March 5, 1963 R. W. ABBOTT ETAL 3,079,766

CONDENSATE DISPOSAL ARRANGEMENT FOR AIR CONDITIONING APPARATUS

Filed June 21, 1961 2 Sheets-Sheet 1

FIG.1

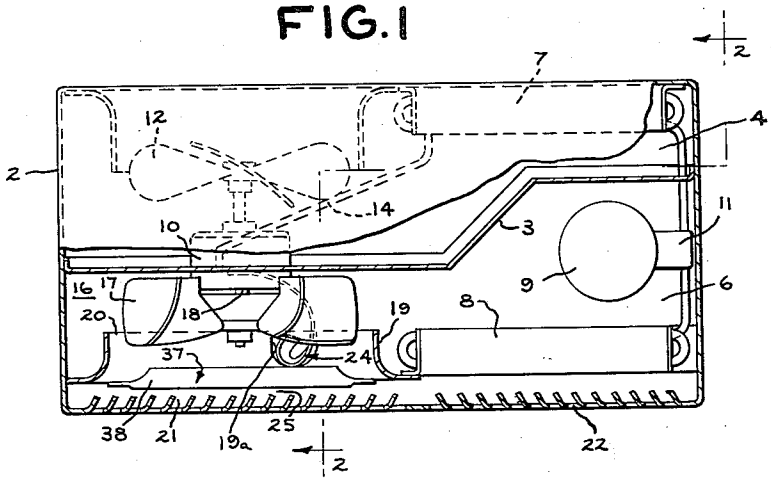
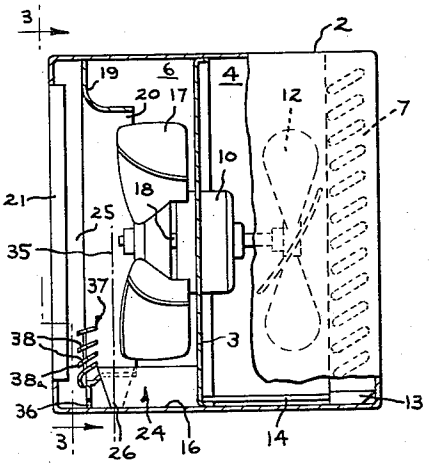


FIG.2



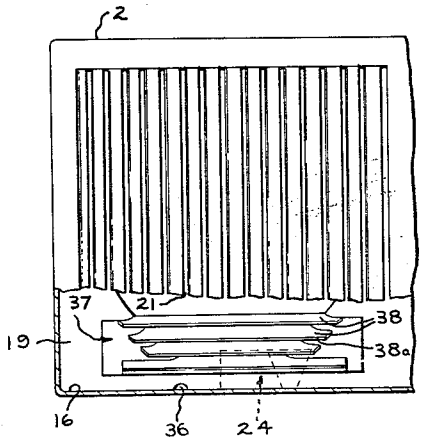


FIG.3

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CONDENSATE DISPOSAL ARRANGEMENT FOR AIR CONDITIONING APPARATUS

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FIG. 4

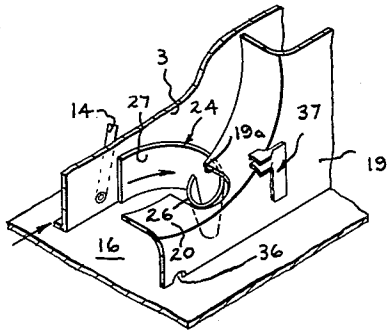
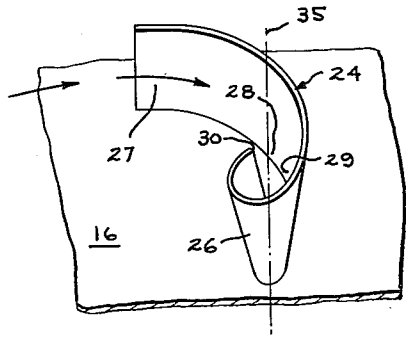


FIG. 5



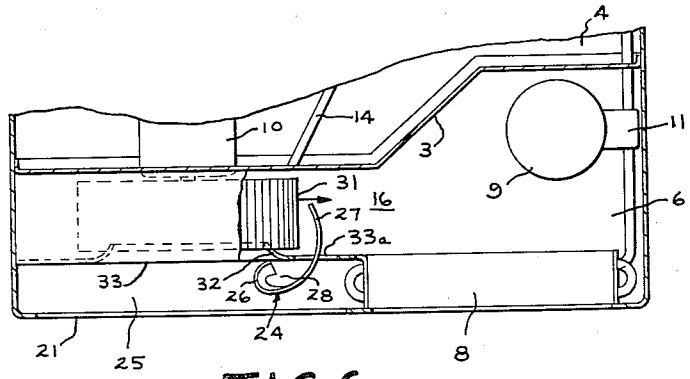


FIG. 6

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CONDENSATE DISPOSAL ARRANGEMENT FOR AIR CONDITIONING APPARATUS

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9 Claims. (Cl. 62—280)

