

Oct. 29, 1957

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2,811,023

CONDENSER AIR CIRCULATION SYSTEM FOR AIR CONDITIONING UNITS

Filed Sept. 27, 1954

Fig. 1

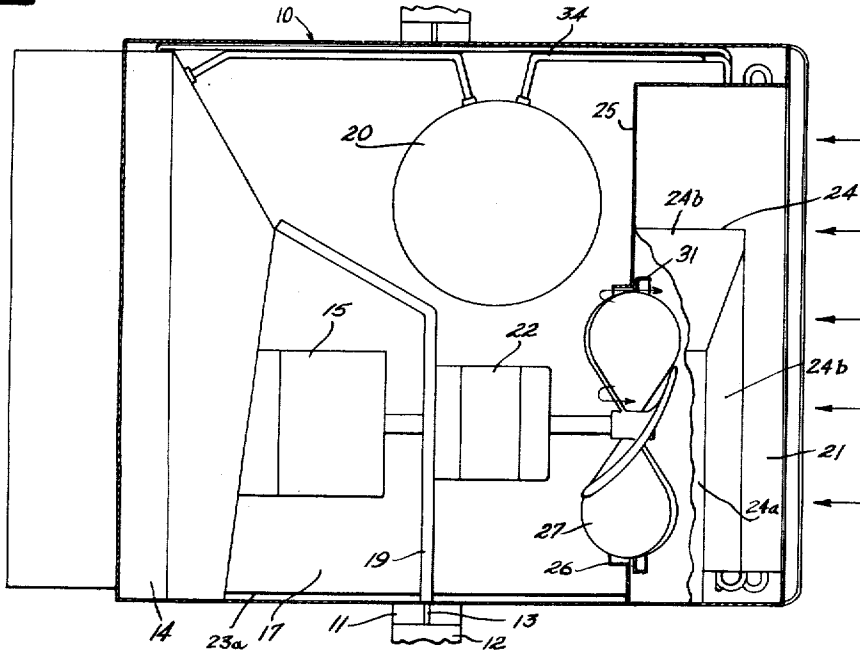


Fig. 2

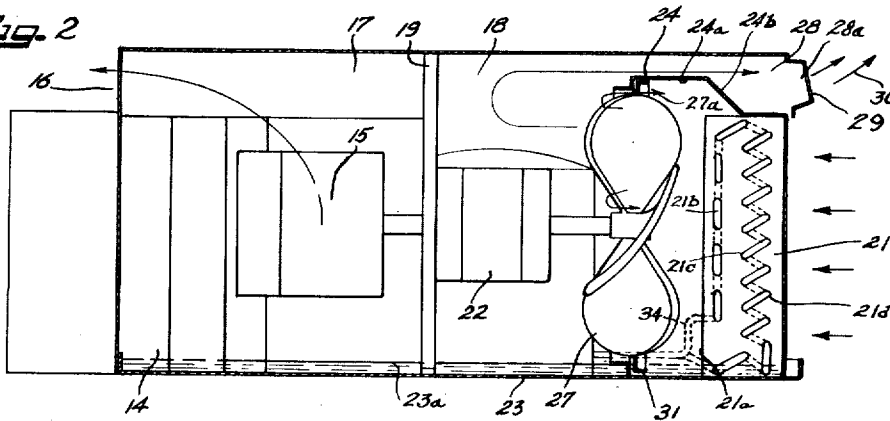


Fig. 4

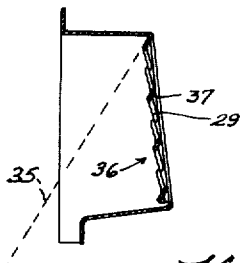
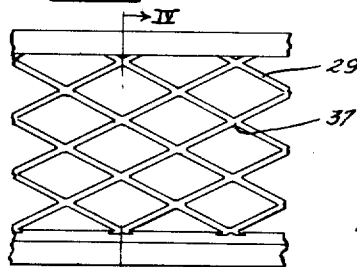


Fig. 3



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CONDENSER AIR CIRCULATION SYSTEM FOR AIR CONDITIONING UNITS

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Application September 27, 1954, Serial No. 458,414

10 Claims. (Cl. 62—140)

The present invention relates to air conditioning apparatus and, more particularly, is concerned with the construction of an improved air flow and condensate removal system for unit type air conditioners.

