Sept. 3, 1957 L. R. SMITH ET AL 2,804,758

AIR CONDITIONER HAVING AUTOMOTIVE DRAIN MEANS

Filed March 19, 1954

Fig. 1.

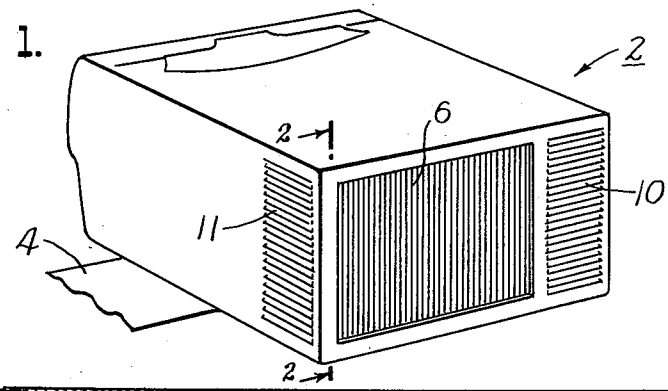


Fig. 2.

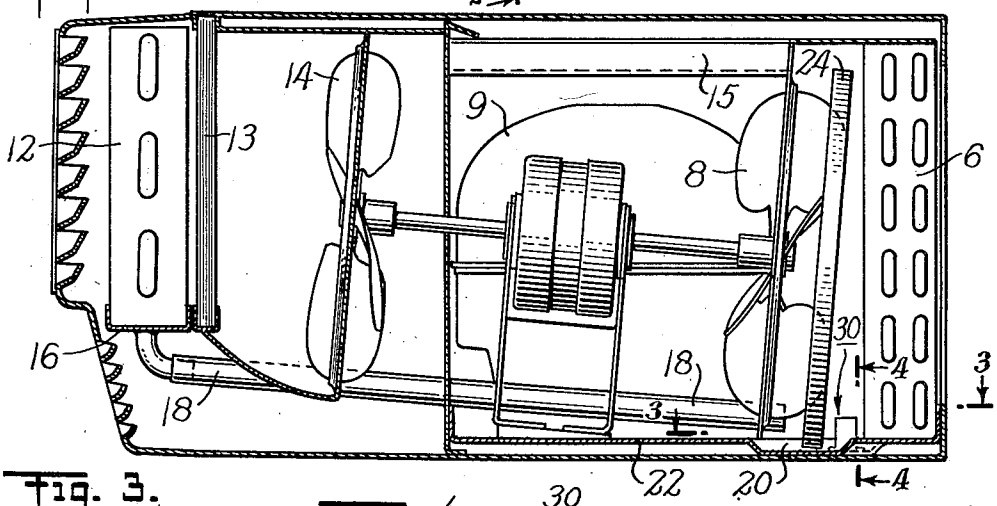


Fig. 3.

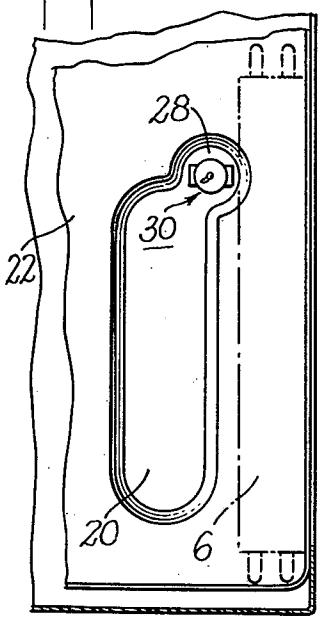


Fig. 4.

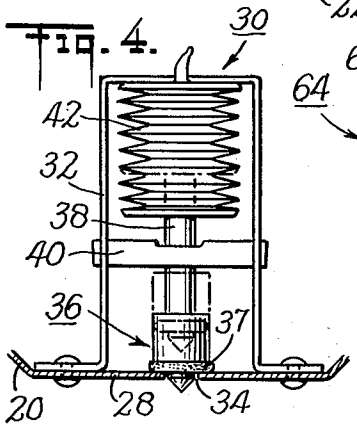


Fig. 5.

