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ROOM AIR CONDITIONER CONDENSATE DISPOSAL ARRANGEMENT

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FIG. 1

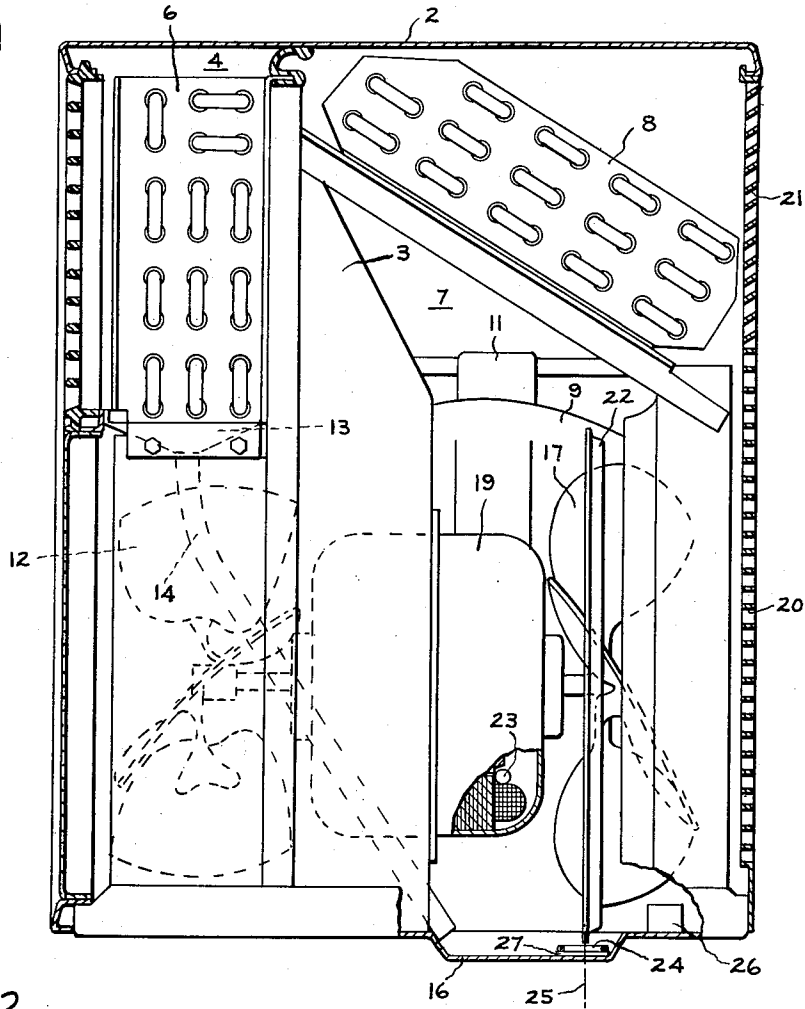


FIG. 2

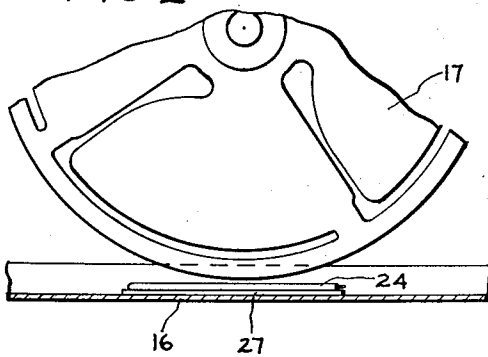
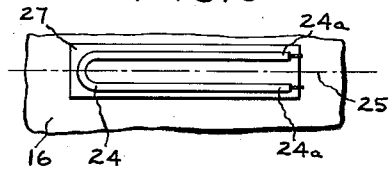


FIG. 3



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ROOM AIR CONDITIONER CONDENSATE DISPOSAL ARRANGEMENT

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The present invention relates to a room air conditioner condensate disposal arrangement utilizing a fan driven condensate slinger extending into a condensate sump which is exposed to outside weather conditions, and more particularly to an arrangement for assuring freedom of rotation of the slinger and fan when water in the condensate sump freezes.

Although the invention is particularly useful in condensate disposal arrangements for reversible-flow type air conditioners which are used as a means for cooling air in the summer and a source of heat in the winter, it will be understood that the invention will also be applicable to the ordinary air conditioner that is permanently installed in a window or wall and used only for ventilation or exhaust purposes during the winter months. For purposes of illustration, however, the invention will be shown and described in connection with a room air conditioner which may be utilized for both heating and cooling an enclosure.