I am of course aware that a large amount of development work has taken place in the field of unit type room air conditioning units in recent years. Many of these improvements have related to control systems for such air conditioners, improved compressor and fan constructions, and other similar important structural details required to render the small window type of room air conditioning unit commercially acceptable. However, much less has been accomplished in improvement of the efficiency of air conditioner operation, and especially, in improvement of the efficiency in condensate removal, condenser air exhaust and of air flow conditions over the air conditioner condenser.

The present invention is therefore concerned with the provision of a novel and much improved condensate removal and condenser air flow controlling system. By the present invention, a greatly simplified condensate removal construction is provided which requires no extensive troughs, conduits or other similar structures, and a highly efficient heat transfer structure is provided for cooling the compressed refrigerant and for removing the heated air upwardly and away from the rear of the air conditioning unit to prevent it from recycling through the heat exchange unit.

In accomplishing the above improvements, the present air conditioner utilizes a condenser extending completely across the rear of the air conditioning unit and which is subjected exclusively to heat exchange action with outside air. Further, all of the air passing over the condenser surfaces is drawn through the condenser to the fan and exhausted thru an external opening not directly connected to the condenser heat exchanger.

In addition to this single path condenser air flow arrangement, a novel shroud is provided for the condenser and the condenser fan which not only provides the conventional shrouding action but also provides a greatly simplified condensate removal apparatus. The air passing from the condenser through the condenser fan to the external opening is deflected in a direction away from the air inlet to the condenser by means of a simple grille-work which provides a pleasing and decorative appearance while at the same time providing air flow deflection sufficient to prevent the possibility of the recycling of condenser air.

It is therefore an object of the present invention to provide a novel and much simplified condensate removal structure for dispersing evaporator condensate.

Still another object of the present invention is to provide a novel air exhaust deflector grille for the prevention of recycling of condenser air flow.

Still a further object of the present invention is to provide a novel high speed air conditioner exhaust system.

Another object of the present invention is to provide

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a simplified condensate removal shroud forming a part of the condenser shroud.

Still another object of the present invention is to provide a novel and highly efficient heat exchanger for use in air conditioning systems.

Still other and further objects of the present invention will at once become apparent to those skilled in the art from a consideration of the attached drawings wherein:

Figure 1 is a plan view of a unit type air conditioner constructed according to the present invention;

Figure 2 is an elevational view of the improved air conditioner of the present invention;

Figure 3 is an enlarged and elevational view of the condenser compartment exhaust grille-work; and

Figure 4 is a side elevational view in cross section taken along the line IV—IV of Figure 3.

As shown in the drawings:

As viewed in Figure 1, an air conditioner unit generally indicated at 10 is positioned within a conventional window opening 11 in an exterior room wall 12 by means of conventional filler wall boards 13. The air conditioning unit is provided with a conventional evaporator unit 14 through which air is driven by means of the evaporator fan 15 for discharge into the air conditioned room by way of a discharge opening 16. The evaporator chamber 17 is separated from a condenser chamber 18 by an insulated wall 19 which may, if desired, be provided with apertures permitting air flow between the inside and outside of the room.

The above described elements of the evaporator chamber and their relationship to the remainder of the unit, are considered conventional and it will be understood that any desired evaporator arrangement may be utilized with the novel condenser arrangement of the present invention without departing from the inventive concepts.

On the external side of the insulating wall 19, a compressor 20, a condenser 21 and a condenser fan motor 22 are secured to the insulating wall 19 or the base pan 23. As may be seen in Figure 1, the condenser 21 extends substantially the full width of the air conditioner and is provided with an enclosing top shroud 24 that extends rearwardly several inches to cooperate with a vertical closure wall 25. The shroud 24 and the vertical wall 25 provide, with the exception of the circular orifice 26 for the fan blades 27, a complete enclosure for the inner surface of the condenser 21. By providing this enclosure, the fan blades 27 operate efficiently to draw air from the outside of the air conditioning unit through the condenser 21 over its entire surface.