The present invention relates to air conditioning apparatus and more particularly to an arrangement for disposing of water which condenses out of the air stream circulated through the cooling unit of an air conditioning apparatus.

The present invention is an improvement over the invention of the application of Lawrence W. Speaker, Serial No. 118,731, filed concurrently with the present application and assigned to the General Electric Company, the assignee of the present application. The invention of the said Lawrence W. Speaker was made prior to the present invention and nothing is herein claimed as our invention that is shown or described in the Speaker application, which is to be regarded as prior art with respect to this present application.

Although the present invention is shown and described in connection with a self-contained reversible-flow type air conditioner which is adapted for mounting in a wall of an enclosure and used for cooling air in the summer and as a source of heat in the winter, it will be understood that the invention is broadly applicable to many types of air conditioning apparatus in which it is desirable to atomize or break up water droplets for entrainment into an air stream. Self-contained air conditioners usually employ a refrigeration system including two heat exchangers, one located within an inner compartment of the unit and exposed to indoor air while the other is located in the outer compartment and exposed to outdoor air. A pair of fans or air circulating means are usually provided in the unit for circulating separate streams of air from the enclosure and from the outdoors respectively through the heat exchangers located in the separate compartments. A condensate collection sump is provided in the unit for collecting condensate water which condenses out of the air being circulated over the heat exchanger operated as an evaporator or cooling unit.

The condensate water disposal problem in the above-described self-contained air conditioners is especially difficult in those units commonly called room air conditioners and adapted for mounting in a window or outer wall of an enclosure. Because it is undesirable, and in many cases not practical, to attach drain conduits to these units leading to suitable drain outlet, it is necessary to employ other means for disposing of the condensate water. Many conditioners of this type employ a slinger ring which is attached to and surrounds the periphery of the outdoor fan. This slinger ring extends or dips into the condensate water in the sump and, during rotation of the fan, throws water out of the sump onto the other components of the unit and preferably onto the heat exchanger over which outdoor air is circulated. A disadvantage associated with the slinger ring type of condensate disposal arrangement is that the slinger is likely to become frozen solidly in ice when the conditioner is operated during the winter season and the temperature drops below freezing. In such a case, the outdoor fan is prevented from rotating by the ice around the slinger and this either causes the fan motor to overheat or results in some other serious damage to the mechanical parts of the unit. Therefore, it has been found desirable to dispose of condensate water through use of other means not likely to be damaged when the condensate water freezes in the sump.

Accordingly, it is an object of the present invention to provide an improved condensate water disposal arrangement for an air conditioner having a new and improved arrangement for lifting water out of the condensate collection sump of the air conditioner and entraining water droplets in the outdoor air stream being circulated through the air conditioner.

Another object of the present invention is to provide an improved arrangement for lifting water droplets out of a water receptacle disposed beneath a fan and for throwing the water droplets onto the fan blades for atomization thereby.

A more specific object of the present invention is to provide a condensate disposal arrangement for a room air conditioner utilizing a stabilized air vortex for lifting water droplets from a water receptacle, disposed on the high pressure side of a fan orifice panel, and directing the water droplets into the low pressure region upstream from the fan orifice.

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 a part of the specification.

In carrying out the objects of the present invention, there is provided an air conditioning apparatus including a refrigeration system having a cooling unit which condenses moisture out of an air stream being circulated thereover. The apparatus employs an air circulating means or fan arranged to circulate an air stream through the unit from the outdoors. Surrounding the fan is an orifice opening formed in a panel or plenum for directing outdoor air into the fan from a region upstream therefrom. A condensate water collection receptacle is disposed within the unit and arranged with respect to the air circulating means so that at least a portion of the air discharged from the fan flows over the surface of water in the receptacle. Means are provided in the apparatus for collecting condensate water from the cooling unit and delivering this water to the receptacle. In order to dispose of water, collecting within the receptacle, there is provided an air vortex generator including an eye section adapted to receive air flowing over the water in the receptacle and to confine this diverted air stream to a generally circular path as well as to impart an upward thrust to the air stream thereby creating a substantially stabilized air vortex, or whirling mass of air, flowing upwardly from the eye section and having a low pressure region in the center thereof communicating with water in the bottom of the eye section. The eye section is so disposed with respect to an opening formed in the lower portion of the orifice plenum that the air vortex is directed from the eye section through the opening into the region upstream from the fan so that water droplets are lifted from the eye section by the air vortex and carried into the air stream entering the fan.

