Oct. 25, 1949. E. L. HART 2,485,733

AIR CONDITIONER HAVING CONDENSATE REMOVAL MEANS

Filed Dec. 24, 1946 2 Sheets-Sheet 1

FIG. 1.

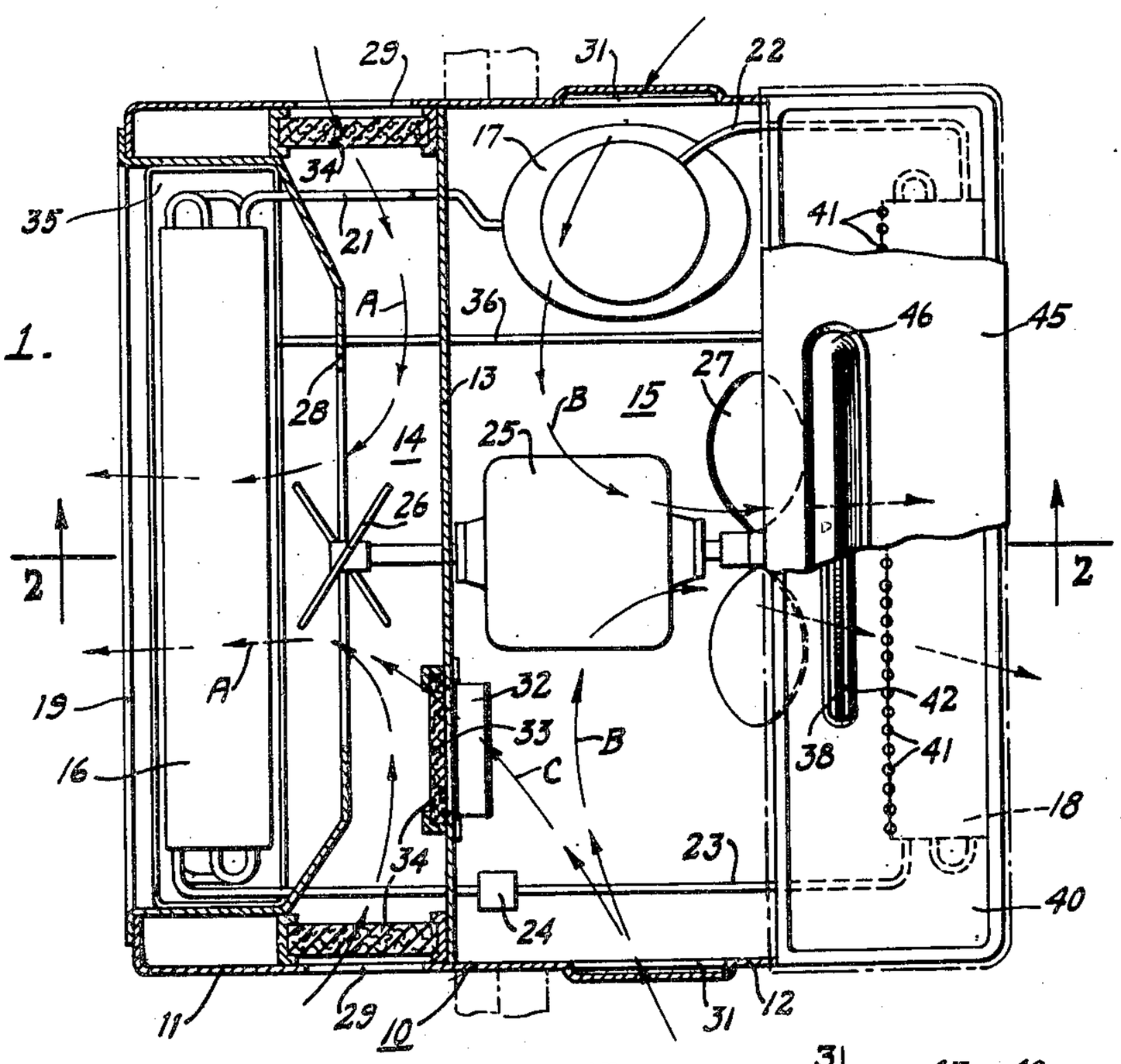
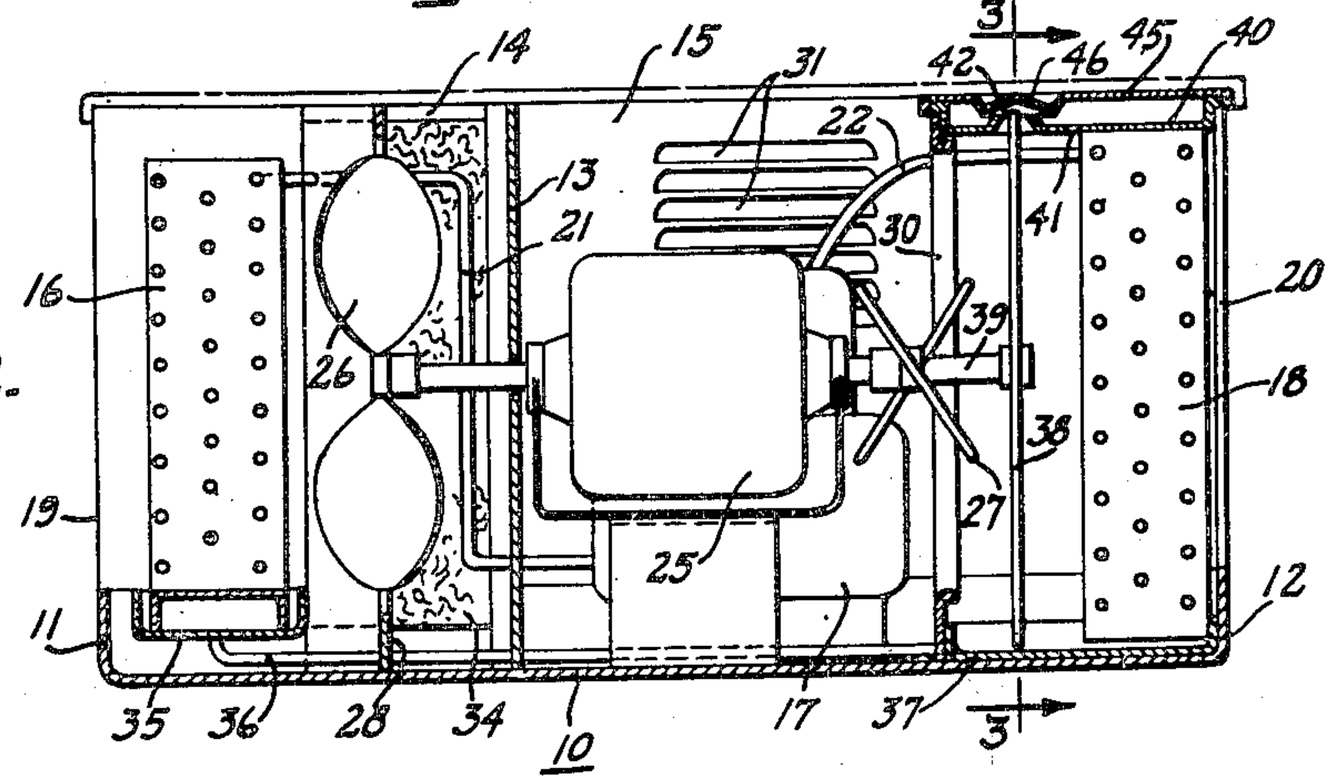