Some of these units employ a reversible-type refrigeration apparatus containing two heat exchangers, one located within an inner compartment of the unit and the other located in the outer compartment which is exposed to the outdoor air. Each heat exchanger operates interchangeable either as a condenser or as an evaporator for heating or cooling an enclosure. The conditioner is provided with a sump for collecting condensate water which collects upon the unit being utilized as an evaporator. The sump is normally positioned in the outer compartment of the air conditioner and is sometimes located underneath the outdoor heat exchanger unit. In order to dispose of condensate water collecting within the sump, many conditioners employ a slinger ring attached to and surrounding the periphery of the fan or blower used to circulate a stream of air over the outer heat exchanger. The slinger ring extends or dips into the condensate water in the sump and, during rotation, throws water out of the sump onto the outside heat exchanger or into the air stream flowing through the outside heat exchanger.

During the winter months, any water collecting in the sump is likely to freeze around that portion of the slinger dipping into the sump, and thereby interfere with the rotation of the slinger and the fan. Under such conditions, the fan motor generally heats up causing the overload protector to interrupt the current to the motor until the windings of the motor cool. The overload protector will continue to switch the current to the motor windings on and off until the condition is alleviated or until the unit is turned off. If the frozen condition around the slinger ring is allowed to remain, the continued throwing in and out of the overload protector switch may damage this device or might possibly cause some damage to the motor windings.

It is an object of the present invention to provide an improved condensate disposal arrangement utilizing a slinger attached to a fan and including means for quickly freeing the slinger if the fan is energized while the slinger is secured in ice formed in the condensate sump.

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It is a more specific object of the present invention to provide in combination with a slinger type water disposal arrangement a means for assuring that ice in the condensate sump is melted in the immediate area surrounding the slinger ring whenever the fan motor is turned on and the temperature is below freezing.

Further objects and advantages of the invention will become apparent as the following description proceeds and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

In carrying out the objects of the present invention there is provided, in combination with an air conditioner of the type adapted to be utilized throughout the year, a heat exchange apparatus including at least one fan mounted in the air conditioner for circulating a stream of outside air through portions of the heat exchange apparatus. A sump is positioned directly beneath the fan for collecting condensate water which forms on the heat exchange apparatus. The fan is provided with an annular slinger ring which dips into the condensate sump and slings water from the sump onto the other components of the heat exchange apparatus. As the sump is exposed to outdoor temperatures and to the outdoor air stream flowing through the unit, the water in the sump is likely to freeze around the slinger ring during cold weather. In order to free the slinger ring at those times when ice forms in the condensate sump, a small heater element is disposed in the sump directly below that portion of the slinger ring dipping into the sump so that heat from the element will melt ice in the space around the slinger ring. A temperature responsive means is provided for energizing the heater element whenever the temperature of the air stream flowing through the apparatus drops below freezing so that ice is immediately melted in the condensate sump in the area immediately surrounding the slinger ring whenever the air conditioning unit is operated.

For a better understanding of the invention reference may be had to the accompanying drawing in which:

Fig. 1 is an elevation view of an air conditioner having the condensate disposal arrangement of the present invention;

Fig. 2 is a partial elevation view showing the slinger ring and a cross section of the sump incorporating the heater element; and

Fig. 3 is a plan view of the heater element utilized in the preferred embodiment of the invention.

Referring now to Fig. 1, there is shown an air conditioner having a heat exchange apparatus including a refrigeration system and a pair of fans for blowing separate streams of air over the components of the refrigeration system. More particularly, the air conditioning unit comprises a casing 2 which is divided by a barrier 3 into an inner compartment 4 having mounted therein an indoor heat exchanger 6 and an outer compartment 7 containing an outdoor heat exchanger 8. The heat exchangers 6 and 8 are connected in refrigerant flow relationship with a compressor 9 also positioned in the outer compartment 7. The conditioner is provided with a reversing valve 11 which may be selectively operated to reverse the flow of refrigerant to the heat exchangers 6 and 8. When the conditioner is operated, air is drawn from within the room and circulated by an air moving means or fan 12 through the inner compartment 4 of the conditioner and passed over the heat exchanger 6 which is then operated as an evaporator. The fan 12 is driven by a motor 19 which is mounted in the barrier 3. During operation of the unit on the cooling cycle, moist air from within the room is circulated over the heat exchanger 6 operating as an evaporator, where water condenses out of the air stream onto the coil surfaces of this heat ex-

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changer and drains downwardly into a suitable drip tray 13 from which it is delivered by means of an insulated conduit 14 to a condensate collection sump 16 formed in the base of the unit. The sump 16 is located in the outer compartment 7 of the conditioner for reasons which will be hereinafter explained.