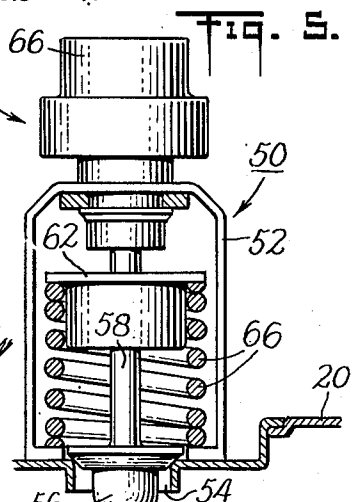
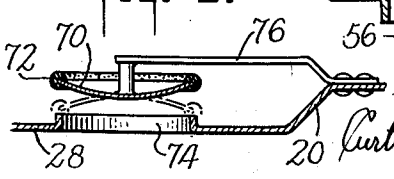


Fig. 6.



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United States Patent Office

2,804,758

Patented Sept. 3, 1957

2,804,758

AIR CONDITIONER HAVING AUTOMOTIVE DRAIN MEANS

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Application March 19, 1954, Serial No. 418,062

3 Claims. (Cl. 62—140)

This invention relates to air conditioning units, and more in particular to such units as are adapted to be positioned in a window or a like opening with the heat being dissipated to the outside atmosphere.

An object of this invention is to avoid certain difficulties which have been encountered in connection with air conditioning units of the type which have the condenser exposed to the atmosphere. A further object is to provide means to insure against the trapping and freezing of water during the cold months. A further object is to avoid damage to such units and to insure proper operation at all times.

Unitary or package air conditioners have been provided for installation in a window or a similar opening and generally have been referred to as window air conditioning units. Such units are adapted to rest upon or at the level of the window sill, usually with the condenser positioned outside the window line and with a fan circulating air through the condenser to cool it. These units are provided with air filters and there is a fan which recirculates the air from the room through the filter and the evaporator of the unit so as to filter and to cool and dehumidify the air. These units may also be provided with means for heating either by the reverse refrigeration cycle method, auxiliary electric resistance heating or by other methods. Fresh air is also introduced into the room by the circulating fan and it may be assisted by the fan which circulates air through the condenser. Some of these units are arranged so that one or both of the fans may be used to exhaust or "pump out" air from the room when there is no cooling and it is desirable to ventilate with air entering at other openings.

It is more or less standard practice to keep units of the above character in place during the entire year, particularly if the conditions are such that ventilating, heating, filtering or air exhausting operations are contemplated. However, it has been indicated above that the condenser and its fan are often exposed to the atmosphere and, during the winter months when extended periods of freezing temperatures are encountered, there is a tendency for ice and snow to accumulate upon the condenser and in the vicinity of the fan. It is impractical at times, and at other times merely inconvenient, to provide water-tight covers for the exposed parts of such units. Additionally, the installation of such a cover would interfere with the use of the unit for ventilating, etc., as discussed above.

The condenser fan or the fan shaft of such a unit may be used to provide a mounting for a condensate "slinger" which is rotated and slings or sprays condensate water onto the condenser. Such condensate water is from the evaporator of the unit and may be delivered to a condensate sump adjacent the fan and the condenser. This slinger then dips into this sump as it rotates, withdrawing water and throwing it into the air stream and onto the condenser.

When units are provided with such a condensate sump, there is a tendency for water to collect and freeze within the sump during the winter months. The freezing of such

water generally freezes around a portion of the slinger and therefore prevents rotation of the slinger and the fan. Under such circumstances, the fan and its motor are blocked to that the filtering, heating and ventilating operations discussed above are interfered with; that is, if the condenser fan is driven by the same motor as the air circulating fan, then the unit cannot be used to circulate and filter air within the room or to draw in fresh air. Furthermore, it is not possible to exhaust or pump out air with the condenser fan or with the air circulating fan. The unit therefore loses its usefulness for the winter months.

Furthermore, if the occupant of the room turns on the fan motor to heat or ventilate with the unit and finds that the fan does not work because the slinger is frozen in the condensate sump, he may then fail to turn off the motor. The high current flowing through the stalled motor under such circumstances may very well damage it seriously, particularly if the condition continues for a substantial period of time. A similar condition may exist where the condenser fan is driven by a separate motor and is stalled by the freezing of water in the sump during the time that the air circulating fan is operated by another motor. Under some circumstances, the high current of the stalled motor might overload the electrical circuit or the fuses with the attendant inconvenience and danger. It is an object of the present invention to avoid the difficulties referred to above in a simple and dependable manner without interfering in any way with the efficiency and dependable operation at all times.