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

FIG. 1 is a plan view partially in cross section of an air conditioner having the condensate disposal arrangement of the present invention;

FIG. 2 is an elevation view taken along line 2—2 of FIG. 1 illustrating the arrangement of the vortex generator with respect to the fan;

FIG. 3 is a front elevation view of the air conditioner showing the inlet to the fan and illustrating the louvered splash baffle across the bottom of the orifice opening;

FIG. 4 is a perspective view showing the air vortex generator extending into a slot formed in the bell mouth opening of the orifice plenum;

FIG. 5 is a perspective view showing the preferred embodiment of the air vortex generator; and

FIG. 6 is a plan view partially in cross section of an air conditioner utilizing a centrifugal blower and incorporating the condensate disposal arrangement of the present invention.

Referring now to FIG. 1 there is shown an air conditioner of the reversible refrigerant flow type which is adapted to be positioned in an opening in an enclosure. The unit comprises a casing **2** divided by a barrier **3** into an inner compartment **4** and an outer compartment **6** within which there are mounted respectively an indoor heat exchanger **7** and an outdoor heat exchanger **8**. The heat exchangers **7** and **8** are connected in refrigerant flow relationship with the compressor **9** also positioned in the outer compartment **7**. In the illustrated embodiment of the invention, the refrigeration system is provided with a reversing or change-over valve **11** which may be selectively operated to reverse the flow of refrigerant to the respective heat exchangers **6** and **8**. When the conditioner is in operation, air is drawn from within the room and circulated by the air moving means or fan **12** through the inner compartment **4** of the conditioner and passed over the heat exchanger **6**. The fan **12** is driven by a motor **10** mounted in the barrier **3**.

During operation of the unit on a cooling cycle, the heat exchanger **7** is operated as an evaporator or cooling unit and moisture from the air being circulated over the heat exchanger **7** is condensed onto the coil surfaces of this heat exchanger. Means are provided for collecting this condensate water and delivering it to the condensate sump or receptacle **16** provided in the outer compartment **6** of the air conditioner. More specifically, these means include a suitable drip tray **13** (seen only in FIG. 2) from which condensate water is delivered to the sump **16** through means of an insulated conduit **14**. The water receptacle or sump **16** is, in the embodiment of the invention shown in FIGS. 1 and 2, formed in the bottom of the case **2** in the outer compartment of the conditioner.

In order to circulate a stream of air from the outdoors through the unit, there is provided an air circulating means or fan **17** which is, in the illustrated embodiment of the invention, also driven by the motor **10** through the shaft **18**. When the unit is operated, the outdoor fan **17** draws outdoor air from the region **25** upstream from the fan **17** through bell mouthed orifice **20** formed in the panel or scroll **19**. Air circulates inwardly through the orifice opening **20** toward the barrier **3** and is diverted radially along the barrier into the remaining portions of the outer compartment **6**. In the embodiment of the invention shown in FIGS. 1 and 2, the outdoor air then flows through the right hand portion (as seen in FIG. 1) of the outer compartment **6** where it passes through the heat exchanger **8** and is discharged to the outdoors through the outlet opening **22**.

When the air conditioning apparatus is operated on the cooling cycle, the outdoor heat exchanger **8** is operated as a condenser and is cooled by the outdoor air being circulated thereover. When the apparatus is operated on the heating cycle, the reversing valve **11** reverses the flow of refrigeration through the heat exchangers **7** and **8** thereupon utilizing the heat exchanger **7** as the condenser and the heat exchanger **8** as the evaporator or cooling unit. During the heating cycle, the outer compartment heat exchanger **8**, which is then operating as an evaporator or cooling unit, condenses moisture out of the outdoor air being circulated thereover. Condensate water, collecting on the coils of the outer heat exchanger **8**, drips into the bottom of the outer compartment **6** which forms the condensate collection sump **16**. Although the drawing does not illustrate this, it may be desirable to have the bottom of the outer compartment **6** slant in the direction of the area beneath the fan for facilitating the disposal of the water as will be hereinafter explained.

