

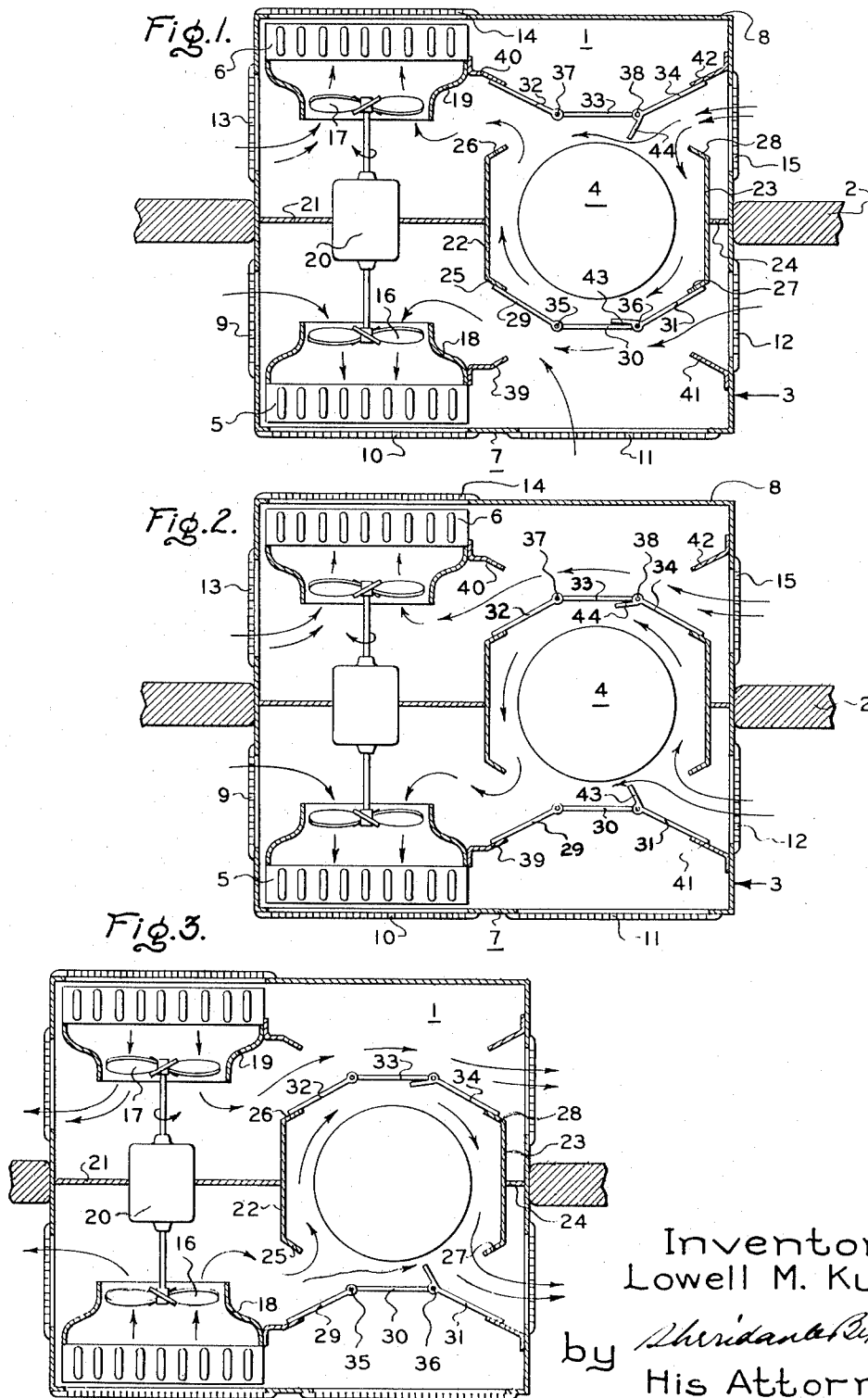
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MULTI-PURPOSE AIR CONDITIONER

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MULTI-PURPOSE AIR CONDITIONER

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My invention relates to air conditioning apparatus and more particularly, to such apparatus which may be used for a number of purposes, for example either to heat, to cool, or to dehumidify air.