FIG. 2.



INVENTOR.
EDWARD L. HART

BY
Brown, Denk & Synnestvedt

AGENTS

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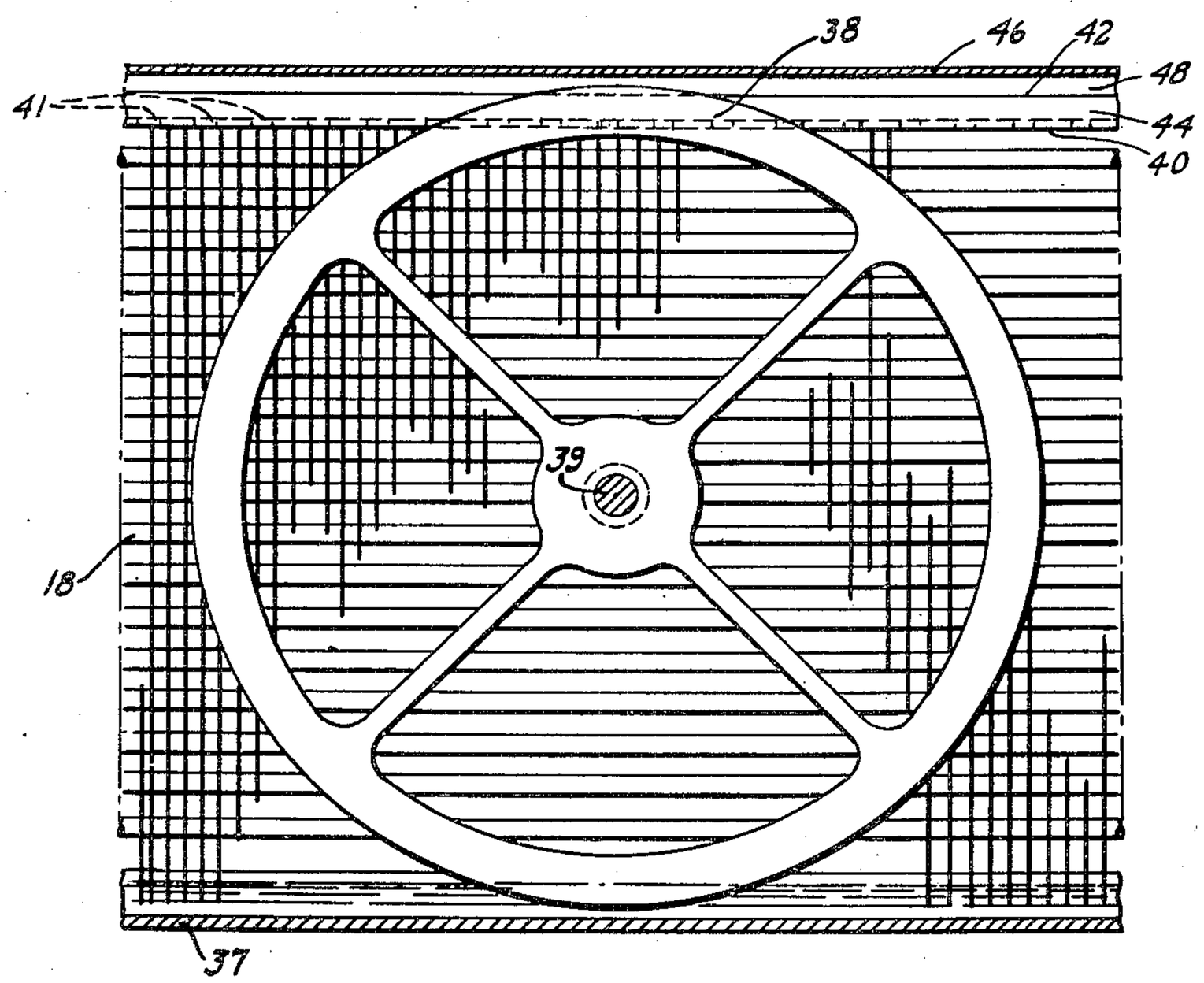
FIG. 3.



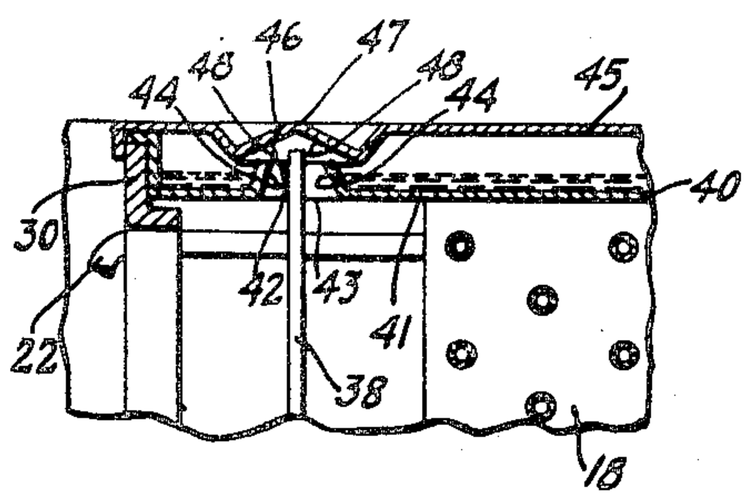


FIG. 4.

