United States Patent

Harrison et al.

[15] **3,640,087**

[45] **Feb. 8, 1972**

[54] FROST-ANTICIPATING BIMETAL CONTROL FOR AN AIR CONDITIONER

[72] Inventors: **Bobby G. Harrison**, Evansville; **Charles D. Esche**, Newburgh, both of Ind.

[73] Assignee: **Whirlpool Corporation**

[22] Filed: **May 8, 1970**

[21] Appl. No.: **35,611**

[52] **U.S. Cl.** **62/227**, 62/262

[51] **Int. Cl.** **F25b 1/00**

[58] **Field of Search** 62/227, 262, 180, 186, 215

[56] **References Cited**

UNITED STATES PATENTS

3,293,875	12/1966	Kelly	62/180
3,194,027	7/1965	Prendergast	62/262
3,411,311	11/1968	Wegman	62/180

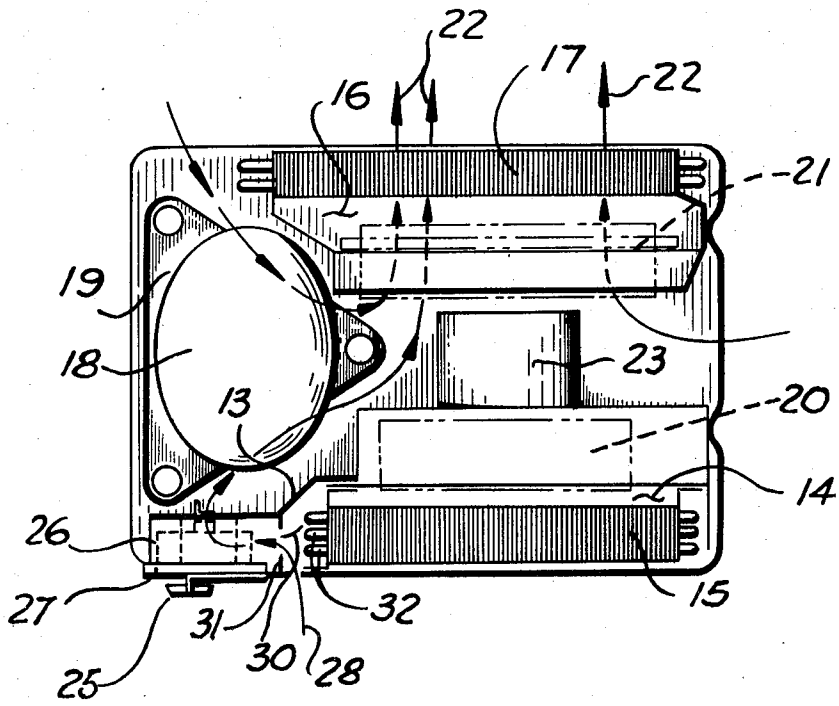
Primary Examiner—Meyer Perlin

Attorney—James S. Nettleton, Thomas E. Turcotte, Burton H. Baker, Gene A. Heth, Franklin C. Harter, Anthony Niewyk, Robert L. Judd and Hofgren, Wegner, Allen, Stellman & McCord

[57] **ABSTRACT**

An air conditioner for cooling room air having a separate electrical apparatus compartment within the air conditioner housing completely enclosing a temperature responsive device such as a bimetal thermostat element within the compartment. Means are provided for establishing a subsidiary flow path for room air over the thermostat and separate from the main room airstream that is directed over the air conditioner evaporator. The subsidiary airstream is directed through the electrical apparatus compartment in heat exchange relation with the temperature-responsive device and then to the exterior of the room rather than being returned to the room. In a preferred embodiment an end portion of the evaporator is arranged in the subsidiary air flow path in heat exchange relationship with the subsidiary airstream so as to effect the temperature of this air. Frost buildup on the air conditioner evaporator is anticipated by a lowering evaporator temperature which is reflected at the unit thermostat as a result of room air passing over the end portion of the evaporator in its passage to the thermostat.