Air entering the condenser chamber 18 first passes over the condenser 21 and through the orifice 26. It then passes, as shown in Figure 2, over the motor 22, the compressor 20, and out through an overhead exhaust passage 28 formed by the top wall of the air conditioner housing and the top of the shroud 24. The exhaust opening 28a is provided with an air flow deflecting grille 29 which, as will be more fully discussed below, causes the air flow to move upwardly generally in the direction of the arrow 30.

By providing a substantially smaller exhaust opening 28 than air inlet to the condenser 21, a substantial increase in air velocity is provided at the exhaust opening 28. This increase of velocity of the air causes air to leave the exhaust grille 29 at a rapid pace and in view of the air speed and upward inclination of the air path, it has been found that substantially no intermixing of the exhaust air takes place with the air being drawn in through the condenser 21. Actually, the velocity imparted to the exhaust air, and its upward inclination, causes a current of air to move vertically past the external end of the condenser 21 by convection thereby supplying upwardly moving relatively cool air to the condenser.

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As explained above, the shroud top wall 24 provides the lower surface of the exhaust air duct. A further important function is also served by the shroud wall 24 in combination with a condensate slinger 31 peripherally carried by the blades 27 of the fan. As may be clearly seen from Figure 2, the shroud 24 is provided with a substantially horizontal flat surface 24a and an inclined surface 24b which is secured to the top frame of the condenser 21. As condensate from the evaporator 14 collects in the pan 23, it passes along a trough 23a, through a small aperture in the vertical wall 25, to a position in contact with the bottom tubes of the condenser 21. The slinger 31 then picks up the moisture not immediately evaporated by this contact and throws it with the aid of the peripheral leakage air current, indicated at arrow 27a, caused by the pressure difference on opposite sides of the shroud wall 25 and the slight clearance between the ends of the fan blades 27 and the orifice 26, against the inner surface 21a of the condenser 21. A substantial amount of the condensate is also thrown upwardly against the surface 24a of the shroud 24 and from thence flows down the inclined surface 24b onto the top of the condenser 21 and runs down the inner surface 21a thereof. Since the air conditioner is ordinarily mounted in the window 11 with a slight degree of inclination in order to permit the ready flow of the condensate from the evaporator 14 backwardly toward the condenser 21, the surface 24a is also tilted slightly to permit the upwardly thrown condensate to run backwardly down the inclined wall 24b. However, in installations in which it is desired that the air conditioner unit as a whole be mounted horizontally, the shroud 24 may be provided with a surface 24a which is slightly inclined.

Evaporation of the condensate on the condenser 21 is accomplished in a very efficient manner since the condenser is provided with an unusual refrigerant flow pattern. As may be seen from Figure 2, refrigerant flows from the compressor 20 through conduit 34 to the bottom of the first, inside, row of tubes 21b of the condenser 21. The tubes of the inner row 21b extend horizontally along the length of the condenser 21 but are connected vertically at their ends, to each other. Thus, condensate flows from the bottom inside surface of the condenser 21 upwardly to the top of the condenser in the first pass. The somewhat cooled refrigerant, then at the top of the condenser, flows down through the second and third rows of tubes 21c and 21d respectively. The rows 21c and 21d are connected by angularly disposed connectors such that the refrigerant flows first through the uppermost horizontal tube of the row 21c and then through the uppermost tube row 21d, from thence slightly downwardly to the second horizontal tube of the row 21c, thence to the second horizontal tube in row 21d etc. as shown in the dotted lines of Figure 2.

The condenser arrangement thus illustrated is highly efficient for two reasons. In the first place, it puts the hottest row of condenser tubes at a point upon which the condensate is thrown by slinger 31 and at a point where condensate may readily drip from the top shroud surfaces 24a and 24b. As the condensate drips downwardly over the tubes 21b it is heated by the increasingly hotter tubes until it is evaporated. Except in very unusual weather conditions water thus dripping downwardly is completely evaporated before it reaches the bottom of the first row of tubes 21b. This system places the hottest condenser tubes in contact with the cool condensate providing a large temperature differential and thus efficient heat transfer. In the second place, an unusually efficient heat transfer is provided for the incoming air to the condenser. This air passes first over the cooler rows 21d and 21c and then passes over the hot row 21b. In view of this arrangement, a substantial temperature differential is retained between the coils of the condenser and the incoming air at all points of air travel through the

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condenser 21, thereby substantially increasing the heat transfer from the condenser to the air. It has been found that this construction including the provision of the row 21b of tubes has provided an unusually efficient and highly effective heat transfer not found in the air conditioner units heretofore known.