It should be noted that the water receptacle or sump **16** may take on any desirable form and is, of course, not limited to the arrangement wherein the water receptacle forms the entire bottom portion of the outer compartment of the air conditioner. It is important, however, that the position of the sump or receptacle **16** relative to the air moving means or fan **17** be such that at least a portion of the air stream being discharged from the fan flows over the surface of water in the sump. In the air conditioner illustrated in FIGS. 1 and 2, the fan **17** discharges at least a portion of its air stream in the radial direction toward the bottom of the sump **16** where it is forced to flow along the bottom of the sump. Also the barrier diverts a portion of the air stream downwardly over the sump. In the FIGS. 1 and 2, the fan **17** is shown as a mixed flow fan in which the air is propelled rearwardly by the forward portions of the fan and turned within the fan to be discharged in a direction normal to the axis of the fan. While a mixed flow fan characteristically provides a great amount of radial air flow which is desirable in connection with the present invention, it should be noted that all axial flow fans have a large amount of radial air flow from the blades thereof.

In order to dispose of the condensate water collecting in the water receptacle or condensate collection sump **16**, the present invention incorporates an air vortex generator **24** of the type disclosed in the aforementioned Speaker application, which is designed to receive or trap a portion of the air stream discharged from the fan or air circulating means **17** and to impart a swirling motion and an upward thrust to this trapped air stream thereby creating a relatively stabilized air vortex or whirling mass of air, which flows upwardly from the generator. This air vortex generator, as may best be seen in FIG. 5, includes an eye section, designated by the reference numeral **26** and a diverter section **27** attached to the eye section and adapted to divert a portion of an air stream into the opening or gap **28** formed between the curved eye section and the diverter **27**. The air vortex generator **24**, shown in FIG. 5, is formed from a thin upright strip which is reversely looped at one end to form an eye section of generally spiral or C-shaped cross section. It will be noted that the edge **30** of the strip does not engage the inner wall **29** and air is diverted into the C-shaped eye section through the gap **28** between the inner wall **29** and edge **30**. The inner wall surface **29** of the eye section is slanted upwardly or flared outwardly from the bottom thereof toward the top to define a substantially inverse shaped frusto-conical cavity. That is, the wall **29** slants from a relatively small opening at the bottom thereof to a relatively larger opening at the top. Because of the reversely looped shape of the eye section, air flowing therein is confined to a generally circular path and caused to swirl around an axis **35** passing through the eye section. The upward slant or outwardly flared shape of the inner wall surface **29** of the eye section **26** also imparts an upward thrust to the swirling air stream. In this manner the eye section **26** develops a stabilized air vortex flowing upwardly from the eye section and having an area of relatively low pressure in the center thereof which communicates with the cavity defined by the inner wall **29** of the eye section. The low pressure in the center of the air vortex causes water droplets to be carried out of the eye section by the upwardly flowing vortex.

Referring now to FIGS. 1, 2 and 4 it will be seen that the vortex generator **24** is arranged within the sump **16** so that its diverter section **27** is disposed in the path of the air stream flowing over the surface of water in the sump. In the preferred embodiment of the invention, the orifice partition **19** forms one end wall of the condensate collection sump **16** and condensate water collects in the area beneath the fan or in the area directly behind the partition **19**. The eye section **26** of the generator is disposed with respect to the fan **17** so that the axis **35** of the eye section, or air vortex discharging therefrom, extends in a direction slightly upstream from the fan **17**. It will

be noted that the diverter section 27 extends across the bottom of the receptacle 16 and is arranged flush against or abuts the lower portion of the barrier 3. An opening or slot 19*a* formed in the orifice partition 19 permits the diverted air stream or air vortex discharging from the vortex generator to be discharged upwardly into the region 25 just upstream from the fan 17. Inasmuch as the vortex generator extends upwardly from the sump 16, water usually surrounds the lower portions of the generator and flows or is blown into the eye section of the generator. It is believed that the low pressure region created in the center of the vortex causes the water to be lifted from the sump upwardly into the vortex somewhat as a tornado lifts an object in its path. This water is then rotated by the air mass and the turbulence of the air mass or vortex atomizes the water into small droplets which are then carried by the upwardly flowing vortex into the air stream flowing through the low pressure region 25 toward the fan 17. These water droplets then hit the fan blades to be further atomized and thrown into the remaining portions of the outer compartment and to be carried onto the outer heat exchanger 8 of the unit.

