased it. The present invention, therefore, incorporates an exhaust damper which will automatically compensate for various situations which may arise, this exhaust damper being normally closed but opening in response to increases in temperature of the air traversing the evaporator, the extent of such opening being roughly in proportion to increases in temperature of the air over a certain minimum. The exhaust damper is so arranged as to reduce the amount of air delivered to the evaporator, regardless of whether that air is entirely recirculated air, entirely outside air, or any mixture of both. It will be obvious under these conditions, that if the overloading of the system occurs because the proportioning inlet dampers are permitting too much high-temperature, fresh air to be drawn into the unit, the situation will be automatically corrected by shunting this air right back outside again while permitting a lesser amount of fresh air to emerge from the conditioning compartment at a cooler temperature. Likewise, if overloading of the refrigerating system occurs because of excessive humidity due to overcrowding of the conditioned space while 100 percent recirculated

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air is being treated, the situation will be automatically corrected by exhausting most of this recirculated air and removing latent heat from a small amount traversing the evaporator. In either event, the unit continues to operate, thus removing the psychological factor while the unit continues to exert its best efforts to correct the physical factors.

Accordingly, the principal object of the present invention is to provide an air conditioning unit with thermosensitive exhaust means opening in response to increases in the temperature of the air traversing the conditioning compartment of the unit.

A further object of the present invention is to provide a device of the foregoing character which is simple and inexpensive, eliminating complicated systems of valves, relays and servomotors which have heretofore been used in large conditioning systems, but which are too bulky and expensive to be used in room air conditioners.

The objects and advantages of the present invention will be more readily ascertained by inspection of the following specification, taken in connection with the accompanying drawings wherein like numerals refer to like parts throughout.

In the drawings, Fig. 1 is a schematic view of an air conditioning unit incorporating the present invention;

Fig. 2 is a partial section taken substantially from the plane of the line 2—2 of Fig. 1, the view being on an enlarged scale;

Fig. 3 is a vertical section taken substantially along line 3—3 of Fig. 2; and

Fig. 4 is a schematic illustration of a modified form of the invention.

A preferred form of unit is disclosed in Fig. 1, the unit being schematically set forth with many details eliminated, such details being within the knowledge of those skilled in the art. The unit comprises a housing 10 within which is located partition means 11 dividing the unit into two major compartments, an evaporating compartment 12 and a condensing compartment 13. Refrigerant condensing mechanism is situated in the condensing compartment 13, the same being herein illustrated as comprising a hermetically sealed motor-driven compressing unit 14 connected to an air-cooled condenser 15 through a compressor discharge conduit 16. The condensed refrigerant liquid passes through a liquid conduit 17 into an evaporator 18 located in the evaporating compartment, the liquid being restricted by suitable orifice means such as expansion valve 19. The refrigerant expands to a gas in the evaporator 18 and is returned to the compressor through a suction line 20. The refrigerating mechanism thus schematically illustrated is representative of literally hundreds of variations which are known in the art.

The condensing compartment is provided with at least two openings in the walls thereof, in the present illustration the openings being in the outer end of the housing 10 and separated from each other by a horizontal plate 21 dividing the condenser 15 into two portions, one of which spans the inlet opening 22 and the other of which spans the outlet opening 23 for a stream of cooling air drawn through the condensing compartment by blower means comprising a propeller 24 driven by an electric motor 25.

The evaporating compartment 12 houses a motor-driven blower represented by the scroll housing 26 having an inlet opening 27 in its side and having a rectangular discharge opening 28 directing the air upwardly and forwardly into a pressure chamber 29 defined in part by the housing walls, by an upper portion of the partition means 11, and by auxiliary partition means 30 extending from the partition means 11 forwardly to the front wall of the unit. The space beneath the partition means 30 comprises a suction chamber 31 which is preferably provided with a fresh air inlet opening 32 and a recirculated air inlet opening 33. The unit is usually rested on a window sill indicated at 34 and the movable window indicated at 35 is drawn down onto the top of the unit, the fresh air

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inlet 32 being located so as to lie outside of the conditioned space and the recirculated air inlet 33 inside thereof. In accordance with the previously stated principles, the unit is preferably provided with proportioning inlet dampers comprising a recirculated air damper 36 and a fresh air damper 37 which are interconnected for reverse operation by a linkage comprising a link 38 pivotally connected to the damper 37 and to a crank 39 which is manually controlled by means of a knob 40 or equivalent, there being a second crank 41 having a sliding yoke connection at 42 with the damper 36. The arrangement is such that manipulation of the knob 40 may cause damper 36 to be entirely closed while damper 37 is fully opened, or vice versa, or both dampers to be partially open and permitting a mixture of fresh and recirculated air to be drawn into the suction chamber, at all times the volume of air being substantially equal. The air is forced by the blower means to traverse a replaceable filter 43 and then to traverse the surfaces of the evaporator 18, the conditioned air emerging into a plenum chamber 44 defined in part by the front wall of the housing in which is located outlet means, preferably comprising directional nozzles 45 which may be shifted about to direct the emerging stream or streams of air to suit the desires of the owner. Moisture which is condensed on the surfaces of the evaporator 18 may drain into a pan 46 from which a drain pipe 47 extends, the same being connected by a suitable hose (not shown) to a condensate pan 48 in which the lower end of the condenser 15 is positioned, the condensate being evaporated and carried away with the outgoing stream of air from the condensing compartment 13. It will be recognized by those skilled in the art that the unit as so far described is representative of many different modifications.