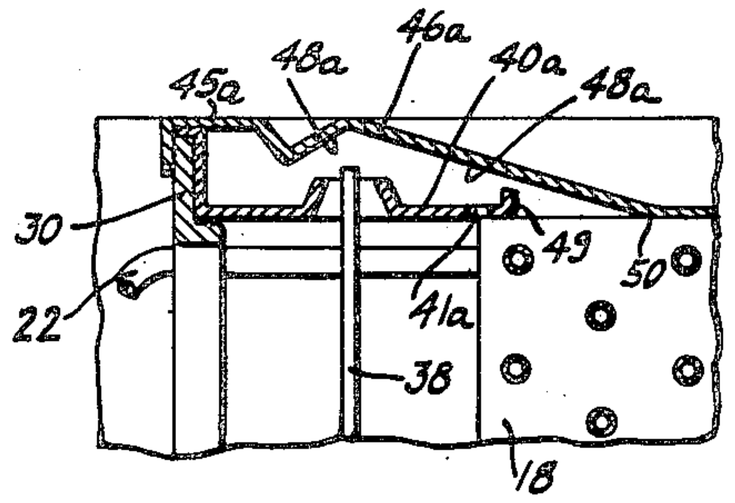


FIG. 5.

INVENTOR.
EDWARD L. HART

BY
Brown, Denk & Lynnestvedt

AGENTS

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AIR CONDITIONER HAVING CONDENSATE REMOVAL MEANS

Edward L. Hart, Abington, Pa., assignor to Philco Corporation, Philadelphia, Pa., a corporation of Pennsylvania

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8 Claims. (Cl. 62—140)

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The present invention relates to air conditioners and, particularly, to room-air conditioning units of the type which are equipped with refrigerating means. More specifically, the invention has to do with the disposal of water which accumulates, in such units, as a result of condensation of moisture removed from the treated air.

In equipment of the general kind above mentioned, the air which is intended for discharge into the room, is passed in heat exchange relationship with the cooling coils of an evaporator. In this manner, the coils cool the air and remove entrained moisture which condenses and collects on the surface of the coils. Attempts have been made to utilize the condensate as a cooling medium for the condenser which is conveniently mounted for communication with the outside, through a window or like opening. For example, structures have been proposed for the purpose of dispersing the condensate in the ambient air and causing the moisture laden air to flow in heat exchange relationship with the condenser. Thus, some condensate is re-evaporated and produces a cooling effect on the condenser. Structures of this sort, however, have the disadvantage that the amount of water actually brought in heat exchange relationship with the condenser is minute as compared to the amount of water which falls back into the unit. Therefore, such structures not only fail to take full advantages of the condensate available to cool the condenser but, lack the ability to dispose of the condensate at a rate sufficiently rapid to insure that no overflowing will occur. In an effort to remedy these conditions, it has been suggested to employ a power driven pump adapted to spray condensate directly over the condenser. However, the provision of a pump is undesirable, because of the added costs of production, operation and up-keep.

It is, therefore, the primary object of this invention to provide an arrangement which eliminates the use of a power driven pump and yet is capable of making full use of the available condensate to cool the condenser efficiently, while disposing of such condensate.

It is also an object of the invention to provide an arrangement of the kind above specified, which requires but a few simple parts adapted for convenient and ready association with existing parts of the air conditioning unit. Notably, the invention results in an arrangement which is economically produced and inexpensively incorporated in air conditioning units, which does not affect costs of operation and up-keep, and which is most reliable and effective in preventing water overflow.

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Another and more specific object of the invention resides in the provision of an arrangement whereby the condensate, which normally accumulates in a sump below the condenser, is transferred from such sump and is conveniently gathered above the condenser. This feature of the invention makes it possible to accumulate condensate at a location where it can be best utilized to cool the condenser, because the condensate is then able to drip over and in direct heat exchange relationship with the condenser. In this manner, adequate and rapid vaporization of the condensate is assured and cooling of the condenser in a most positive and efficient way is attained.

These and other objects, and the manner in which they are obtained, will appear from the following description based on the accompanying drawings wherein the invention is shown as applied to an air conditioning unit of the type adapted to be mounted on a window sill of an enclosure.

It is to be understood, however, that the invention, in its broadest aspect, is not limited to that particular application but may be used in any kind of air conditioner in which removal and full utilization of condensate for cooling the condenser is a problem.

