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DRIP EVAPORATING UNIT OF AIR CONDITIONERS

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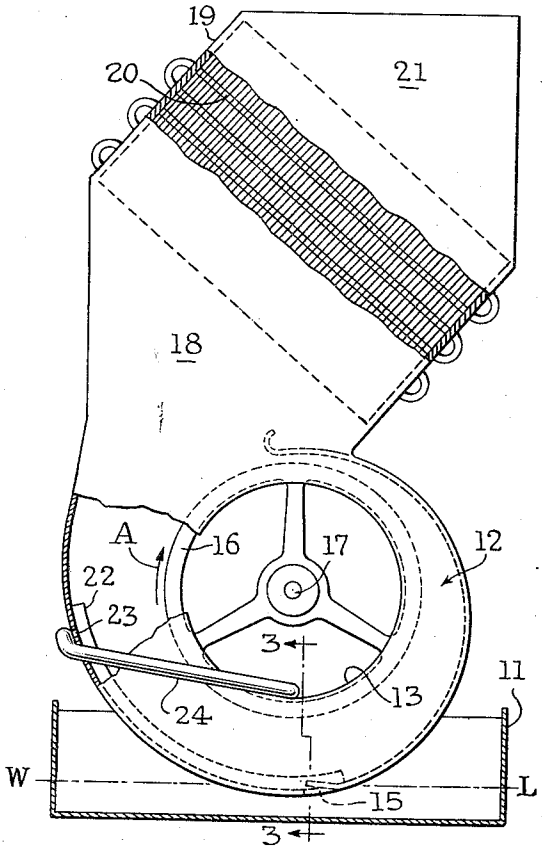


Fig.1

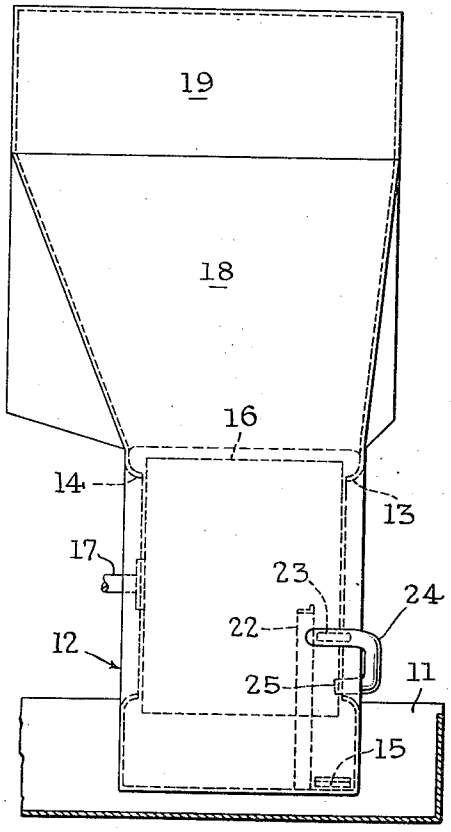


Fig.2

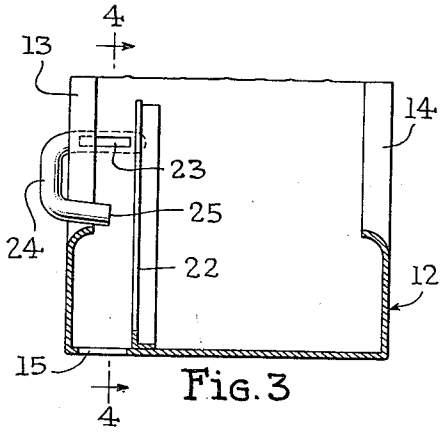


Fig.3

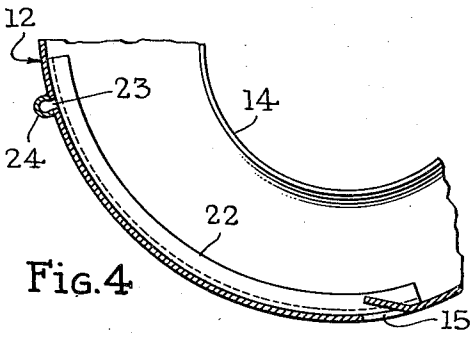


Fig.4

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DRIP EVAPORATING UNIT OF AIR CONDITIONERS

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5 Claims. (Cl. 62—140)