Referring to the drawing:

Figure 1 is a perspective view, with parts broken away, of one embodiment of the invention;

Figure 2 is a sectional view on the line 2—2 of Figure 1;

Figure 3 is a fragmentary sectional view on the line 3—3 of Figure 2;

Figure 4 is an enlarged fragmentary sectional view of the line 4—4 of Figure 2; and

Figures 5 and 6 are views similar to Figure 4 and showing other constructions.

Referring particularly to Figure 1 of the drawing, an air conditioning unit 2 of the window type is mounted upon the window sill and ledge 4 with an exposed condenser 6 through which air is blown (see Figure 2) by a fan 8. The air is drawn in at the right (Figure 1) at 10 and at the sides at 11, and it passes over the compressor 9 (see Figure 2), and is then blown outwardly through the condenser by the fan. At the left, the unit includes an evaporator 12 and filter 13 through which air is blown into the room by a fan 14. A substantial amount of this air is recirculated, but when desirable, fresh air is drawn in through passageway 15 at the top of the unit casing.

As indicated above, the normal operation of the unit causes condensate to collect upon the cold surfaces of the evaporator. This condensate falls to the bottom of the evaporator where it is collected in a trough 16 and it flows through a tube 18 to a condensate sump 20 in the bottom of the casing pan 22. Fan 8 has a slinger ring 24 which dips into the condensate sump 20 and picks up any condensate therein. The condensate picked up in this manner is somewhat thrown and blown onto the condenser by the air stream which the fan directs through the condenser. Hence, the fan causes the air to circulate, and its rotation also disposes of the condensate upon the condenser. The condensate thus deposited is evaporated and this promotes the refrigerant cooling and condensing action, and improves the operating efficiency. By disposing of the condensate in this manner, it is not necessary to provide drain piping from the unit.

As shown best in Figure 3, the condensate sump has a somewhat circular extension **28** at one end which has its center at a slightly lower level than the remainder of the sump. Centrally positioned within this sump extension **28** is a temperature-controlled automatic valve assembly **30**. This assembly has its valve normally closed, but it is opened automatically whenever the temperature falls below 45° F. Referring to Figure 4, valve assembly **30** has a sheet metal inverted U-frame **32** riveted to pan **20** directly over a central valve opening **34** in the pan. Opening **34** is normally closed by a valve member **36** which is seated therein and which has a pointed end and a sealing O-ring **37** which engages the rim of the opening. Valve member **36** is rigidly mounted on a valve stem **38** which is guided by a bracket **40** and is normally held seated by a sealed bellows **42** rigidly fixed at its top to U-frame **32**.

Bellows **42** is charged with a volatile fluid which turns to liquid as its temperature drops to 45° F., and it tends to evaporate when its temperature rises above 45° F. When the temperature falls below 45° F., the pressure within the bellows becomes less than atmospheric pressure so that the bellows contracts, and this lifts the valve member **36** to the broken line position. When the temperature rises, the bellows expands and the valve is closed as shown in full lines.

With this arrangement, the valve is held closed during the summer months and during normal spring and fall weather when the temperature is above 45° F. Hence during operation for cooling the air, the condensate which collects in the sump is delivered to the air stream and thence to the condenser as disclosed above. However, when the temperature of the air surrounding the valve assembly **30** falls below 45° F., the valve immediately is opened and any water which is in the condenate sump is drained therefrom. Thus, no water is held in the condensate sump whenever the surrounding temperature approaches the freezing temperature. While the opening action is somewhat critical, it is significant that considerable leeway is permissible in the temperatures at which the valve is opened and closed. Even if snow and rain should enter the face of the condenser and some water should collect in the condensate sump, there is no danger of a pool of water freezing in the sump. Furthermore, the periodic rising and falling of the temperature during the winter months would move the valve member to and from its closed position so as to dislodge any objectionable accumulation within the valve opening.

It is thus seen that the arrangement herein disclosed prevents the freezing of the condensate slinger ring **24** into a body of ice in the condensate sump. This insures that the fan motor **50** which drives both fans will not be stalled, and may be operated to circulate, heat and ventilate. Furthermore, with the arrangement herein disclosed, it is unnecessary to take such precautions to prevent the entry of water, snow and ice into the unit and the unit need not be covered but may be left open so that air may be drawn in for ventilating purposes. In the present embodiment, there is no specific provision for pumping out or exhausting air from the room. However, it is contemplated that such an arrangement be provided when desired.