In all air conditioning units utilizing a compression type refrigeration system, one of the most serious energy losses is caused by the heat given off by the refrigerant compressor. In multi-purpose units, some use has been made of this compressor heat during air warming operations, but during both air cooling and dehumidifying operations the compressor heat has represented a complete loss. During a cooling operation, the rejection of compressor heat is about all that can be done, but during a dehumidifying operation there is a useful purpose to which the compressor heat could be put. Specifically, in a dehumidifying operation it is ordinarily not desired to cool the room being conditioned and therefore, it is often necessary that some heat be added to the moisture free air leaving the moisture removing means. Heretofore, auxiliary heating means such as electrical coils, etc. have been used to supply the heat but obviously, a more efficient system would be had if the compressor heat could be used for that purpose.

It is, therefore, an object of my invention to provide new and improved air conditioning apparatus in which the compressor heat may be utilized during a dehumidifying operation.

Another object is to provide a new and improved multi-purpose air conditioner in which means are provided for rejecting the compressor heat during the cooling operation and for utilizing such heat during air warming or dehumidifying operations.

A further object is to provide improved air conditioning apparatus in which means are included for selectively placing the refrigerant compressor either in the path of the air to be conditioned or in the path of the air carrying off rejected heat.

In one preferred method of carrying my invention into effect, I provide an air conditioning unit in which a pair of heat exchangers and a compressor are connected in a reverse cycle type refrigerant circuit allowing interchange in the function of the heat exchangers. I mount this circuit with all its elements in a single casing that includes both a plurality of openings leading into the room to be conditioned and a plurality of openings leading into the outside atmosphere. Further mounted in the casing are a pair of blower means, one of which creates a flow of the outside air through one portion of the casing and one of the heat exchangers, and the other of which creates a flow of the room air through another portion of the casing and the other heat exchanger. A partition means is mounted in the casing to separate the two air flows; and, in accordance with my invention, adjustable baffle means are provided whereby either one of the air flows may be directed over the compressor so as to pick up its heat. Thus, during a warming or a dehumidifying operation, the room air to be conditioned is passed over the compressor whereas

in a cooling operation the outside air is passed over the compressor. In other words, during a warming or dehumidifying operation, the compressor heat is utilized to warm the air to be conditioned whereas during a cooling operation, the compressor heat is effectively removed from the casing without adding any appreciable warmth to the conditioned air.

The novel features which I believed to be characteristic of my invention are set forth with particularity in the appended claims. My invention, however, both as to its organization and method of operation may best be understood by reference to the following description taken in conjunction with the accompanying drawings in which:

Fig. 1 is a schematic view, partially in section, of a preferred embodiment of my new and improved air conditioning unit;

Fig. 2 is a view similar to Fig. 1 but showing the air conditioning unit adjusted for an air warming operation rather than an air cooling operation;

Fig. 3 is another schematic view partially in section, but showing the air conditioning unit adjusted for a dehumidifying operation.

Referring now to Fig. 1, I have shown therein an air conditioning unit 1 of the type adapted to be placed in the wall 2 lying between the room to be conditioned and the outside atmosphere. This air conditioning unit includes a casing 3 in which are mounted a compressor 4 and a pair of heat exchangers 5 and 6 connected in series connection. Heat exchanger 5 is positioned within the portion 7 of casing 2 protruding into the room while heat exchanger 6 is positioned in the portion 8 of the casing protruding into the outside atmosphere.

Both the outside and the room portions of the casing include a plurality of openings or apertures which connect the inside of the casing to the surrounding atmosphere. Thus, inner or room casing portion 7 includes the openings 9, 10, 11, and 12 while the outer casing portion 8 includes the openings 13, 14 and 15. More specifically, apertures 9 and 12 are positioned in the opposite side walls of casing portion 7, while apertures 10 and 11 are positioned in the end wall thereof. Similarly, in outside casing portion 8 apertures 13 and 15 are positioned in the opposite side walls while aperture 14 is positioned in the end wall.

