Jan. 15, 1957 J. P. SLATTERY 2,777,303

CONDENSATE SUMP DRAIN VALVE

Filed Sept. 13, 1955

FIG. 1

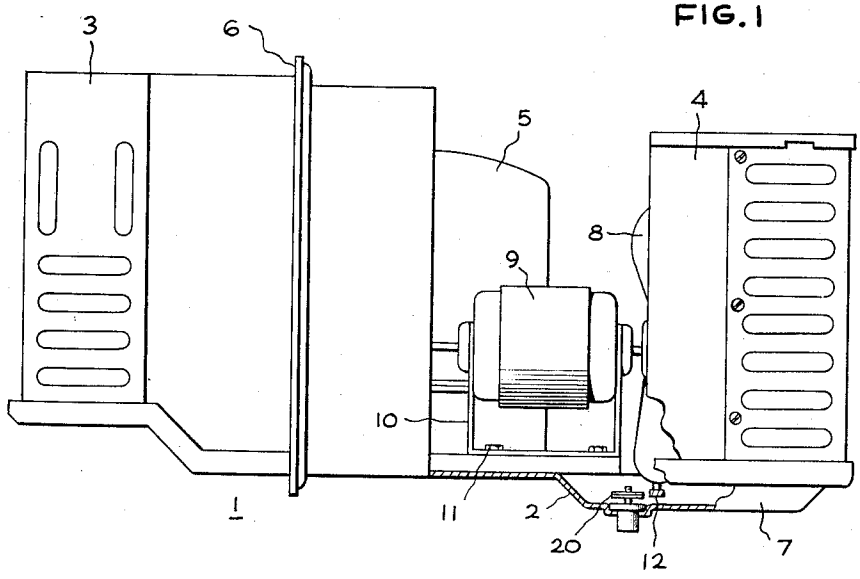


FIG. 2

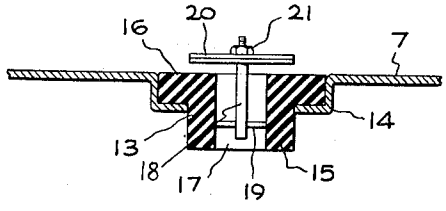


FIG. 3

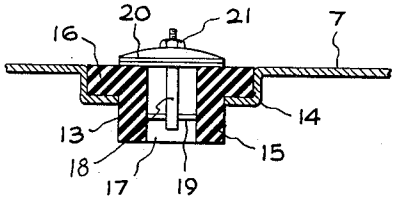


FIG. 4

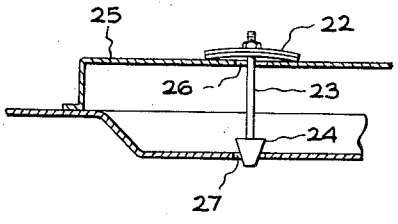
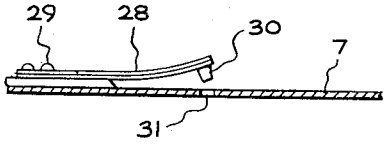


FIG. 5



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CONDENSATE SUMP DRAIN VALVE

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1 Claim. (Cl. 62—140)

My invention relates to apparatus for conditioning the air within an enclosure and more particularly to a condensate sump drain valve for air conditioning apparatus of the reversible type which is capable of both heating and cooling.

Conditioning the air within an enclosure has been accomplished by apparatus employing a refrigeration cycle and generally located within an opening in the enclosure. In order to both heat and cool the air within the enclosure, the reversible type of refrigeration apparatus has been used containing two heat exchangers, one located within the enclosure and the other outside the enclosure exposed to the outdoor air. These heat exchangers operate interchangeably as a condenser and an evaporator to both heat and cool the enclosure. Control means are provided by which reversal of the operating cycle can be obtained. The apparatus is provided with a sump located beneath the outside coil. Troughs in the base pan conduct condensate dropping from the inside coil to this sump. A slinger mounted on the periphery of the condenser fan slings the condensate onto the condenser, cooling it and disposing of the condensate by evaporation. Condensate from the outdoor coil collects in this sump when the unit is operating on the heating cycle and since none of this water is disposed of by evaporation, it builds up and is splashed over the lip of the base pan and onto the outdoor coil by the slinger. The apparatus may also at times have to operate on the heating cycle when a below freezing outside temperature has frozen this sump water locking the fan and slinger rigid. This usually results in blown fuses or damaged parts when the apparatus is operated.