9 Claims, 3 Drawing Figures



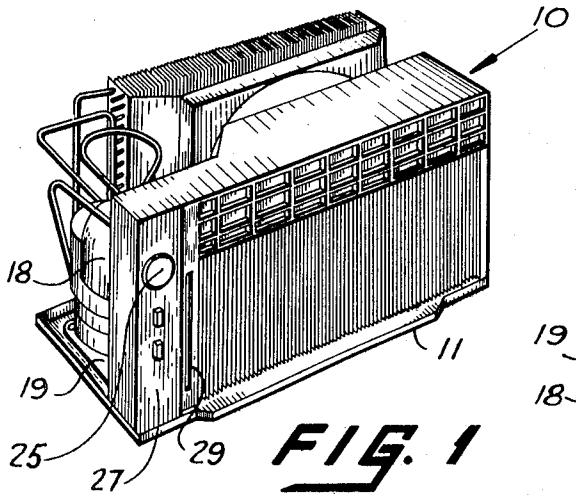


FIG. 1

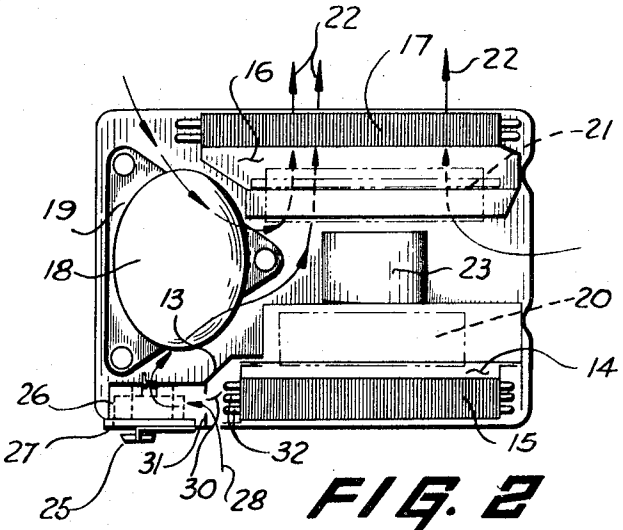


FIG. 2

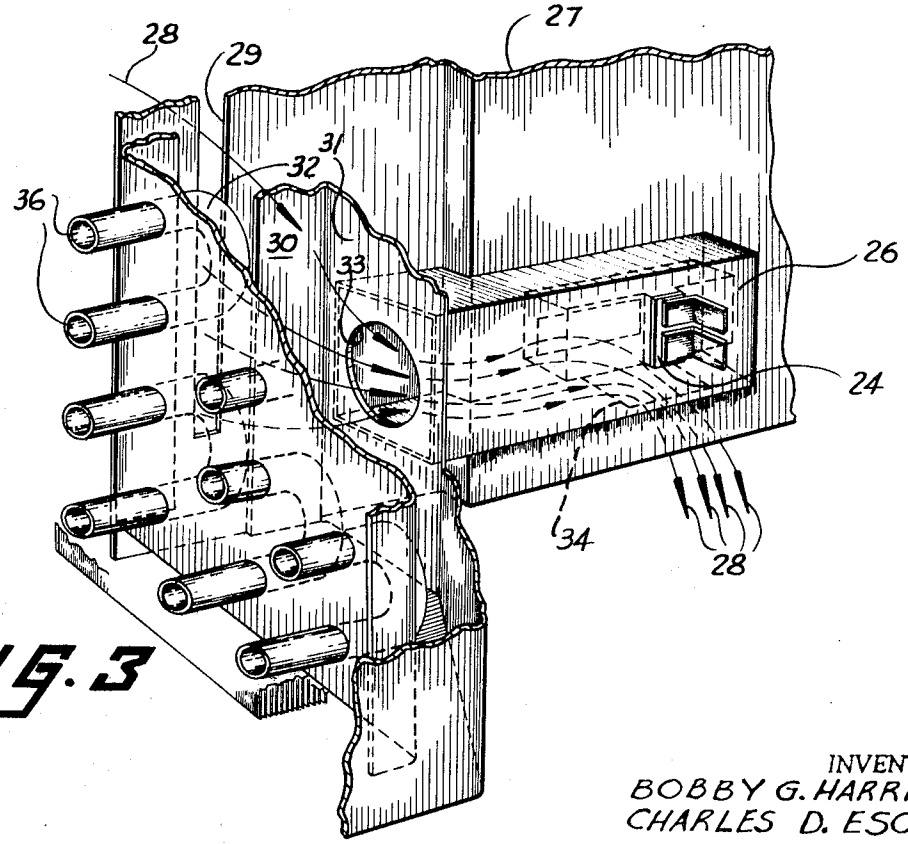


FIG. 3

INVENTORS
BOBBY G. HARRISON
CHARLES D. ESCHE

BY Hodgson, Sturges, Oldham, Fellows & Clifford
ATTORNEY

FROST-ANTICIPATING BIMETAL CONTROL FOR AN AIR CONDITIONER

BACKGROUND OF THE INVENTION

In air conditioners for cooling room air particularly of the small self-contained type such as are widely positioned in windows or in specially prepared openings in apartment walls the operation of the conditioner is customarily controlled by an adjustable temperature-responsive device. The temperature-responsive portion of the device is normally positioned in the room airstream before this stream is directed through the evaporator as by a motorized blower. Because of this location of the temperature-responsive portion it is readily accessible to the user especially when he is cleaning or replacing the customary air conditioner air filter.

Because of this ready accessibility it is customary that the temperature-responsive portion be a fluid expansion bulb or similar device that does not carry electric current in order that the conditioner will be safe for the ordinary user. This type of temperature control with the remote temperature-sensing fluid expansion bulbs or the like is relatively expensive relative to a simple bimetal thermostat. However, heretofore it was felt that such a bimetal could not be used because it is current carrying and therefore could cause electrical shock to the user coming in contact with it.

Various attempts have been made to solve this problem and these attempts have usually been to locate the bimetal temperature sensor in a remote protected area so as to avoid accidental contact by the user. Then room air is directed over the bimetal in this remote area. This has not been very successful, however, because it is difficult to achieve sufficient airflow to accurately reflect room temperature and this does not solve the problems caused by evaporator icing during use of the air conditioner particularly under high humidity conditions.

SUMMARY OF THE INVENTION