In the drawings:

Figure 1 is a plan view, partly in section, illustrating a preferred embodiment of the invention;

Figure 2 is a vertical sectional view taken substantially on line 2—2 of Figure 1;

Figure 3 is a sectional fragmentary view, on an enlarged scale, looking in the general direction of arrows 3—3 of Figure 2;

Figure 4 is an enlarged fragmentary view of a portion of the apparatus shown in Figure 2; and,

Figure 5 is a view similar to Figure 4, but illustrates a slightly modified form of the invention.

With reference to the drawings, the apparatus as shown particularly in Figures 1 and 2, includes a housing 10 which, in accordance with the practice now well known, is adapted to extend horizontally through a space between the sill and partly opened sash of a window. By mounting the housing 10 in this manner, one end portion 11 of said housing projects into the room, and the other end portion 12 of said housing projects outside the room. A partition wall

13 divides the housing into a front compartment 14 and a rear compartment 15.

The housing 10 contains a conventional refrigerating system which, basically, comprises an evaporator 16 and a condensing unit, the latter including a motor-compressor 17 and a condenser 18. The evaporator is mounted in the front compartment 14 and is disposed adjacent a room-air outlet 19 which, for the purpose of illustration, is shown at the front of housing 10. The condensing unit is mounted in the rear compartment 15, the condenser 18 being disposed adjacent an outside-air outlet 20 (Figure 2) which is provided at the rear of the housing. As particularly shown in Figure 1, the motor-compressor is adapted to withdraw evaporated refrigerant from the evaporator through a suction line 21, and is adapted to discharge compressed refrigerant vapor into the condenser through a conduit 22. From the condenser, liquified refrigerant flows to the evaporator through a liquid line 23 in which is interposed a suitable flow restrictor, such as an expansion valve 24.

The housing also encloses a motor 25 which is conveniently arranged in the rear compartment 15 and is adapted to drive fans 26 and 27. One fan 26 is located within the front compartment 14 and is disposed in cooperative relation with a shield or baffle 28, so that air drawn through room-air inlets 29 flows in heat exchange relationship with the evaporator 16, as indicated by arrows A in Figure 1. The other fan 27 is located within the rear compartment 15 and is disposed in cooperative relationship with a shield or baffle 30 (Figure 2), so that air drawn into said compartment through outside-air inlets 31 flows in heat exchange relationship with the condenser 18 as indicated by arrows B in Figure 1.

A damper 32 which is associated with an opening 33 in partition wall 13, provides for the admission of controlled amounts of outside air into the conditioning compartment 14, as represented by arrows C in Figure 1. Suitable filters 34 are provided to purify the air passing into compartment 14 through said inlets 29 and opening 33. This air is cooled and dehumidified as it passes in heat exchange relationship with the evaporator.

Condensate, which forms on evaporator 16, is collected in the usual sump or pan 35 which is conveniently disposed beneath said evaporator. A drain pipe 36 conveys condensate from sump or pan 35 to a second sump or pan 37 (Figures 2 and 3) which is conveniently located beneath the condenser. A rotatable wheel-like member 38 is mounted ahead of the condenser and is disposed to extend into the second pan 37, as can be clearly seen in Figures 2 and 3. This wheel-like member is suitably associated with the condenser fan 27. It may form a part of the fan or, as shown particularly in Figure 2, it may be connected to an extension 39 of the fan motor shaft, for rotation therewith. With such an arrangement, it will be understood that, as the water rises in pan 37, it comes in contact with the rotating wheel-like member which then picks up and throws water particles tangentially.

It is pointed out that the structure so far described is similar, in generality, to structures which have been previously used. It is, therefore, to be understood that such general structure forms no part of the invention except in so far as it relates to and affects the construction and operation of the characteristic features of this invention, which features will now be described.

In accordance with the present invention, means are provided to intercept water which is thrown by the wheel-like member; to entrap the water at a level above the condenser; and, finally, to discharge drops of the collected water over and in direct heat exchange relationship with the condenser.