Accordingly it is an object of this invention to provide a new and improved drain valve arrangement to eliminate the condensate which has collected in the sump of a reversible air conditioner.

It is a further object of this invention to provide a drain arrangement for a reversible type air conditioner which operates completely automatically with rapid and positive movement to effectively either seal or open the drain passage in the condensate sump during desired periods.

It is another object of this invention to provide a drain means for the condensate sump in a reversible type room air conditioner which is adapted to operate in response to any outdoor temperature within a wide range and with a high degree of accuracy.

It is a still further object of this invention to provide a drain arrangement for the condensate sump in a reversible type room air conditioner which lends itself to the adaptation of many forms and requiring only a minimum of maintenance.

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

In carrying out my invention, I provide a reversible

air conditioning apparatus which contains an indoor heat exchanger coil and an outdoor heat exchanger coil. A sump is arranged in the base pan beneath the outdoor coil and the condensate from the indoor coil formed during cooling is conducted along a trough within the pan into the sump. Condensate from the outdoor coil falls into this sump during the heating cycle. A fan for passing air over the outdoor coil contains a slinger ring on its blade extremity dipping into the sump so that it splashes the water in the sump over the outdoor coil during the cooling cycle when the outdoor coil is acting as a condenser. A thermally responsive element cooperates with a drain opening in the sump when the outside temperature falls below a predetermined temperature to drain the sump of any condensate that may have collected. This predetermined temperature is preferably one above that at which the unit may be required to operate on the heating cycle when the presence of water in the sump is not desired. The thermally responsive element seals the sump drain opening when the outside temperature is above this predetermined temperature to permit condensate to collect in the sump where it is used for condenser cooling.

For a better understanding of my invention, reference may be had to the accompanying drawings in which Fig. 1 is an elevation view of a reversible type air conditioning apparatus partially cut away to disclose my invention;

Fig. 2 is a sectional view of the preferred embodiment of my invention in one of its two positions;

Fig. 3 is a sectional view of the preferred embodiment of my invention in its other position from that of Fig. 2;

Fig. 4 is a sectional view of a portion of Fig. 1 showing a modification of my invention; and

Fig. 5 is a sectional view of a portion of the apparatus of Fig. 1 showing another modification of my invention.

In the drawing, I have shown in Fig. 1 a reversible air conditioning apparatus 1 which is arranged to be positioned within an opening in an enclosure. The outer casing for the unit has been removed to show the various parts. The air conditioning apparatus comprises a fabricated base pan 2 supporting an indoor heat exchanger unit 3 and an outdoor heat exchanger unit 4. Both coils 3 and 4 are of the coil and fin type generally used in refrigerating systems and have circulated through them a refrigerating liquid. A compressor 5 supported on the base pan is connected by tubing with coils 3 and 4. A reversing valve (not shown) is also provided in the refrigeration system through which the various tubing connections can be established for either heating or cooling. A flange 6 located around the outer portion of the unit provides a sealing surface for the unit with the edges of the enclosure opening so that outside air will not enter the enclosure around the unit.