It will be noted from FIGS. 2 and 4 that the air stream trapped by the vortex generator flows from a region of relatively high pressure in the area behind the orifice partition 19 into an area of relatively low pressure in the region 25 just upstream from the fan 17. This has the effect of further reducing the pressure in the area of the eye section 26 and greatly enhances the operation of the air vortex generator 24 in lifting water out of the condensate collection sump 16.

The droplets of water thrown or lifted out of the eye section 26 through the slot or opening 19*a* are impelled at a substantial force upwardly toward the front of the unit. In order to prevent this water from being thrown out of the unit through the inlet 21, the arrangement of the present invention provides a splash baffle 37 extending across the lower portion of the bell mouth orifice opening 20 and attached to the upstream side of the orifice partition 19. The splash baffle is, of course, slightly upstream from the orifice and ahead of the eye section 26 of the vortex generator. The splash baffle is provided with several louvers 38 having their upstream edges 38*a* slanting downwardly so that the water droplets thrown by the vortex generator are prevented from passing through the baffle 37. Water collects on the louvers 38 and drips downwardly into the area upstream from the orifice partition 19. In order to drain this water back into the condensate sump, an opening 36 is provided in the bottom of the orifice partition 19. Inlet air flows between the louvers 38 and carries some of the water droplets dropping off the louvers 38 into the fan 17.

It should be mentioned that the air circulating means or fan in the outer compartment does not have to be a radial or axial flow fan such as that illustrated by the fan 17 in the outer compartment. Rather, the fan or air circulating means could be a blower, such as the blower 31 illustrated in FIG. 6, having a scroll 33 with an outlet discharging along the surface of the condensate collection sump 16 in the outer compartment. Thus, in FIG. 6 there is shown a blower wheel 31 driven by a motor 10 mounted in the barrier 3 which circulates an outdoor air stream through the outer compartment over the outdoor heat exchanger 8. More specifically, the air stream enters the blower wheel 31 through an opening 32 in the scroll 33 and is discharged along the bottom of the sump 16 toward the heat exchanger 8 in the right hand portion (as seen in FIG. 6) of the outer compartment 6. As the air stream discharges from the blower 31, a portion thereof encounters the diverter section 27 of the air vortex generator 24, which extends through an opening or slot 33*a* formed in the front portion of the blower scroll 33. A portion of the air stream is diverted into the eye section 26 of the vortex generator wherein a stabilized air vortex is generated which discharges into the region 25 formed upstream from the opening 32 in the scroll 33. Water in the bottom of the sump 16 flows into the eye section through the slot 33*a* and is thrown in droplets upwardly into the air stream entering the blower 31. As in the previous arrangement illustrated in FIGS. 1 and 2, air is diverted by the air vortex generating member from the high pressure side of the scroll 33 to the low pressure side thereof where the air vortex lifts the water into the air stream entering the air circulating means, or blower wheel 31, which further atomizes the droplets and blows them into other portions of the outer compartment.

In the embodiment of the invention shown in FIG. 6, the vortex generator extends completely through an opening or slot formed in the scroll or partition 33 while, in the previous embodiment of the invention of FIGS. 1 and 2, the eye section of the vortex generator is disposed directly beneath the opening or slot formed in the curved or bell mouth portion 20 of the partition 19. It is to be understood that an opening could have been provided through the partition 19 of the arrangement shown in FIGS. 1 and 2 similar to the opening 33*a* of the arrangement disclosed in FIG. 6 and the vortex generator could be mounted through the opening so that the eye section is entirely on the upstream side of the partition 19. It should be noted, however, that the slot or opening always leads from the high pressure side of the partition or scroll to the low pressure side and provides access for the vortex generator to direct the stabilized air vortex discharging from the eye section thereof into the low pressure region 25 upstream from the fan or blower. The particular shape of the opening or the disposition of the generator therein is unimportant so long as the low pressure region of the air vortex, created in the eye section, communicates with water in the eye section and discharges into the region just ahead of the air circulating means so that water droplets are lifted into the low pressure region upstream from the orifice opening thereby to be carried by the air stream into the blades of the air circulating means.