In the present invention the temperature-responsive portion of the thermostat which in a specific embodiment is a current-carrying bimetal thermostat is located in a separate compartment in the air conditioner housing and passages are provided to and from the interior of the compartment where the bimetal is located so that the compartment protects the temperature-responsive bimetal from accidental contact. Means are provided for establishing a subsidiary stream of room air separate from the main room airstream normally directed through the evaporator and flowing this subsidiary stream through the compartment in heat exchange relation with the temperature-responsive device. After leaving the compartment the subsidiary airstream is directed to the exterior of the room rather than back into the room itself. In a preferred embodiment this subsidiary airstream is directed by flow means in contact with a portion of the evaporator so as to be effected by the temperature thereof before flowing over the temperature responsive device in the compartment.

THE DRAWINGS

FIG. **1** is a perspective view of an air conditioner of the room type embodying the invention but with the rear enclosing casing omitted.

FIG. **2** is a plan view of the air conditioner of FIG. **1** with the principal streams of airflow that are important to this invention illustrated by arrows.

FIG. **3** is an enlarged fragmentary perspective view partially broken away for clarity of illustration and looking from the interior of the conditioner toward the front wall thereof.

DESCRIPTION OF THE ILLUSTRATED EMBODIMENT

The air conditioner **10** shown in the accompanying drawings includes a supporting base **11**, a vertical wall **13** defining a first chamber **14** containing a refrigerant evaporator **15** and a second chamber **16** containing a refrigerant condenser **17**. As is customary, the refrigeration unit in addition to the evaporator and condenser contains a motor driven compressor **18** supported on a base **19**.

As is customary in air conditioners of this type room air is withdrawn from the room and forced back into the room over the evaporator **15** for chilling by a blower **20**. Air from the exterior of the room is drawn into the housing **12** and exhausted back to the exterior by a second blower **21** as indicated by the airflow arrows **22**. This airflow **22** serves to cool the refrigerant flowing through the condenser **17** and thus dissipate the heat extracted from the room air in the evaporator **15**. Both blowers **20** and **21** are driven by a single electric motor **23** as is customary.