The air conditioning apparatus is provided with selective control means, which are not shown, by which the unit may be operated for either heating or cooling the enclosure. During the operation of the unit on the cooling cycle, the air within the enclosure moving over the heat transfer coil surfaces of coil 3 results in a condensation on the coil surfaces which, as it collects and falls, is caught by the base pan 2. The base pan 2 is formed with troughs so that the condensate flows towards the rear of the pan and collects in a reservoir or sump 7 which forms a part of the pan. I have shown in Fig. 1 a fan blade 8 mounted on the rear of the unit which moves the outside air over coil 4. The fan blade is driven by an electric motor 9 supported by means of a bearing pedestal 10 secured by bolts 11 to the base pan 2. Mounted on the extremities of the fan blade 8 is a slinger ring 12 which extends downwardly into the space defined by the sump 7. When the sump 7 contains water the slinger ring dips into the water. As the fan rotates the water is

picked up and thrown over the coil 4 to provide additional cooling means in conjunction with the air circulated by the fan over the coil. This additional cooling feature is highly desirable when the outside coil is acting as a condenser during the cooling cycle as it increases the capacity of the condenser and of the refrigeration system.

The sump 7 formed in the base pan 2 beneath the outside coil 4 is provided with bottom opening 13. This opening 13 is defined by an L-shaped marginal flange 14 formed in the sump plate 7. A resilient, tubular, gasket member of a material such as rubber or plastic 15 having an enlarged portion 16 is pressed within the opening 13 and is supported on the flange 14 by means of the shoulder 16. The gasket member 15 is provided with a central bore 17 through which condensate collecting in the sump 7 can drain.

Disposed within the bore 17 of the gasket member 15 is a rod 18 secured by means of rod 19 to the gasket 15. The upper end of the rod 18 extends above the gasket and supports a thermally responsive element such as a bi-metal disc 20 secured thereto by means of a nut 21. The thermally responsive bi-metal disc 20 is of the type that below a certain predetermined temperature it occupies the flat shape shown in Fig. 2. Above this predetermined temperature the bi-metal disc flexes and assumes a saucer-like configuration as shown in Fig. 3. It will be noted that in Figure 2, when the bi-metal disc is in the position shown, the gasket passage 17 is opened and any water collected within the sump 7 will drain therethrough. In Figure 3 when the disc has assumed its saucer-like shape the edges of the disc move into sealing engagement with the gasket member 15 closing the drain passage 17 and the sump remains full.

In the operation of the air conditioning apparatus, when the outside temperatures are within the range where the air conditioning unit is normally operated on the cooling cycle, the disc 20 occupies the position as shown in Figure 3. The bi-metal disc has flexed to its saucer-like shape and is in sealing engagement with gasket member 15. The condensate from the inside coil collects in the sump 7 and as the drain passage 17 is closed the slinger ring 12 on the fan blade 8 can pick up water from the sump and splash it over the outdoor coil which is at this time acting as a condenser. When the apparatus is operated on the heating cycle condensate falls from the outdoor coil which is acting as an evaporator and collects in the sump. It is desirable during the heating cycle to eliminate this water from the sump as well as any water that might remain from a previous cooling operation since little of it is disposed of by evaporation and it would build up and be splashed over the lip of the base pan 2 and onto the outdoor coil by the fan slinger ring. Additionally, there is the hazard of the water freezing in the sump and locking the fan blade and slinger ring in position causing the fusible element in the circuit to blow or possibly doing damage to the working parts. The bi-metal disc 20 is therefore calibrated such that when the outside temperature falls to a predetermined value whereat heating may be required within the enclosure, it flexes to the position of Figure 2 opening the drain passage 17 and the condensate water in the sump 7 passes out. I find that a satisfactory temperature at which the bi-metal disc opens the drain is in the vicinity of 55° F. Thus when the outside temperature drops to the calibrated temperature of the disc at which the air conditioning unit could be called on for heating there is automatically an opening of the drain passage in the condensate sump and no liquid remains to splash over the outside coil or to possibly freeze and lock the slinger ring and fan blade in position. Often it is desirable not to operate the reversible heat exchanger units at temperatures near freezing due to the reduced efficiency and possibly separate resistance heaters might be employed instead at temperatures close to freezing. Even in this type of unit, operation of the reversible heat exchangers and fan on the heating cycle could occur subsequent to a freezing of condensate when the outside temperature rises quickly before the condensate melts. Even if heaters are used the heater fan usually is connected to the same shaft as the outdoor fan and its action would be impeded by the frozen sump water.