As shown in Fig. 1, an air moving means or fan 17 is disposed in the outer compartment and is also driven by the motor 19 mounted in the barrier 3. The fan 17 circulates outside air over the heat exchanger 8 and, during the cooling cycle, this air is used to remove heat from the heat exchanger 8 which is then operated as a condenser. More specifically, the fan 17 pulls outside air through the inlet opening 20, blowing it inwardly against the barrier 3 whereupon it flows upwardly through the heat exchanger 8 and is then discharged to the outdoors through the outlet opening 21.

When the unit is operating on the heating cycle, the reversing valve 11 reverses the flow of refrigerant through the heat exchangers 6 and 8 thereby utilizing heat exchanger 6 as a condenser and heat exchanger 8 as an evaporator. During the heating cycle, air from the room, being circulated over the heat exchanger 6 by the fan 12, is warmed and then discharged back into the room. The heat exchanger 8 is then operated as an evaporator to absorb heat from the outside air stream and this heat is transferred, via the refrigeration system, to the condenser, or heat exchanger 6, for heating the room air. During the heating operation, the outer compartment heat exchanger 8 condenses moisture out of the outdoor air stream and this moisture also collects in the condensate collection sump 16.

Mounted on the extremities of the fan, as may be clearly seen in Fig. 2, is a slinger ring 22 which extends downwardly into the space defined by the sump 16. The slinger, upon rotation, picks up water out of the sump and throws it outwardly onto the other components within the outer compartment 7 and more specifically onto the heat exchanger 8 where it is vaporized by the heat of this component when the air conditioner is operating on the cooling cycle. During the cooling cycle operation, the water thrown on the heat exchanger 8 provides additional cooling and thereby increases the capacity of this heat exchanger and the refrigeration system. To some extent, the water thrown by the slinger ring 22 is atomized or formed into small droplets and some of these droplets are carried out of the unit by the air stream flowing through the outer compartment 7. In this manner the water is continually removed from the air conditioner even during the winter when the heat exchanger 8 is normally operated as an evaporator and no longer is as effective in vaporizing the water thrown thereon.

As thus far described this air conditioner with its reversible heat exchanger system forms no part of the present invention, but is intended only to be illustrative of one type of air conditioner to which this invention is particularly well adapted. It is not intended to limit the invention only to air conditioners of the reversible refrigerant flow type as the invention is also very useful in the ordinary type of air conditioners which may be permanently mounted in a wall or window of a room to provide cooling of the room air during the summer and to provide ventilation and exhausting of air during the winter months. As will now be described, the invention deals with an arrangement for assuring that ice formed around the slinger will not damage the air conditioning unit or prevent its operation during freezing weather.

Since the sump 16 is exposed to outdoor temperatures and exposed to the air stream flowing through the outer compartment 7, any water collected therein is likely to freeze whenever the outdoor temperature drops below the freezing point of water or below 32° F. If this should occur during a period of inoperation, any water collected within the sump 16 is likely to freeze around the slinger and solidly secure the slinger and fan thereby preventing

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their rotation when the fan motor is again energized. This locked fan condition causes excessive current to flow through the fan motor windings and also results in greater motor heat. It has been normal practice in present day air conditioners, to provide the fan motor with an overload protector which is responsive to the temperature of the motor windings or to the current flowing through the windings in order to interrupt the current to the fan motor under overload conditions. Either of these two types of overload protectors operate satisfactorily and would serve to protect the motor windings whenever ice around the slinger causes the fan to stall. However, if the "ice bound" condition of the slinger is not corrected there will be a continual cycling on and off of the current to the fan motor as the overload protector switch is periodically energized and de-energized. This could eventually damage the overload protector and might result in damage to the fan motor windings. In the preferred embodiment of the invention shown, the fan motor 19 is provided with overload protection means 23 which is of the type that interrupts the current to the motor according to the temperature of the motor windings. That is, it is temperature responsive rather than responsive to a particular amount of electrical current.

In order to free the fan from ice whenever the unit is turned on, the condensate collection sump is provided with a small heating element 24 which is arranged on the bottom of the sump 16. The heating element 24 is so arranged or designed to provide heat only to that portion of the sump, or to that portion of the ice, into which the slinger ring dips. In the illustrated embodiment of the invention, as may be seen in Figs. 2 and 3, the heating element 24 is U-shaped and is positioned directly below the slinger ring 22 and coextensive with that portion of the slinger dipping into the sump. Each leg or side 24a of the U-shaped heating element is of a length at least equal to that portion of the slinger ring dipping into the sump and each of the legs of the element lies on opposite sides of the plane 25 formed by the slinger ring as it extends into the sump.