In order to cycle the compressor **18** on and off as required by the temperature of the room air there is provided a bimetal thermostat **24** that can be set to a desired temperature control condition in a customary manner as by a control knob **25**. This thermostat constitutes a temperature-responsive device and is located in its own compartment **26** which in the illustrated embodiment is at one end of the evaporator **15** and immediately behind the front panel **27** of the air conditioner.

In order to detect the temperature of the room air for controlling the operation of the compressor **18** and thus of the refrigeration unit, there is provided means for establishing a subsidiary stream of room air indicated by the arrows **28** through the compartment and in contact with the bimetal **24**.

In the illustrated embodiment this subsidiary room airstream **28** flows from the room through a front vertical airflow metering slot **29** in the front panel **27** into an entranceway **30** that leads to the compartment **26**. This entranceway is defined by the front panel **27** and a rearwardly extending wall **31** which is positioned adjacent but spaced from the one end tubular return bends **32** of the evaporator coil **15**.

As can be seen from both FIGS. **2** and **3** the compartment **26** which is a separate enclosure has an entrance opening **33** into which the subsidiary airstream **28** flows and an exit **34** on the bottom of the compartment **26** through which this air exhausts after contacting the bimetal elements **24**. This exhaust air is directed by the opening **34** into the front of the condenser chamber **16** and the air is then exhausted to the exterior by being drawn by the suction in this second chamber created by the condenser fan **21**. Thus the airflow **28** is as indicated because the air pressure within the condenser chamber **16** is lower than that in the room with the result that the subsidiary airstream is not returned to the room but exhausted therefrom by way of the condenser **17**. Because a low pressure is also created in the evaporator chamber **14** by the evaporator fan **20** it is necessary to isolate both the compartment **26** and the entranceway **30** from the evaporator chamber. If there is any substantial amount of air leakage the airflow across the bimetal would be in a reverse direction and would therefore indicate a false temperature condition that would not reflect room temperature.

In order that the bimetal element **24** will anticipate cold evaporator temperatures the subsidiary airstream **28** is directed in contact with an end portion of the evaporator **15**. In the illustrated embodiment this is accomplished by having the evaporator return bends **32** of evaporator tubes **36** located in the entranceway **30** between the metering slot **29** and the circular entrance opening **33** to the bimetal containing compartment **26**. As the subsidiary room airstream **28** contacts the return bends **35** of the evaporator the air is immediately chilled and it is in this chilled condition when it enters the compartment **26**. In the event the evaporator **15** begins to clog due to frost buildup the airflow through the evaporator set up by the blower **20** decreases because of the resistance to airflow by the accumulating frost. The evaporator tubes **36** themselves immediately become colder which of course also makes the return bends **32** colder. Because of this the temperature of the subsidiary airstream **28** is reduced before it contacts the bimetal thermostat element **24**. When the temperature of the air reaches the preselected point the thermostat switch opens deenergizing the compressor **18** and stopping the refrigera-

tion. However, as is customary, the fan motor **23** continues to operate and as the room air is relatively warmer than the evaporator the frost buildup is melted and the evaporator warmed. Then, as the subsidiary airstream **28** becomes warmer due to the reduced refrigerating effect of return bends **32** the thermostat again closes to resume refrigeration.

The airflow metering slot **29** is used to provide sufficient subsidiary room air so that the cooling effect of the evaporator return bends **32** will neither be too great nor insufficient in view of the much greater volume of room air that is directed through and over the evaporator **15**. The size of this slot varies with the different sizes of air conditioners and thus the cooling effect achieved. The size of the metering slot **29** will also be affected by the degree of pressure differential between the room air within the first chamber or the cold side and the air in the warm side of the wall **13** or within the second chamber **16**. In a specific example for a room air conditioner with a 5,000 BTUH cooling capacity the metering slot **29** was 7.75 inches long and 0.125 inch wide.