In accordance with my invention, I provide an exhaust opening 50 in the portion of the partition means 11 defining a wall of the pressure chamber 29, the same being normally closed by an exhaust damper 51 connected to an upper portion of housing 10 by means of hinges 52. The lower edge of the exhaust damper is closely adjacent the outlet 28 from the blower means 26 and the arrangement is such that the exhaust damper swings across at least a major portion of the airstream so that upon being fully opened, the major portion of the air drawn into the suction chamber 31 is exhausted into the condensing compartment 13 through the exhaust opening 50. Preferably, a gasket 53 is fixed to the edge of the opening 50 so as to seal the opening when the damper is closed and to prevent chattering.

An exhaust damper operating mechanism is provided in accordance with the present invention, the same comprising a thermosensitive member preferably comprising a bimetallic strip 54 having one end anchored in the pressure chamber 29 as by means of a supporting bracket 55 fixed to the housing 10. The bimetallic strip is initially flexed from the position it would assume at ordinary temperatures so as to comprise a leaf spring, the free end of which passes through a guide slot 56 in a bracket 57 fixed to the surface of the damper 51 and thereby exerting resilient pressure against the damper to hold it in closed position. The bimetallic strip is so proportioned as to maintain the damper closed until the temperature of the surrounding air exceeds a certain minimum, such as for example, 90 degrees. As long as the air approaching the evaporator remains below 90 degrees, the compressor motor will not be overloaded in a system designed accordingly. However, if the temperature exceeds 90 degrees in the illustrative example, the bimetallic strip 54 will warp away from the partition means 11, thereby partially opening the damper 51 and relieving the load on the unit by exhausting some of the air drawn into the suction chamber 31. The bimetallic element is preferably so proportioned as to commence opening the damper at a minimum temperature such as 90 degrees and to have the damper open to its fullest extent at a maximum tempera-

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ture such as 110 degrees, and the damper is so related to the outlet from the blower 26 that when fully open, a small amount of the output of the blower still traverses the evaporator 18 to provide a reduced stream of conditioned air. The extent of opening of the damper may constantly vary as conditions within and without the occupied space fluctuate.

The bimetallic strip is illustrative of several well-known forms of thermosensitive operating means which may be employed in this combination, for example, a flexible, metallic bellows filled with an expansible fluid may be utilized, as illustrated in Fig. 4 wherein such a bellows is indicated at 60. One end of the bellows is anchored in the housing as by means of a bracket 61, the free end of the bellows being connected by a link 62 to a lever 63 depending from a pivot 64 mounted in the housing. The free end of the lever 63 is connected to a bracket 65 on the damper 51 by means of a link 66. In this arrangement, if the air passing through the pressure chamber is below the minimum the bellows 60 contracts to exert closing pressure against the damper 51, but when the temperature rises above the minimum the bellows expands and swings the damper open in proportion to the increase in temperature.

The position of the outlet opening 50 is selected so as to have positive air pressure forcing exhaust air from the unit when the damper is open, and the position of the thermosensitive element is selected so as to have it located in the airstream before the air traverses the evaporator 18 but after the entering airstreams have been mixed in the event that both inlet dampers are open. The element is thus responsive to the temperature of the air to be treated under any condition so as to permit employment of thermosensitive means of the most efficient character, such devices usually functioning better at higher temperatures than at lower temperatures. However, the bimetallic or other thermosensitive means may be located elsewhere and still come within the broad aspects of the present invention. For example, if the thermosensitive means were located in the plenum chamber 44, the unit could be made to operate in accordance with my intent, but the range of temperature differences would be less, the characteristics of thermosensitive means would permit of less positive action, and overloading of the compressor motor might occur prior to functioning of the exhaust damper under certain conditions. My invention, however, comprises not only the broad solution to the problem but also the specific location of the various parts of the mechanism.

Having illustrated and described preferred embodiments of the invention, it should be apparent to those skilled in the art that the same permits of other modifications in arrangement and detail. I claim as my invention all such modifications as come within the scope of the appended claims.