This invention relates to air conditioners and is particularly useful in conditioners of the console type. The purpose of the invention is to evaporate in the condenser air stream the drip water condensed from the air in the evaporator air stream, and do so without requiring the use of high speed fans, even when the condenser is located at a considerable height above the condenser air fan.

This condition exists in most console units and to an extent also in window-sill units, and has led to the use of high speed condenser air fans, or complicated atomizers or both. High speed fans are noisy, and pumps, atomizers and spray wheels each require valuable space, impose objectionable limitations on design and always introduce maintenance problems, which become troublesome sooner or later.

The present invention can be used with either type of unit, and even in those designs which locate the evaporator and the condenser air fan just above the drip-collecting pan, so that gravity feed of drip water into the fan wheel is not possible.

Without adding any moving part, the invention adds to a low speed squirrel cage condenser air fan, means which will continuously draw drip from a pan immediately below the fan scroll and jet it into the fan runner through one of the air entrance eyes. The result is quiet operation, better air flow and such minute atomization of the drip water that even a rather slowly moving condenser air stream will carry the mist upward to a condenser located in the top of a console unit. Water does not accumulate in quantity in the drip pan but is put usefully to work cooling the condenser which is continuously wetted. This is true because any drip not picked up by the air stream returns to the pan and is again fed to the fan wheel and again atomized.

The invention is based on the discovery that, with a fan scroll dipping into a drip-collecting pan, and having a submerged water-entrance slot, the fan rotor when running at speeds much lower than those heretofore considered necessary, will entrain water along the inner surface of the scroll to an exit connection through which it flows to the interior of the fan wheel under a pressure differential created by the fan's own operation. To avail of this, minor changes are made in the scroll. The exit connection is a simple tube arranged to jet the water into the interior of the revolving fan cage. The resulting fine atomization permits even a relatively slow air current to carry the fog of water droplets into the condenser, which operates thoroughly wet. The fan scroll had best dip only slightly into the water in the pan. This assures a more even air flow than can be had with the prior art practice of creating a rather deep water bath in the fan scroll.

The invention will now be described by reference to the accompanying drawing which shows only the drip pan, the fan scroll and fan wheel, the condenser housing and the connection from the fan scroll to the condenser housing.

In the drawings:

Figure 1 is chiefly an elevation of the drip evaporating unit, looking in the direction of the axis of the fan shaft. Parts are broken away and sectioned to disclose details which would otherwise be hidden.

Figure 2 is a similar elevation looking to the right relatively to Figure 1.

Figure 3 is a fragmentary section on the line 3—3 of Figure 1.

Figure 4 is a fragmentary section on the line 4—4 of Figure 3.

A pan **11** receives drip water from the evaporator (not shown) which can be located at any point permitting gravity flow of drip to the pan. The line W—L indicates the water level at which a state of equilibrium is reached in the operation of the machine. This level is materially lower relatively to the fan scroll than the equilibrium water level for units which depend only on a slot in the fan scroll to admit drip water (see Moore 2,316,704, April 13, 1943, for a typical example).

The fan scroll is indicated at **12** and has two entrance eyes **13**, **14** for air and a short water-entrance slot **15**. The squirrel cage fan wheel appears at **16**. It is fixed on a rotary shaft **17** which turns in bearings (not shown) and is driven by a motor (not shown). Shaft **17** commonly is the motor shaft in commercial units.

The scroll **12** discharges through a flaring connection **18** to rectangular duct **19** in which the finned condenser tubes conventionally indicated at **20**, are mounted. A discharge connection **21** leads to atmosphere (out of doors). It is probably unnecessary to explain that the air which enters the eyes **13** and **14** is drawn from out of doors since this is standard practice in the art.