In order for the air conditioner to operate properly, it is necessary that a positive flow of air be passed through each of the two heat exchangers and for that purpose heat exchanger 5 is positioned directly in front of opening 10 and heat exchanger 6 is positioned directly in front of opening 14. Further, fans or blowers 16 and 17 are positioned respectively adjacent heat exchangers 5 and 6, and shells 18 and 19 are provided respectively to channel the flow from fan 16 through heat exchanger 5 and the flow from fan 17 through heat exchanger 6. These fans or blowers are driven by reversible means, as for example, the electric motor 20, so that they may be used to pass air through the heat exchangers in either direction.

To separate the flow of air through heat exchanger 5 from that through heat exchanger 6, a partition 21 is supplied which extends from one side wall of the air conditioner to a point about half way across the air conditioner. The exact point of termination of this partition 21 is not crucial, however. Butted against the end of partition 21 so as to form a T, is a second partition member 22, and spaced from this partition member 22 and extending parallel thereto is still another partition member 23. The partition 23 is itself joined to the opposite side wall of the compressor by a short partition 24.

The compressor 4 is positioned between the partitions 22 and 23 and both of these members include inclined end portions which extend toward the compressor so as to

further enclose it. Thus partition 22 is provided with inwardly extending portions 25 and 26 and partition 23 is provided with end portions 27 and 28. However, neither the oppositely disposed end portions 26 and 28 on the outer side of the compressor nor the opposing ends 25 and 27 on the room side of the compressor make contact with each other, so that there is thereby formed a separate passage on each side of the casing through which air may reach the compressor. In other words, partitions 22 and 23 define around compressor 4 an open ended compartment which communicates with both portions 7 and 8 of the casing.

Now, within casing portion 7 it should be noted that partitions 21 and 22 cooperate with the casing walls to form an incomplete compartment around heat exchanger 5. Similarly, within casing portion 8 the same two partitions and the casing walls define a compartment partially enclosing heat exchanger 6. But both of these heat exchanger compartments contain openings through which air may pass toward the compressor compartment. In fact, these openings together with those in the compressor compartment comprise a very important aspect of my invention for they provide a passageway whereby the flow of air through either heat exchanger may be passed around the compressor so as to pick up the compressor heat.

Thus, in accordance with my invention, I have provided adjustable baffle means whereby either of the openings to the compressor compartment may be opened or closed to the flow of air. More specifically, to close the opening between ends 25 and 27, I have provided a structure comprised of the baffles 29, 30 and 31, and to close the opening between ends 26 and 28, I have provided a structure comprised of the baffles 32, 33 and 34. With respect to the first mentioned structure, the center baffle 30 is stationary whereas the end baffles 29 and 31 are adapted to swing in a horizontal plane. For example, they may be pivoted to baffle 30 as by pins 35 and 36. Similarly in the outer baffle structure, the center baffle 33 is stationary and the end baffles 32 and 34 are mounted for pivotal movement, for example by pins 37 and 38. Thus, on the room side of the compressor compartment the baffles 29 and 31 may swing inwardly to contact the partition ends 25 and 27 to close the opening therebetween; and on the outer side, the baffles 32 and 34 may swing inwardly to contact the ends 26 and 28 to close the opening therebetween. In other words, it may be said that the compressor compartment contains a pair of movable walls, either or both of which may be adjusted to provide an opening into the compartment.

In order to fully open the passageways to the compressor, it is necessary that the various movable baffles or walls be swung to an outward position. To terminate the outward movement of the movable baffles, I have provided a plurality of stops or partition members 39, 40, 41 and 42, the stops 39 and 40 being mounted respectively on the fan shells 18 and 19 and the stops 41 and 42 being mounted on the right-hand side wall of the casing (as viewed in Fig. 1). When the baffles 29 and 31 and the baffles 32 and 34 are swung outwardly to contact their respective stops, they close off the spaces lying between them and the casing wall. In the outer casing portion, this merely creates a dead air space but in the inner casing portion, the opening 11 is effectively blocked off. The manner in which opening 11 is blocked off may be best seen in Fig. 2.

It should also be noted that at their ends adjacent the compressor, the movable baffles 31 and 34 are respectively provided with inclined fins 43 and 44. When these baffles are swung to their outward positions, fins 43 and 44 extend inwardly toward the compressor so as to somewhat block off the passages between the stationary baffles and the compressor. More specifically, when baffle 31 is moved outwardly against stop 41, fin 43 partially blocks off the passage between compressor 4 and baffle 30 whereas, when baffle 34 is swung outwardly against stop 42, fin

44 partially blocks off the passage between baffle 33 and compressor 4. The purpose of this blocking off of the passageways will be explained hereinafter.