I claim:

1. A room air conditioning unit comprising a housing, an air conditioning system of the compressor, condenser, evaporator type mounted in said housing, a partition dividing said housing into an evaporating compartment and a condensing compartment and having an exhaust opening therethrough, the evaporator of said system being located in said evaporating compartment and the compressor and condenser of said system being located in said condensing compartment, a blower in said evaporating compartment arranged to draw air thereinto and to cause the air to traverse the evaporator to be conditioned thereby, a damper for closing said exhaust opening, and means arranged in the path of the air approaching said evaporator for effecting opening of said damper in proportion to the amount by which the temperature of the air exceeds a certain minimum temperature comprising a thermosensitive member, means anchoring one end of said member in said housing, and means connecting the other end of said member to said damper.

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2. A room air conditioning unit comprising a housing, an air conditioning system of the compressor, condenser, evaporator type mounted in said housing, a partition dividing said housing into an evaporating compartment and a condensing compartment and having an exhaust opening therethrough, the evaporator of said system being located in said evaporating compartment and the compressor and condenser of said system being located in said condensing compartment, means for causing a flow of cooling air through said condensing compartment, a blower in said evaporator compartment arranged to draw air thereinto and to cause the air to traverse the evaporator to be conditioned thereby, damper means normally closing said exhaust opening, and means arranged in the path of the air leaving said blower and approaching said evaporator for effecting opening of said damper means when the temperature of the air exceeds a certain minimum temperature comprising a bimetal strip, means anchoring an end of said strip in said housing, and means slidably connecting the free end of said strip to said damper means.

3. A room air conditioning unit comprising a housing, an air conditioning system of the compressor, condenser, evaporator type mounted in said housing, a partition dividing said housing into an evaporating compartment and a condensing compartment and having an exhaust opening therethrough, the evaporator of said system being located in said evaporating compartment and the compressor and condenser of said system being located in said condensing compartment, means for causing a flow of cooling air through said condensing compartment, a blower in said evaporator compartment arranged to draw air thereinto and to cause the air to traverse the evaporator to be conditioned thereby, damper means normally closing said exhaust opening, and means arranged in the path of the air traversing said evaporator for effecting opening of said damper means when the temperature of the air exceeds a certain minimum temperature comprising a bimetal strip, means anchoring an end of said strip in said housing, and means connecting the free end of said strip to said damper means, said strip warping in a direction to close said damper means upon cooling and being proportioned to open said damper means progressively as the temperature of the surrounding air progressively exceeds said minimum temperature.

4. In a room air conditioning unit comprising a housing, an air conditioning system of the compressor, condenser, expander type mounted in said housing, a partition dividing said housing into an evaporating compartment and a condensing compartment, the evaporator of said system being located in said evaporating compartment and the compressor and condenser of said system being located in said condensing compartment, means for causing a flow of cooling air through said condensing compartment, a blower in said evaporating compartment arranged to draw air thereinto and to cause the air to traverse the evaporator to be conditioned thereby; the improvement comprising means providing an exhaust opening from said evaporating compartment on the pressure side of said blower, damper means normally closing said exhaust opening, and thermosensitive means operatively connected to said damper means and located in the path of the air traversing said evaporator for effecting opening of said damper means in response to increases in the temperature of the surrounding air above a minimum temperature.

5. A room air conditioning unit of the type adapted to be mounted in a window or other opening in a room to be conditioned, comprising a housing, first partition means within said housing dividing the housing into two major compartments, one of said compartments constituting an evaporating compartment adapted to project into the room and the other of said compartments constituting a condensing compartment adapted to project out of the room, each of said compartments having air inlet

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and outlet openings, a refrigerating system of the compressor, condenser, expander type mounted in said housing, the evaporator thereof being located in said evaporating compartment and the compressor and condenser thereof being located in said condensing compartment, 5 means in said condensing compartment for moving a stream of outside air in contact with said condenser to cool the refrigerant, a blower mounted in said evaporating compartment and arranged to draw air thereinto and to propel the air in contact with the evaporator and thence 10 into the room, other partition means dividing said evaporating compartment into a suction chamber and a pressure chamber, the inlet to said blower means being located in said suction chamber and the outlet thereof being located in said pressure chamber, said evaporator being located in said pressure chamber, a portion of said 15 first partition means defining a wall of said pressure chamber, said portion having an exhaust opening therethrough, a damper normally closing said exhaust opening, and a

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temperature responsive member located in said pressure chamber operatively connected to said damper, said member being proportioned to hold said damper in closed position when the temperature of the air surrounding the member is below a certain minimum temperature, and progressively to open said damper as the temperature of the air progressively exceeds said minimum temperature.

6. The construction set forth in claim 5, in which said blower comprises a scroll housing having a substantially rectangular outlet, and said damper comprises a hinged plate having its free edge arranged to swing across said outlet.

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