Figure 4 shows a modification of my invention. A thermally responsive, bi-metal disc 22 is connected by means of elongated rod 23 to a plug or stopper 24. The disc is supported by means of an L-shaped bracket 25 welded or otherwise secured to the base pan 2 adjacent the sump 7 and containing an aperture 26 through which the rod 23 passes. A drain opening 27 is provided in the sump 7 which receives the plug 24 in sealing engagement. In this modification of my invention, when the unit is operating on the cooling cycle and when the outside temperature is above a pre-determined temperature, the disc is flattened to the flat shape of the disc in Fig. 2 and the plug 24 drops by means of gravity into the opening 27 closing the sump drain. When the outside temperature drops to the predetermined temperature where the heating cycle may be required for the enclosure, the disc flexes to the saucer shape of Figure 4 and the disc marginal edge pressing against the sump bracket 25 lifts the stopper from the opening 27 allowing the condensate to drain through. Thus the sump drains when the condensate is no longer needed as discussed in the preferred embodiment of my invention.

Figure 5 shows another modification of my invention. In this embodiment a thermally responsive bi-metal strip 28 is used rather than a disc and is attached at one end by means of bolts 29 to the sump bottom. A plug 30 is attached to the other end of the bi-metal strip and is so arranged that when the bi-metal strip moves downwardly the plug engages in sealing relationship a drain aperture 31 formed in the sump bottom. In this embodiment of my invention the plug seals the drain passage 31 when the unit is operating above the predetermined temperature for the bi-metal strip. When the outside temperature drops below this temperature and heating may be called for from the unit, the strip flexes upwardly removing the plug from the opening 31 draining the condensate liquid which may have collected in the sump.

In summation it will be seen that I have provided an improved temperature responsive arrangement for a reversible air conditioning apparatus whereby efficient and rapid removal of condensate liquid from the unit can be obtained when the outside temperature drops below a predetermined level. With my invention the condensate is removed quickly and positively from the condensate sump and this action is initiated automatically by the change in temperature in the outside air, requiring no other type of control. The removal of the condensate from the unit greatly improves the operation of the unit in that no water remains in the sump to freeze and inhibit the fan action. There is also no water left to be splashed over the outside coil when this coil is the evaporator or over the base pan of the apparatus. I have also shown in my disclosure a number of forms that my invention readily adapts itself to, each of which acts in a simple and direct manner to efficiently produce the desired effect I have described.

My present invention is an improvement over the invention of the application of William G. Spiegelhalter, S. N. 533,650, filed September 12, 1955, and assigned to the assignee of the present application, which invention was made by said William G. Spiegelhalter prior to my invention. I, therefore, do not herein claim as my invention anything shown or described in said Spiegelhalter application, which is to be regarded as prior art with respect to this present application.

While in accordance with the patent statutes I have described what at present is considered to be the preferred embodiments 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 claim to cover all such changes and modifications that 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:

In a reversible heat transfer system for an enclosure, a compressor, a pair of complementary interconnected evaporator-condenser units one inside and the other outside said enclosure each having valve connections with said compressor and selectively operable for heating and cooling said enclosure, a condensate sump arranged beneath said outside unit, an opening in said condensate

sump, a tubular, resilient, gasket containing a central bore positioned within said opening, a thermally responsive bimetal disc supported on said gasket in sealing engagement therewith, said disc flexing when the outside air drops to a predetermined temperature to permit condensate to drain through said passage.

References Cited in the file of this patent

UNITED STATES PATENTS

1,558,276	Peterson	Oct. 20, 1925
2,342,566	Wolfert	Feb. 22, 1944
2,357,362	Smith	Sept. 5, 1944