Having described the invention, the embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In an air conditioner for cooling room air passing therethrough including a housing having a first chamber therein communicating with said room air and a second chamber communicating with air on the exterior of the room, a refrigeration unit comprising an evaporator in said first chamber and a refrigerant condenser in said second chamber, and means for circulating room air in a main stream from the room, in heat exchange relationship with said evaporator, and back to the room, the improvement comprising: means defining a compartment in said housing; a temperature responsive device in said compartment for controlling operation of said refrigeration unit; and means for establishing a subsidiary stream of room air through said compartment in heat exchange relation with said temperature-responsive device and then to said exterior.

2. The air conditioner of claim **1** wherein said subsidiary airstream is in heat exchange relationship with a portion of said evaporator for cooling said subsidiary air stream prior to heat exchange relationship with said temperature responsive device.

3. The air conditioner of claim **1** wherein said temperature-responsive device comprises a bimetal thermostat in said compartment contacted by said subsidiary airstream.

4. The air conditioner of claim **1** wherein said compartment comprises an enclosure within said second chamber having inlet means and outlet means for passage of said subsidiary stream of air.

5. An air conditioner for cooling room air passing therethrough, comprising: a housing having a first chamber therein communicating with said room air and a second chamber communicating with air on the exterior of the room; a refrigeration unit comprising an evaporator in said first chamber and a refrigerant condenser in said second chamber; a compartment in said housing; a temperature-responsive device in said compartment for controlling operation of said unit; means for establishing a subsidiary stream of room air through said compartment in heat exchange relation with said temperature-responsive device and then to said exterior; a condenser blower having an inlet in said second chamber positioned to force exterior air over said condenser and exhaust to the exterior; and means for exposing said subsidiary airstream to said condenser blower inlet for said establishing of said subsidiary airstream.

6. An air conditioner for cooling room air passing therethrough, comprising: a housing having a first chamber therein communicating with said room air and second chamber communicating with air on the exterior of the room; a refrigeration unit comprising an evaporator in said first chamber and a refrigerant condenser in said second chamber; a compartment in said housing; a temperature-responsive device in said compartment for controlling operation of said unit; and means for establishing a subsidiary stream of room air through said compartment in heat exchange relation with said temperature-responsive device and then to said exterior, said compartment being in heat exchange relationship with a portion of said evaporator for cooling said subsidiary airstream, and said evaporator comprising a plurality of tubular coils, portions of which extend adjacent said compartment to be contacted by the subsidiary airstream thereat.

7. An air conditioner for cooling room air passing therethrough, comprising: a housing having a first chamber therein communicating with said room air and a second chamber communicating with air on the exterior of the room; a refrigeration unit comprising an evaporator in said first chamber and a refrigerant condenser in said second chamber; a compartment in said housing; a temperature-responsive device in said compartment for controlling operation of said unit; means for establishing a subsidiary stream of room air through said compartment in heat exchange relation with said temperature-responsive device and then to said exterior; means for establishing a principal airstream from said room, through said evaporator first chamber and back to the room, said principal airstream being separate from said compartment subsidiary airstream, and said temperature-responsive device comprising a bimetal thermostat in said compartment contacted by said subsidiary airstream; a condenser blower having an inlet in said second chamber positioned to force exterior air over said condenser and exhaust to the interior; and means for exposing said subsidiary airstream to said condenser blower inlet for said establishing of said subsidiary airstream.

8. The air conditioner of claim **7** wherein said evaporator comprises a plurality of tubular coils, portions of which extend adjacent said compartment to be contacted by the subsidiary airstream thereat.

9. An air conditioner for cooling room air passing therethrough, comprising: a housing having a first chamber therein communicating with said room air and a second chamber communicating with air on the exterior of the room; a refrigeration unit comprising an evaporator in said first chamber and a refrigerant condenser in said second chamber; a compartment in said housing; a temperature-responsive device in said compartment for controlling operation of said unit; and means for establishing a subsidiary stream of room air through said compartment in heat exchange relation with a portion of said evaporator and subsequently with said temperature-responsive device.

* * * * *