In order to operate the heating element 24 whenever ice is likely to form in the condensate sump 16 and in order to prevent operation of the heating element at all other times, there is provided a temperature responsive element 26 adapted to energize the heating element 24 whenever the temperature of the outdoor air falls below 32° F. or below the temperature that water will freeze in the sump 16. Temperature responsive elements or devices adapted to energize a switch are well known in the art and a detailed explanation of the device is not believed necessary except that it must be capable of energizing and de-energizing a relatively low power circuit according to changes in temperature of the air stream being circulated through the outer compartment 7. As the heat output of the heater is concentrated in the relatively small space above the heater, the power consumption and amperage of the heater need not be very great. A heater drawing 2 or 3 amps. can easily melt the ice around the slinger in a matter of seconds. To aid the concentration of heat in the area directly above the heater and to prevent the heat from being rapidly dissipated by the floor of the sump 16, which is normally of metal, a heat insulating means or mat 27 is placed under the heating element 22. When the air conditioning unit is turned on and the temperature is below 32° F. the temperature responsive device 26 energizes the heating element 24 to immediately provide a concentration of heat in the area of the condensate sump directly above the heater, or around the slinger 22. As may be seen in Fig. 2, the slinger ring lies very closely adjacent the heating element 24 and the heat supplied to ice in this particular area melts it very quickly. Thus, even though the fan motor may not be permitted to rotate immediately, it is only a matter of seconds, and at

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least less than a minute, before the ice frozen around the slinger ring in the area directly above the heater is melted to permit rotation of the slinger and fan. During this short period, the overload protector 23 will, of course, prevent the fan motor from becoming too warm and thus prevent damage to the motor. Heat is then continuously supplied by the heating element 24 as long as the unit is turned on during those times when the outdoor temperature is low enough to cause water in the sump 16 to freeze.

While in accordance with the patent statutes there has been described what at present is considered to be the preferred embodiment of the 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, the intent of the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

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

1. In an air conditioner of the type adapted to be utilized throughout the year for conditioning the air within an enclosure, the combination comprising a heat exchange apparatus including at least one fan mounted in said air conditioner for circulating a stream of outside air through said apparatus, a sump for collecting condensate water from said apparatus, said sump being positioned beneath said fan wherein said sump is exposed to outdoor temperatures which in the winter are likely to cause condensate water to freeze within said sump, an annular slinger ring attached to the periphery of said fan and rotatable therewith, said slinger ring dipping into said condensate sump for slinging water therefrom, a longitudinal heating element disposed in said condensate sump directly below said slinger ring, said heating element being arranged coextensive with that portion of said slinger ring dipping into said sump, and temperature responsive means for energizing said heater element when said temperature of said air stream flowing through said apparatus drops below 32° F. so that heat is supplied to melt ice in said condensate sump in the area immediately surrounding said slinger ring.

2. In an air conditioner of the type adapted to be utilized throughout the year for conditioning the air within an enclosure, the combination comprising a heat exchange apparatus including at least one fan mounted in said air conditioner for circulating a stream of outside air through said apparatus, a sump for collecting condensate water from said apparatus, said sump being positioned beneath said fan wherein said sump is exposed to outdoor temperatures which in the winter are likely

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to cause condensate water to freeze, an annular slinger ring attached to the periphery of said fan and rotatable therewith, said slinger ring dipping into said condensate sump for slinging water therefrom, a longitudinal heating element disposed in said condensate sump directly below said slinger ring, said heating element being formed in a U-shape with each of the legs thereof arranged on opposite sides of a plane passing through said slinger ring, each of said legs of said U-shaped heating element being coextensive with that portion of said slinger ring dipping into said sump, and temperature responsive means for energizing said heating element when said temperature of said air stream flowing through said apparatus falls below 32° F. so that heat is supplied to melt ice in said condensate sump in the area immediately surrounding said slinger ring.

3. In an air conditioner of the type adapted to be utilized throughout the year for conditioning the air within an enclosure, the combination comprising a heat exchange apparatus including at least one fan mounted in said air conditioner for circulating a stream of outside air through said apparatus, a sump for collecting condensate water from said apparatus, said sump being positioned beneath said fan wherein said sump is exposed to outdoor temperatures which in the winter are likely to cause condensate water to freeze, an annular slinger ring attached to the periphery of said fan and rotatable therewith, said slinger ring dipping into said condensate sump for slinging water therefrom, a longitudinal heating element disposed in said condensate sump directly below said slinger ring, said heating element being formed in a U-shape with each of the legs thereof arranged on opposite sides of a plane passing through said slinger ring, each of said legs of said heating elements being coextensive with that portion of said slinger ring dipping into said sump, a heat insulating means positioned between said heating element and the bottom of said sump for preventing the dissipation of heat from said element by the bottom of said sump, and temperature responsive means for energizing said heating element when said temperature of said air stream flowing through said apparatus is likely to cause condensate water in said sump to freeze so that heat is supplied by said heating element to melt ice in said condensate sump in the area immediately surrounding said slinger ring.

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