The entrance slot **15** is located near one side, and a barrier **22** is provided by means of a curved angle strip brazed or otherwise fastened to the internal surface of the scroll, so as to define a narrow path in which water is entrained by wheel **16** when rotating. The direction of fan rotation is indicated by the arrow A.

The barrier **22** extends in the direction of rotation from a point in advance of slot **15** through an arc of about 90° to a second slot **23** located preferably above the lower limit of eye **13** and desirably not materially higher than the axis of shaft **17**. Slot **23** communicates with the bore of a tube **24** so formed that it discharges at **25** through eye **13** into the interior of wheel **16** but does not touch the wheel. When the fan operates it creates a substantial pressure differential between slot **23** and the discharge end of tube **24**. This pressure differential is assisted by gravity so that water flow is quite active and a jet discharge into the wheel is had.

The water jet discharging at **25** under the resulting head strikes the blades of the fan wheel, is atomized and flows with the fan air through connection **18** to and into the duct **19** in which the finned condenser tubes **20** are located.

Thus as long as wheel **16** runs and drip is supplied to pan **11**, water is atomized and carried by the flowing condenser air stream to the condenser surface. The condenser is effectively cooled and the drip water is actively circulated, atomized and either evaporated or recirculated until it is evaporated.

The barrier **22**, while not strictly necessary performs a useful function by limiting the spread of water entering through slot **15**. The effect is to define a narrow channel through which water flows to slot **23**. Thus slot **23** may be quite short and yet effective because water flows to it in greater depth than would be the case in the absence of the barrier. Should water tend to accumulate in depth in the bottom of scroll **12** it can flow around the entrance end of barrier **22** and reach slot **23** so as to be fed into the fan wheel.

The device has been applied to console units and has demonstrated ability to raise the water and deliver it under a pressure head to the fan wheel for atomization. It has also demonstrated that a relatively slowly moving air current will carry the resulting finely atomized water to and into the finned condenser. These tests indicate the value of the concept. By adding the recirculating arrangement to the fan and reducing the fan speed to about ⅔ of that originally assumed to be necessary according to past experience, the fan noise was reduced and the over-all performance of the refrigerating unit was increased over six per cent. Improved evaporation of drip resulting from repeated recirculation to the fan was likewise had.

As to these tests, it may be remarked that the evaporator delivered the drip water directly to the pan corresponding to the pan **11**, so that complete reliance was placed for atomization on the features here disclosed and claimed.

The invention is generally applicable to refrigerative units in which drip must be re-evaporated on the condenser. These devices take a wide variety of forms, hence the illustrated embodiment is offered as an example of a satisfactory embodiment of the invention, but no limitation thereto is implied.

I claim:

1. For use with a refrigerative air conditioner which condenses drip water from the air and includes a surface condenser for refrigerant, cooling means for said surface condenser comprising in combination a sump arranged to collect the drip water; an air circulating fan

comprising a scroll housing having an air discharge directed toward the condenser surface, at least one entrance eye for air, and a squirrel cage impeller rotatable in said scroll in a definite direction, the bottom of the impeller being above the level of collected water in the sump and the scroll being positioned to dip into said water and having a water entrance port below said level; means affording a water discharge port leading through the periphery of said scroll housing and angularly displaced from said water entrance port in said direction of rotation; and means forming a conduit fed by said water discharge port and itself discharging water through said eye into the interior of said impeller.

2. The combination defined in claim 1 in which said water discharge port is at a level above the lower margin of the entrance eye whereby gravity assists flow.

3. The combination defined in claim 1 in which the air discharge from the scroll is directed upward toward the condenser whose location is above the scroll.

4. The combination of the structure defined in claim 1 and a barrier defining a channel which leads from said water entrance port to said water discharge port.

5. The combination defined in claim 4 in which the air discharge from the scroll is directed upward toward the condenser whose location is above the scroll.

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