In the embodiment of Figure 5, a valve assembly **50** replaces unit **30** of Figures 1 to 4, has a sheet metal valve body or plate **52** which has a central valve opening **54** and which is mounted in the bottom of the unit pan **22**. Opening **54** is normally closed by a valve member **56** which is seated therein and which has a sealing ring at its periphery. Valve member **56** is rigidly mounted on a valve stem **58** and is normally held seated. However, the valve member is spring-urged upwardly away from its seated position by a compression spring **60** which has its lower end resting upon the valve body. The other

end of spring **60** rests against cup bracket **62** which is rigidly mounted upon the valve stem.

Valve stem **56** extends upwardly into a valve holding unit **64** which is rigidly mounted in an opening in the top of an inverted-U bracket **52**. Cup bracket **62** is rigidly mounted at its bottom on the valve body. The top of unit **64** is a cylinder **66** which is filled with a temperature sensitive plastic material which tends to contract rapidly when its temperature falls. The top of valve stem **56** carries a piston member which closes the bottom of cylinder **66**. Hence, when the plastic material contracts, spring **60** moves the valve stem upwardly, and this pulls the valve member **54** away from its seat and opens the valve. This operating unit **50** is so constructed and adjusted that it opens the valve when the temperature drops below 45° F., and it closes the valve when the temperature rises above 45° F.

In the embodiment of Figure 6, the thermostatic valve unit is in the form of a temperature responsive curved disc **70** which has a rubber bead or ring **72** around its periphery. Disc **70** is positioned directly over a drain opening **74** which has a slightly upturned rim forming a valve seat. Disc **70** is rigidly mounted upon a metal bracket **76** which is riveted to pan **20** at the side of the sump.

Disc **70** is bi-metallic, and is adapted to move to the full-line position when its temperature falls below 35° F. The disc then moves to the broken-line position when the temperature rises, for example, when the temperature of the disc reaches 60°. When the disc is in the broken-line position, its periphery rests against the rim of drain opening **74**, and ring **72** is held tightly against the valve seat so as to provide a tight seal. Hence, the operation is similar to that of the embodiments of Figures 1 to 5. However, the embodiment of Figure 6 requires greater temperature changes than the other embodiments to effect the valve opening and valve closing operations. In this particular embodiment, the valve closes at 60° F., and opens at 35° F. Under some circumstances, these operating temperatures may be higher and the range of operation may be different. The invention also contemplates the mounting of a movable valve member upon a snap-action bi-metallic strip so as to obtain the valve closing and valve opening as discussed above.

As many possible embodiments may be made of the mechanical features of the above invention and as the art herein described might be varied in various parts, all without departing from the scope of the invention, it is to be understood that all matter hereinabove set forth, or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

We claim:

1. In an air conditioning unit, a refrigeration system including an evaporator which is adapted to cool and dehumidify air and a condenser which is adapted to transfer heat to air and which is exposed to outside temperature conditions, said system including a motor means and a pair of fans driven simultaneously thereby, one of which circulates air to and from a conditioned space and the other of which directs air over said condenser, condensate-handling means to collect condensate from said evaporator and to deliver it for disposal to the outside atmosphere and including means mechanically connected to said other fan whereby the freezing of the condensate will interfere with the operation of said motor means, and temperature-controlled drain means which opens a drain passageway when the temperature falls below a predetermined value above 32° F. whereby the condensate handling means is drained so as to avoid the freezing of water therein.

2. In an air conditioning unit of the window type, the combination of, a refrigeration system including an evaporator through which air is directed for cooling and dehumidifying and a condenser which is exposed to the

outside air, said system including a fan and motor assembly which comprises an air circulating fan which is operated to circulate air to and from the conditioned space and a condenser fan which is operated to circulate air through said condenser, sump means adjacent said condenser, means to collect the condensate from said evaporator and to direct it to said sump means, a slinger which is mounted upon said condenser fan and is rotatable thereby to remove condensate from said sump means and to deliver it to the stream of air passing through said condenser, a valve in said sump means which may be opened to drain said sump means, and temperature-responsive control means for said valve which opens said valve automatically at temperatures near freezing and which closes said valve at temperatures substantially above freezing.

3. Apparatus as described in claim 2, wherein said sump means is in the form of a pan positioned at the bottom of said condenser, and wherein said valve is formed by a valve member and an opening in said pan which is opened and closed by said valve member, and wherein said fan and motor assembly is formed by a single motor having a single shaft with said circulating fan mounted upon one end thereof and said condenser fan mounted upon the other end thereof and wherein said slinger is in the form of a ring mounted upon said condenser fan.

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