Basically, such means comprise a pan-and-baffle structure which is adapted to be suitably mounted above the condenser. This structure, as shown in the drawings, includes a pan 40 disposed adjacent the top of condenser 19. The bottom of this pan is provided with perforations 41 and with an elongated slot 42. The perforations are located over the condenser and are distributed to extend substantially along the entire length of the condenser top (see Figure 1). The slot is disposed in general alignment with the peripheral edge of wheel-like member 38 (see Figures 2, 3 and 4). As is more clearly shown in Figure 4, the slot is conveniently formed in a reentrant portion 43 of the bottom of pan 40 so as to provide upstanding ridges 44 which serve to prevent water collected in the pan from overflowing through said slot.

Baffle means in the form of a cover 45, is arranged over the pan 40 to insure that water which is thrown by member 38, will be intercepted and entrapped in pan 40. For that purpose the part of the cover which lies over the slot 42, is advantageously offset to provide an inverted V-shaped portion 46, the apex 47 of which is disposed substantially in line with wheel-like member 38. The sides 48 of portion 46 are adapted to extend beyond the ridges 44 provided by the reentrant portion of the pan 40. Because of this construction, water which is thrown upwardly by wheel-like member 38, strikes portion 46 and is deflected and guided into pan 40 by sides 48 of said portion. From the pan, water passes through perforations 41 and, as hereinbefore mentioned, is discharged over and in direct heat exchange relationship with the condenser.

A modified construction of the arrangement above described is shown in Figure 5. According to this modified construction, a pan 40*a* mounted above condenser 18, extends only a short distance over the latter, as shown at 49, and one of the sides 48*a* of the inverted V-shaped portion 46*a* of cover 45*a*, is projected to contact said condenser beyond the pan, as shown at 50. With a construction of this kind, a certain amount of the water which is thrown against portion 46*a*, drains along the inclined surface of the mentioned side of said portion and drips directly onto the condenser. The remainder of the water which strikes the cover portion 46*a*, drips and accumulates in pan 40*a* and is discharged therefrom through perforations 41*a*, in the manner previously described.

It is to be noted that the size of perforations 41 is such that water does not flow freely therethrough but is discharged in drops from the pan 40. It is also to be noted that a portion of pan 40 is in direct contact with the top of the condenser. In this manner, a considerable amount of heat in the condenser is readily taken up by the water in pan 40. As a result, water dripping from the pan is heated, so that it is well conditioned to evaporate rapidly. This is especially true of the preferred embodiment (Figures 1–4) in which a substantial portion of the pan extends over and contacts the entire top surface of the condenser.

From the foregoing, it will be appreciated that an arrangement constructed in accordance with this invention can be readily manufactured and easily installed in air conditioning units. Use of the arrangement is especially desirable because no complicated expensive mechanism is required to provide for effective cooling of the condenser while disposing of accumulated condensate. The efficiency and reliability of the arrangement in attaining convenient cooling of the condenser and efficient disposal of the condensate are enhanced by the fact that the invention makes it possible to accumulate condensate at a level above the condenser so that this condensate may then be caused to drip over and in direct heat exchange relationship with the condenser.

Although the constructional features of the invention have been described with great particularity, it is to be understood that this has been done by way of example only. Various changes in the details of construction and in the combination and association of parts may be resorted to without departing from the spirit of the invention, which is subject only to such limitations as are imposed by the prior art or are specifically called for in the appended claims.

I claim:

1. In an air conditioning unit, a refrigerating system including an evaporator and a condenser, means providing for circulation of air in heat exchange relationship with the evaporator to cool the air and to remove moisture therefrom, sump means located under said condenser and adapted to receive condensate resulting from the moisture removal, a pan-and-baffle structure above the condenser, and a wheel-like member mounted for rotation between said sump means and said structure and adapted to hurl condensate from the sump means against the baffle for conveyance to the pan, the latter having means adapted to cause condensate to drip over and in heat exchange relationship with the condenser.

2. In an air conditioning unit, a refrigerating system including an evaporator and a condenser, means providing for circulation of air in heat exchange relationship with the evaporator to cool the air and to remove moisture therefrom, sump means located under said condenser and adapted to receive condensate resulting from the moisture removal, a pan-and-baffle structure above the condenser, and means operative between said sump means and said structure to discharge condensate from the sump means against the baffle for conveyance to the pan, said pan having a bottom portion extended over the condenser and provided with perforations distributed substantially along the length of an upper edge of the condenser to cause condensate to drip onto and in heat exchange relationship with the condenser.