In operation, air conditioner 1 may be used as either a cooling means, a heating means, or a dehumidifying means. For that purpose, compressor 4 and heat exchangers 5 and 6 are connected in a reverse cycle refrigeration system so that either heat exchanger can be used as an evaporator or as a condenser. More specifically, heat exchangers 5 and 6 may be connected in the refrigerant circuit in any suitable manner so that their functions may be interchanged. In other words, they are so connected so that in one position of a circuit controller, heat exchanger 5 serves as an evaporator and heat exchanger 6 as a condenser whereas in another position of the circuit controller, heat exchanger 5 serves as a condenser and heat exchanger 6 as an evaporator.

Specifically, when the unit is to be used as a room cooler, heat exchanger 5 serves as an evaporator and heat exchanger 6 serves as a condenser. In the room cooling operation, heat is removed from the room air by heat exchanger 5 and heat is, in turn, removed from the refrigerant system by the heat exchanger 6. To insure sufficient heat transfer, fans 16 and 17 are rotated so as to force an air flow through each of the two heat exchangers. Thus, as shown in Fig. 1, fan 16 pulls in air through openings 9, 11 and 12 and pushes it outwardly through heat exchanger 5 and aperture 10; and fan 17 pulls in air through apertures 13 and 15 and pushes it outwardly through heat exchanger 6 and aperture 14.

In this room cooling operation, it is of course desirable that the heat of the compressor be carried off to the outside air and not passed into the room air. Therefore, I have positioned my air directing baffle means as shown in Fig. 1, so that a portion of the flow of the outside air set up by fan 17 passes around and in contact with the compressor, whereas the flow of room air set up by fan 16 is effectively blocked off from the compressor. By swinging baffles 32 and 34 against their stops 40 and 42, a passageway is completed whereby the outside air entering through the aperture 15 is passed around the compressor before it enters the fan 17. The fin 44 partially blocks off the passage on the baffle 33 side of the compressor so that most of the outside air flows around the room or baffle 30 side of the compressor. This air flow around the compressor picks up most of its heat so that very little of it passes inwardly into the room.

Since the room side baffles 29 and 31 are swung inwardly against the partition ends 25 and 27, the room air entering through apertures 11 and 12 cannot touch the compressor but rather must pass through fan 16 without picking up any of the compressor heat. As this room air leaves fan 16 and passes through heat exchanger 5, now serving as an evaporator, it is of course cooled so as to condition the room. Conversely, the outside air passing through heat exchanger 6, now serving as a condenser, picks up its heat and thereby cools the refrigerant. Thus, all the excess heat given off by the system both at the compressor and at the condenser is passed outwardly from the conditioner so that little, if any, of the lost heat may enter the conditioned room or space. By passing a stream of outside air around the compressor and then blowing this air together with additional outside air outwardly through the condenser, I have provided a system whereby the conditioned air is effectively isolated from the heated parts of the air conditioner.

Turning now to Fig. 2, I have shown my new and improved air conditioner set up for use as a heating means. In this heating operation, the connections to the heat exchangers 5 and 6 are reversed so that heat exchanger 5 now serves as the condenser and heat exchanger 6 serves as the evaporator. Fans 16 and 17 are, however, rotated in the same direction as when the unit was used as a room cooler, so that, as before, a flow

5

of room air is set up outwardly through heat exchanger 5 and a flow of the outside air is set up outwardly through heat exchanger 6. The room air passing through heat exchanger 5 picks up heat to warm the room whereas the outside air passing through heat exchanger 6 gives off heat to warm the refrigerant passing through this element.