While various methods of causing an upwardly deflected air flow from the exhaust duct 28 may be utilized, nevertheless a very satisfactory and yet inexpensive one is more fully disclosed in Figures 3 and 4. There, the grille 29 is shown to comprise a sheet of pierced and stretched sheet metal. Actually, the plane of the original sheet of sheet metal would take the position generally shown in dotted lines 35 in Figure 4. The sheet is intermittently pierced along horizontal lines, and then pulled in the direction of the arrow 36 to provide diamond shaped separations as shown in Figure 3. In view of the initial inclination of the sheet 35, at each of the points of interconnection between the walls of the individual diamond grille openings, upwardly inclined deflecting surfaces 37 are provided. By this arrangement, a very decorative grille opening is provided which simultaneously provides a pleasing appearance and also provides an upward deflection to the air flow path 30.

From the above description, it will be apparent that I have provided a novel and highly efficient combined condensate removal and condenser air flow control system for room unit type air conditioning units. Through the use of a very simple shroud arrangement and a realignment of condenser tubing, an usually efficient heat transfer system and condensate removal apparatus have been achieved. In view of the simplicity of the device, expense has been minimized at the same time that the efficiency has been improved.

It will of course be apparent that modifications and variations may be made in the structure herein disclosed without departing from the scope of the novel concept of the present invention and it is, therefore, my intension that the scope of the present invention be limited solely by the appended claims.

I claim as my invention:

1. In a unit type room air conditioner having a condenser chamber positioned for receiving and discharging air from outside of said room, a condenser extending horizontally substantially the full width of said unit, an exhaust passage above said condenser and extending substantially the length thereof, means for drawing air through said condenser and forcing it at higher velocity out through said exhaust passage, a condensate slinger on said means, and means on the under side of said passage for intercepting condensate from said slinger and directing it downwardly over the surface of said condenser.

2. In a unit type room air conditioner having a condenser chamber positioned for receiving and discharging air from outside of said room, a condenser extending horizontally substantially the full width of said unit, a shroud covering the top of said condenser and extending inwardly therefrom, an exhaust passage above said condenser formed by said shroud and the top of said air conditioning unit, an opening in said shroud, and fan means for drawing air through said condenser and forcing it through said opening and upwardly into said passage for discharge outwardly over said condenser.

3. In a unit type room air conditioner having a condenser chamber positioned for receiving and discharging air from outside of said room, a condenser extending horizontally substantially the full width of said unit, a shroud covering the top of said condenser and extending inwardly therefrom, an exhaust passage above said condenser formed by said shroud and the top of said air conditioning unit, an opening in said shroud, fan means for drawing air through said condenser and forcing it through said opening and upwardly into said passage for discharge outwardly above said condenser, a condensate slinger on said fan, and condensate deflector means inte-

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gral with the underside of said shroud adjacent said opening and slanting downwardly toward the surface of said condenser for intercepting condensate from said slinger and directing it downwardly over the inner surface of said condenser.

4. In a unit type room air conditioner having a condenser chamber positioned for receiving and discharging air from outside of said room, a condenser extending horizontally substantially the full width of said unit, a restricted exhaust passage positioned over said condenser and having an air deflecting grille at the exit thereof for directing air flow from said unit upwardly away from said condenser, a shroud extending along the top surface of said condenser and forming the bottom surface of said restricted exhaust passage, an opening in said shroud, fan means positioned in said opening for drawing air inwardly through said condenser for forcing it outwardly through said restricted exhaust passage at increased velocity, grille means at the exit of said passage for deflecting said outwardly moving air upwardly, and means associated with said fan and with said shroud for deflecting and directing condensate over the surface of said condenser.