While in accordance with the patent statutes there has been shown and described what at present is considered to be the preferred embodiment of this 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 we claim as new and desire to secure by Letters Patent of the United States is:

1. In an air conditioning apparatus having a refrigeration system including a cooling unit adapted to condense moisture out of an air stream circulated therethrough, the combination comprising air circulating means mounted in said unit for circulating an outdoor air stream through said unit, an orifice partition having an orifice opening for introducing outdoor air from a region upstream from said air circulating means into said air circulating means, said orifice partition having an opening therein leading from an area on the downstream side of said partition to said region on the upstream side of said partition, a condensate collection sump disposed in said unit so that at least a portion of said air discharged from said air circulating means flows over the surface of said sump, means in said apparatus for collecting condensate water from said cooling unit and for delivering water to said condensate sump, an air vortex generator arranged in the path of said air stream flowing over said sump and including an eye section communicating with water in said sump, said eye section adapted to receive a portion of said air stream flowing over said sump, said eye section having an inner wall so constructed and arranged as to confine said diverted air stream into a substantially circular path within said eye section and to impart an upward thrust thereto thereby generating a substantially

stabilized air vortex discharging in the upward direction from said eye section and having a low pressure region in the center thereof communicating with water in the bottom of said eye section, said eye section being arranged with respect to said opening in said partition so that said air vortex is discharged through said opening in said partition into said region upstream from said air circulating means thereby lifting waterdroplets out of said eye section into said air stream entering said air circulating means.

2. In an air conditioning apparatus having a refrigeration system including a cooling unit adapted to condense moisture out of an air stream circulated therethrough, the combination comprising air circulating means mounted in said unit for circulating an outdoor air stream through said unit, an orifice partition having an orifice opening introducing outdoor air from a region upstream from said air circulating means into said air circulating means, a condensate collection sump disposed in said unit so that at least a portion of said air discharged from said air circulating means flows over the surface of said sump, said orifice partition having an opening therein leading from an area on the downstream side of said partition to said region on the upstream side of said partition, means in said apparatus for collecting condensate water from said cooling unit and delivering said water to said condensate sump, an air vortex generator arranged in the path of said air stream flowing over said sump and including an eye section extending into said water in said sump, said eye section adapted to receive at least a portion of said air stream and having an inner wall reversely turned upon itself to impart a swirling motion to said air stream, said inner wall being flared outwardly from the bottom of said eye section to the top thereof so that said inner wall also imparts an upward thrust to said swirling air stream thereby generating a stabilized air vortex flowing upward from said eye section and having a low pressure area in the center thereof communicating with water in the bottom of said eye section, said eye section being arranged with respect to said opening in said partition so that said stabilized air vortex is discharged from said eye section through said opening in said partition into said region upstream from said air circulating means so that water droplets are lifted out of said eye section by said air vortex into said air stream entering said air circulating means.

3. In an air conditioning apparatus having a refrigeration system including a cooling unit adapted to condense moisture out of an air stream circulated therethrough, the combination comprising air circulating means mounted in said unit for circulating an outdoor air stream through said unit, an orifice partition having an orifice opening for introducing outdoor air from a region upstream from said air circulating means into said air circulating means, a condensate collection sump disposed in said unit so that at least a portion of said air discharged from said air circulating means flows over the surface of said sump, means in said apparatus for collecting condensate water from said cooling unit and delivering said water to said condensate sump, said orifice partition having an opening therein leading from an area on the downstream side of said partition to said region on the upstream side of said partition, an air vortex generator mounted in said condensate sump and communicating with water therein, said air vortex generator including a diverter section extending upwardly from said sump into the path of said air stream circulated over said sump for diverting a portion of said air stream discharging from said air circulating means and an eye section adapted to receive said diverted air stream from said diverter section, said eye section having an inner wall so constructed and arranged as to confine said diverted air stream into a substantially circular path within said eye section and to impart an upward thrust thereto thereby generating a substantially stabilized air vortex discharging in the upward direction from said eye section and having a low pressure region in the center thereof communicating with water flowing into said eye section from said sump, said vortex generator being so arranged with respect to said opening in said partition as to discharge said stabilized air vortex from said eye section of said generator into said region upstream from said air circulating means so that water droplets are lifted out of said eye section by said air vortex into said air stream entering said air circulating means.

4. In an air conditioning unit having a refrigeration system including an air cooling unit adapted to condense moisture out of an air stream circulated therethrough, the combination comprising fan means mounted in said unit for circulating an outdoor air stream through said unit, an orifice partition having a bell-mouth orifice opening for introducing outdoor air into said fan means from a region upstream therefrom, a condensate collection sump disposed in said unit and so arranged with respect to said fan means that at least a portion of said air discharged therefrom flows over the surface of said sump, means for collecting condensate water from said cooling unit and delivering said water to said condensate sump, said bell-mouth orifice opening having an opening in the lower portion thereof and disposed beneath said region upstream from said fan means, an air vortex generator mounted in said condensate sump, said air vortex generator including an eye section arranged beneath said opening in said bell mouth orifice and an air diverter section, said diverter section extending upwardly from said sump into the path of said air stream circulated over said sump by said fan means for diverting at least a portion of said air stream flowing over said sump into said eye section of said vortex generator, said eye section being so constructed and arranged as to confine said air stream received from said diverter section into a substantially circular path and to impart an upward thrust thereto so that a substantially stabilized air vortex is discharged upwardly from said eye section through said opening in said bell mouth orifice into said region upstream from said fan means, said air vortex having a low pressure region in the center thereof communicating with water in said eye section for breaking up said water into small droplets and lifting said droplets into said air stream flowing into said fan means.