Now, in this operation it is desirable that the heat given off by the compressor also be utilized to warm the room air; and thus in accordance with my invention I have positioned my movable baffle means so that a portion of the room air passes around the compressor. Thus, the room side baffles 29 and 31 are swung outwardly against their stops while the outer baffles 32 and 34 are swung inwardly against partition ends 26 and 28. This provides a path for the room air entering through aperture 12 to flow over and around the compressor before it enters heat exchanger 5. Fin 43, projecting outwardly from baffle 31 encourages almost all the air to flow to the outer or baffle 33 side of the compressor 4 as it passes therearound. The baffles 32, 33 and 34, however, prevent any intermingling of the room air with the outside air. Thus, in accordance with my invention, the heat from the compressor 4 aids the heat from heat exchanger 5 in warming the room air.

It should be particularly noted that in order to convert the preferred embodiment of my new and improved air conditioning means from a cooler to a heater, it is only necessary to reverse the refrigerant flow and to swing two sets of baffles into different operating positions.

In Fig. 3, I have shown this preferred air conditioning unit set up for use as a dehumidifier where it is desired to condense the moisture from the room air without cooling the room. Here again, the heat exchangers are connected in a refrigerant circuit so that heat exchanger 5 serves as an evaporator and heat exchanger 6 serves as a condenser. The directions of rotation of fans 16 and 17, particularly fan 16, are reversed, however, so that air is pulled inwardly through the two heat exchangers, particularly exchanger 5, and then passed outwardly through the side apertures. In other words, outside air is pulled in through aperture 14 and heat exchanger 6 and passed outwardly through apertures 13 and 15. Likewise, the room air is pulled in through aperture 10 and heat exchanger 5 and is passed outwardly through apertures 9 and 12.

In order to utilize the compressor heat during this dehumidifying operation, the baffles 32 and 34 are again swung inwardly against the partition ends 26 and 28 and the baffles 29 and 31 are moved outwardly against their stops 39 and 41. This, of course, places compressor 4 in the flow path leading from fan 16 to aperture 12 and fin 41 by protruding inwardly toward the compressor insures that most of the air flowing in this path will circle around the outside of the compressor rather than merely passing between it and baffle 30.

As the room air is drawn through heat exchanger 5, it is of course cooled, and thereby most of the moisture contained in it is condensed. But all of this air dare not be passed directly back to the room, for if such were done it would cause an undesired cooling of the room. Therefore, in accordance with my invention, a large portion of the flow is passed around the compressor 4 in the manner described above. This allows the compressor heat to warm this air so that it may be passed back into the room without substantially reducing room temperature. Although some of the cool dehumidified air leaving heat exchange 5 is passed directly into the room through aperture 9, the heat picked up by the air leaving through aperture 12 is sufficient to prevent any appreciable cooling of the room. By utilizing the compressor heat in this manner, the necessity for auxiliary heating means is obviated so that no electric coils, etc. need be provided to warm the dehumidified room air. The heat picked up

6

in heat exchanger 5 is, of course, given off to the outside air flowing through heat exchanger 6.

Now in my preferred embodiment I have shown both blowers or fans 16 and 17 driven by a single motor so that both are reversed in direction during the dehumidifying operation. This, of course, causes both the room and the outside air flows to be reversed through their respective heat exchangers. However, if desired, the fans may be driven by separate motors, and in that case only the motor driving the room air fan 16 necessarily need be reversible. The unit will operate quite satisfactorily as a dehumidifier with the outside air passing outwardly rather than inwardly through heat exchanger 6, the same as it does during the cooling and air warming operations. In other words, the motor driving outside air fan 17 could rotate in the same direction during all of the three different operations of the unit.

In any case, no matter how many motors are used, my new and improved air conditioner may be readily adjusted, in accordance with my invention, to operate either as a room cooler, as a room heater, or as a dehumidifier. Its operation in these latter two instances is particularly efficient for in them, the waste heat given off by the compressor is utilized for a useful purpose. In other words, in the latter two operations, the compressor heat is used to warm the conditioned air. Moreover, the means I use to accomplish this result are so simple and inexpensive that they cause practically no cost increase over the air directing means heretofore used in less flexible air conditioning units. But, it should, of course, be understood that I do not wish to restrict my invention to the particular baffle structure which I have shown and described for it is obvious that various other adjustable baffle configurations could be used to accomplish the desired result. Nor is my invention limited to the particular type air conditioner described, for it is obvious that my air directing means may be adapted to any air conditioner utilizing a compression type refrigerant circuit.