3. In an air conditioning unit, a refrigerating system including an evaporator and a condenser, means providing for the circulation of air in heat exchange relationship with the evaporator to cool the air and to remove moisture therefrom, sump means adapted to receive condensate resulting from the moisture removal, a pan above the condenser, the bottom of said pan having a series of perforations and a reentrant portion provided with a slot, a wheel-like member mounted to rotate in a plane extending through the slot to discharge condensate from the sump means through said slot, and a baffle provided over the pan and disposed to intercept condensate discharged through said slot and to convey such condensate to the pan, the perforations in the bottom of said pan being so located as to cause such condensate to drip onto and in heat exchange relationship with the condenser.

4. In an air conditioning unit, a refrigerating system including an evaporator and a condenser, means providing for the circulation of air in heat exchange relationship with the evaporator to cool the air and to remove moisture therefrom, sump means adapted to receive condensate resulting from the moisture removal, a pan above the condenser, the bottom of said pan having a series of perforations and a reentrant portion provided with a slot, a cover for the pan, said cover having a generally inverted V-shaped portion disposed in substantial alignment with said slot, said V-shaped portion having side surfaces adapted to project beyond said reentrant portion, and means operative to discharge condensate from the sump means through said slot and against said V-shaped portion for conveyance to the pan by means of said side surfaces, the perforations in the bottom of the pan being so located as to cause such condensate to drip over and in heat exchange relationship with the condenser.

5. In a room-air conditioning unit, a housing, a refrigerating system enclosed in said housing and including an evaporator and a condenser, means adapted to circulate air in heat exchange relationship with the evaporator and to discharge such air into a room, means adapted to circulate air in heat exchange relationship with the condenser and to discharge such air outside the room, sump means adapted to receive water resulting from the condensation of moisture removed from the air circulated in heat exchange relationship with the evaporator, a pan-and-baffle structure above the condenser, and a wheel-like member disposed for rotation between said sump means and structure to hurl water from the sump means against the baffle for conveyance to the pan, the latter having means adapted to cause water to drip over and in heat exchange relationship with the condenser.

6. In a room-air conditioning unit, a housing having two compartments each provided with inlet and outlet means to permit passage of air therethrough, a refrigerating system including an evaporator mounted in one of said compartments and a condenser mounted in the other of said compartments, means including an evaporator fan adapted to circulate air in heat exchange relationship with the evaporator and to discharge such air into a room, means including a condenser fan adapted to circulate air in heat exchange relationship with the condenser and to discharge such air outside the room, sump means arranged below the condenser and adapted to receive water resulting from condensation of moisture removed from the air circulated in heat exchange relationship with the evaporator, a pan and baffle structure disposed above the condenser, a wheel-like member adapted for rotation with the condenser fan and disposed between said sump means and said structure to hurl water from the sump means against the baffle for conveyance to the pan, the latter having means adapted to cause water to drip over and in heat exchange relationship with the condenser.

7. In an air conditioning unit, a housing, a partition wall dividing the housing into two main compartments, a refrigerating system enclosed within said housing and including an evaporator in one of said compartments and a condenser in

the other of said compartments, means providing for circulation of air in heat exchange relationship with the evaporator to cool said air and to remove moisture therefrom, a pan disposed beneath the evaporator and adapted to receive condensate resulting from the moisture removal, a second pan disposed beneath the condenser and adapted to receive condensate from the first mentioned pan, a third pan located above the condenser and a baffle above said third pan, means for conveying condensate from the first mentioned pan to the second pan, and a rotatable wheel-like member extending between and transversely of the second pan and the baffle to discharge condensate from said second pan against the baffle, said baffle having means to deflect and to guide such condensate into the third pan, and said third pan having means to cause condensate to drip over and in heat exchange relationship with the condenser.

8. In an air conditioning unit, a refrigerating system including an evaporator and a condenser, means providing for circulation of air in heat exchange relationship with the evaporator to cool the air and to remove moisture therefrom, sump means arranged below the condenser and adapted to receive condensate resulting from the moisture

removal, a pan located above the condenser, a baffle disposed above said pan, and a wheel-like member mounted for rotation between the sump means and the baffle to discharge condensate from the sump means against the baffle, said baffle having means to deflect and to guide a part of said condensate directly over and in heat exchange relationship with the condenser and another part of said condensate into the pan, and said pan having means to cause condensate to drip over and in heat exchange relationship with the condenser.

EDWARD L. HART.

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