5. In an air conditioning apparatus having a refrigeration system including a cooling unit adapted to condense moisture out of an air stream circulated therethrough, the combination comprising a fan mounted in said unit for circulating an outdoor air stream through said unit, an orifice partition having a bell-mouth orifice for introducing outdoor air into said fan from a region upstream therefrom, said bell-mouth orifice having an opening in the lower portion thereof extending beneath said region upstream from said fan, a condensate collection sump disposed in said unit and so arranged with respect to said fan that a portion of said air discharged therefrom flows over the surface of said sump, means for collecting condensate water from said cooling unit and delivering said water to said condensate sump, an air vortex generator mounted in said condensate sump, said air vortex generator including an eye section arranged beneath said opening in said bell-mouth orifice and an air diverter section, said air diverter section extending upwardly from said sump into the path of said air stream circulated over said sump for diverting at least a portion of said air stream discharging from said fan into said eye section of said vortex generator, said eye section having a C-shaped inner wall adapted to receive said diverted air stream and to impart a swirling motion thereto, said C-shaped inner wall of said eye section being flared outwardly from the bottom of said eye section to the top thereof so that said wall imparts an upward thrust to said swirling air stream thereby generating a substantially stabilized air vortex having a low pressure area communicating with water in the bottom of said eye section, said

eye section of said vortex generator being arranged in relation with said opening in said bell-mouth orifice so that said stabilized air vortex is discharged from said eye section through said opening in the lower portion of said bell-mouth orifice into said region upstream from said air circulating means thereby to lift water droplets out of said eye section into said air stream entering said fan.

6. In an air conditioning unit having a refrigeration system including an air cooling unit adapted to condense moisture out of an air stream circulated therethrough, the combination comprising a blower mounted in said unit for circulating an outdoor air stream through said unit, a blower scroll having an orifice opening for introducing outdoor air into said blower from a region upstream therefrom, a condensate collection sump disposed in said unit and so arranged with respect to said blower so that at least a portion of said air stream discharged therefrom flows over the surface of said sump, means for collecting condensate water from said cooling unit and delivering said water to said condensate sump, an opening in the lower portions of said blower scroll leading from an area on the downstream side of said blower to said region on the upstream side of said blower scroll, an air vortex generator adapted to communicate with water in said condensate sump, said air vortex generator including an eye section arranged on the upstream side of said blower scroll and an air diverter section, said diverter section extending through said opening in said blower scroll into the path of said air stream on the downstream side of said blower scroll for diverting at least a portion of said air stream through said opening in said blower scroll into said eye section of said vortex generator, said eye section being so constructed and arranged as to confine said air stream received from said diverter section into a substantially circular path and to impart an upward thrust thereto so that a substantially stabilized air vortex is discharged into said region upstream from said blower, said air vortex having a low pressure region in the center thereof communicating with water in said eye section for breaking up said water into small droplets and lifting said droplets into said air stream flowing into said blower.

7. In an air conditioning apparatus having a refrigeration system including a cooling unit adapted to condense moisture out of an air stream circulated therethrough, the combination comprising a fan mounted in said unit for circulating an outdoor air stream through said unit, an orifice partition having an orifice opening for introducing outdoor air into said fan from a region upstream therefrom, said orifice partition having a small opening therein leading from an area on the downstream side of said partition to said region on the upstream side of said partition, a condensate collection sump disposed in said unit so that at least a portion of said air discharged from said fan flows over the surface of said sump, means in said apparatus for collecting condensate water from said cooling unit and for delivering water to said condensate sump, an air vortex generator arranged in the path of said air stream flowing over said sump and including an eye section communicating with water in said sump, said eye section adapted to receive a portion of said air stream flowing over said sump and having an inner annular wall so constructed and arranged as to confine said diverted air stream into a substantially circular path within said eye section and to impart an upward thrust thereto thereby generating a substantially stabilized air vortex discharging in the upward direction from said eye section and having a low pressure region in the center thereof communicating with water in the bottom of said eye section, said eye section being so arranged with respect to said opening in said orifice partition as to discharge said air vortex through said small opening in said partition into said region upstream from said fan thereby lifting water droplets out of said eye section into said air stream entering said air circulating means, and a splash baffle extending across the lower front portion of said orifice opening on the upstream side thereof for stopping water droplets thrown outwardly through said small opening in said orifice partition thereby preventing said water droplets from being thrown out of said unit.