Thus, while in accordance with the patent statutes I have described what at present is considered to be the preferred embodiment of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention and it is, therefore, aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In an air conditioning unit of the type adapted to be placed in a wall between the room to be conditioned and the outside atmosphere, a casing having a plurality of openings leading into said room and a plurality of openings leading into said outside atmosphere, a pair of heat exchangers and a compressor mounted in said casing, a first blower means mounted in said casing for creating a flow of outside air through one of said heat exchangers and back to said outside atmosphere, a second blower means mounted in said casing for creating a flow of the room air through the other of said heat exchangers and back to said room, partition means mounted in said casing for effectively separating said air flows, and adjustable baffle means mounted in said casing for selectively directing either one of said air flows over said compressor thereby to allow the heat of said compressor to be absorbed by the selected one of said air flows.

2. In an air conditioning unit of the type adapted to be placed in wall between the room to be conditioned and the outside atmosphere, a casing having a plurality of openings leading into said atmosphere and a plurality of openings leading into said room, a pair of heat exchangers and a compressor mounted in said casing, a blower for creating a flow of the outside air through one of said heat exchangers and back to said outside atmosphere, a second blower for creating a flow of the room air through the other of said heat exchangers and back to said room, motor means for driving said blowers including means for

7

reversing the direction of rotation of said second blower and thereby the direction of the room air flow, partition means mounted in said casing for effectively separating said air flows, and adjustable baffle means for selectively directing at least a portion of either one of said air flows over said compressor thereby to allow the heat of said compressor to be absorbed by said portion of the selected air flow.

3. An air conditioning unit comprising a casing provided with a plurality of compartments, a pair of heat exchangers and a compressor each mounted in a separate one of said compartments, means connecting one of the heat exchanger compartments to the room to be conditioned and the other of the heat exchanger compartments to the outside atmosphere, a first blower for passing a flow of the room air through one of said heat exchangers and the compartment thereof and back to said room, a second blower for passing a flow of the outside air through the other of said heat exchangers and the compartment thereof and back to said outside atmosphere, motor means for driving said blowers including means for reversing the direction of rotation of said first blower and thereby the direction of the room air flow, and adjustable baffle means for selectively connecting either one of said heat exchanger compartments to the compressor compartment thereby to pass at least a portion of the air flowing in the selected heat exchanger compartment through said compressor compartment.

4. An air conditioning unit comprising a casing provided with a plurality of compartments with one of said compartments including a pair of movable walls, a compressor mounted in said one compartment, a pair of heat exchangers each mounted in a separate one of the other compartments, means connecting one of the heat exchanger compartments to the room to be conditioned and the other of the heat exchanger compartments to the outside atmosphere, a first blower means for passing a flow of the room air through one of said heat exchangers and the compartment thereof and back to said room, a second blower means for passing a flow of the outside air through the other of said heat exchangers and the compartment thereof and back to said outside atmosphere, motor means for driving said blowers including means for reversing the direction of rotation of said first blower means

8

and thereby the direction of said room air flow, and means for adjusting said movable walls to selectively connect the compressor compartment to either one of said heat exchanger compartments, thereby to allow the air flow through the connected heat exchanger compartment to also pass through said compressor compartment to absorb the heat of said compressor.

5. In an air conditioning unit, a casing provided with a plurality of compartments, a pair of heat exchangers and a compressor each mounted in a separate one of said compartments, means connecting one of the heat exchanger compartments to the room to be conditioned, a blower means for passing a flow of room air through said one compartment and the heat exchanger therein and back to said room, and adjustable baffle means for optionally connecting the compressor compartment to said one compartment thereby to direct at least a portion of said room air flow through said compressor compartment and over said compressor to absorb the heat of said compressor.

6. In an air conditioning unit, a casing provided with a plurality of compartments, a pair of heat exchangers and a compressor each mounted in a separate one of said compartments, means connecting one of the heat exchanger compartments to the room to be conditioned, a reversible blower means for passing a flow of room air in either direction through said one compartment and the heat exchanger therein and back to said room, and adjustable baffle means for optionally connecting the compressor compartment to said one compartment thereby to direct at least a portion of said room air flow through said compressor compartment and over said compressor to absorb the heat of said compressor.

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