5. In a unit type room air conditioner having a condenser chamber positioned for receiving and discharging air from outside of said room, a condenser extending horizontally substantially the full width of said unit, a restricted high velocity exhaust passage having an air deflecting grille at the exit thereof for directing air flow from said duct in an upward direction away from said condenser, a shroud covering the top surface of said condenser and forming the bottom surface of said passage, an aperture in said shroud at a point facing said condenser, fan means in said aperture for drawing air through said condenser and forcing it outwardly through said passage at increased velocity, a slinger on said fan for throwing condensate from the base of said unit to said shroud, inclined means on said shroud for directing condensate from the uppermost portion thereof downwardly onto the inner surface of said condenser, and means for directing the refrigerant from a refrigerant compressor initially over the inner surface of said condenser for heat transfer relation with said condensate and with the air passing through said condensate as it leaves said condenser.

6. A combined compressed refrigerant-to-air heat exchanger and condensate evaporator for air conditioning units comprising a tube and fan condenser having a first vertical row of horizontally disposed tubes vertically connected to each other at the ends thereof and extending along one side of said condenser, at least one additional row of horizontally disposed tubes extending generally parallel to said first row and connected at the ends thereof whereby refrigerant first flows through said first vertical row of horizontal tubes and then passes through said additional row, means for drawing air through said condenser whereby air is passed over said additional row prior to passage over said first row, and means for discharging condensate from said air conditioner over said first row whereby said condensate is evaporated by the refrigerant in its hottest state.

7. A condenser for a room air conditioner or the like comprising a heat transfer unit extending horizontally along substantially the entire width of the air conditioner, a shroud covering the top of said transfer unit and extending downwardly vertically parallel to said unit, an aperture in said shroud and means for drawing air inwardly through said heat transfer unit and aperture and

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for forcing said air outwardly over the top surface of said shroud, a top wall surface on said air conditioner forming a horizontal surface confining the outwardly moving air between said surface and the shroud, the distance between said top surface and said shroud comprising substantially less than the vertical dimension of said heat transfer unit whereby the air flowing outwardly over said shroud assumes a high velocity, and means at the outer end of said shroud for deflecting said outwardly moving air in an upward direction away from the inlet to said heat transfer unit.

8. A condenser for a room air conditioner or the like comprising a heat transfer unit extending horizontally along substantially the entire width of the air conditioner, a shroud covering the top of said transfer unit and extending downwardly vertically parallel to said unit, an aperture in said vertical portion, a fan positioned in said aperture for drawing air inwardly through said heat transfer unit and for forcing said air outwardly over the top surface of said shroud, a top wall surface on said air conditioner forming a horizontal surface confining the outwardly moving air between said surface and the shroud, the distance between said top surface and said shroud comprising substantially less than the vertical dimension of said heat transfer unit whereby the air flowing outwardly over said shroud assumes a high velocity, and means at the outer end of said shroud for deflecting said outwardly moving air in an upward direction away from the inlet to said heat transfer unit, said last named means comprising a one-piece grille of sheet metal longitudinally pierced and stretched substantially at right angles to the plane of the sheet to provide air deflecting surfaces.

9. In a unit type room air conditioner having a condenser chamber positioned for receiving and discharging air from outside of said room, a condenser extending horizontally of said unit, a shroud covering the top of said condenser and substantially enclosing said condenser within said air conditioner, an exhaust passage above said condenser formed by said shroud and the top of said air conditioning unit, an opening in said shroud, fan means for drawing air through said condenser from outside said room and forcing it through said opening and outwardly through said passage above said condenser, and means at the outlet of said passage for deflecting said air upwardly as it leaves said unit.

10. In a unit type room air conditioner having a condenser chamber positioned for receiving and discharging air from outside of said room, a condenser extending horizontally of said unit, a shroud covering the top of said condenser and substantially enclosing said condenser within said air conditioner, an exhaust passage above said condenser formed by said shroud and the top of said air conditioning unit, an opening in said shroud, fan means for drawing air through said condenser from outside said room and forcing it through said opening and outwardly through said passage above said condenser, and means at the outlet of said passage for deflecting said air upwardly as it leaves said unit, said last named means comprising a grille of sheet metal pierced and stretched to provide outwardly and upwardly angled air deflecting surfaces.

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