8. In an air conditioning apparatus having a refrigeration system including a cooling unit adapted to condense moisture out of an air stream circulated therethrough, the combination comprising a fan mounted in said unit for circulating an outdoor air stream through said unit, and orifice partition having a bell-mouth orifice for introducing outdoor air into said fan from a region upstream therefrom, said bell-mouth orifice having an opening in the lower portion thereof extending beneath said region upstream from said fan, a condensate collection sump disposed in said unit and so arranged with respect to said fan that a portion of said air discharged therefrom flows over the surface of said sump, means for collecting condensate water from said cooling unit and delivering said water to said condensate sump, an air vortex generator mounted in said condensate sump, said air vortex generator including an air diverter section extending upwardly from said sump into the path of said air stream circulated over said sump for diverting at least a portion of said air stream, said vortex generator also including an eye section adapted to receive said diverted air stream and having a C-shaped inner wall adapted to impart a swirling motion to said diverted air stream, said C-shaped inner wall of said eye section being flared outwardly from the bottom of said eye section to the top thereof so that said wall imparts an upward thrust to said swirling air stream thereby generating a substantially stabilized air vortex having a low pressure area communicating with water in the bottom of said eye section, said eye section of said vortex generator being arranged below said slot in said bell-mouth orifice so that said stabilized air vortex is discharged upwardly through said slot into said region upstream from said fan thereby throwing water droplets out of said eye section into said region upstream from said fan, and a splash baffle extending across the lower front portion of said bell-mouth orifice for interrupting water droplets thrown by said air vortex.

9. An air conditioning unit for conditioning the air within an enclosure comprising a case, said case being divided by a barrier into indoor and outdoor compartments respectively facing the enclosure and the outdoors, a cooling unit mounted in said indoor compartment, a condensing unit mounted in said outdoor compartment, means for circulating an air stream from said enclosure over said cooling unit, a fan mounted in said outer compartment for circulating an outdoor airstream through said condensing unit, an orifice partition having a bell-mouth orifice for introducing outdoor air into said fan from a region upstream therefrom adjacent the rear of said unit, said bell-mouth orifice having an opening in the lower portion thereof extending beneath said region upstream from said fan, a condensate collection sump disposed in said unit in the outer compartment of said unit and so arranged with respect to said fan that a portion of said air discharged therefrom flows over the surface of said sump, means for collecting condensate water condensed out of said air stream circulated over said cooling unit and for delivering said water to said condensate sump, an air vortex generator mounted in said condensate sump, said air vortex generator including an eye section extending upwardly from said sump and an air diverter section abutting said barrier and extending across said sump in the path of said air stream for diverting at least a portion of said air stream into said eye section of said vortex generator, said eye section having a C-shaped inner annular wall adapted to receive said diverted air stream and to impart a swirling motion thereto, said C-shaped inner wall of said eye section being

flared outwardly from the bottom of said eye section disposed within said sump to the top thereof so that said wall imparts an upward thrust to said swirling air stream thereby generating a substantially stabilized air vortex having a low pressure area communicating with water in the bottom of said eye section, said eye section of said vortex generator being arranged beneath said slot in said bell-mouth orifice so that said air vortex is directed through said slot into said region upstream from said fan thereby to lift water droplets out of said eye section into said air stream entering said fan and a splash baffle mounted across the lower front of said bell-mouth orifice, said splash baffle including a plurality of louvers slanting downwardly from their downstream edges toward their upstream edges for permitting air flow through said baffle while interrupting water droplets thrown by said vortex generator in the upstream direction.

References Cited in the file of this patent

UNITED STATES PATENTS

1,423,412	Garner	July 18, 1922
1,881,049	Garner	Oct. 4, 1932
1,972,398	Garner	Sept. 4, 1934
2,119,958	Newill	June 7, 1938
2,278,989	Gruitch	Apr. 7, 1942
2,335,456	Seitz	Nov. 30, 1943
2,710,510	Roseman	June 14, 1955
2,873,908	Powers	Feb. 17, 1959
2,941,382	Wuesthoff	June 21, 1960