April 10, 1951 W. A. GRANT 2,548,665

ROOM COOLING UNITS EMBODYING CONTROL
TO LIMIT CONDENSATION
Filed March 11, 1948

FIG. 1

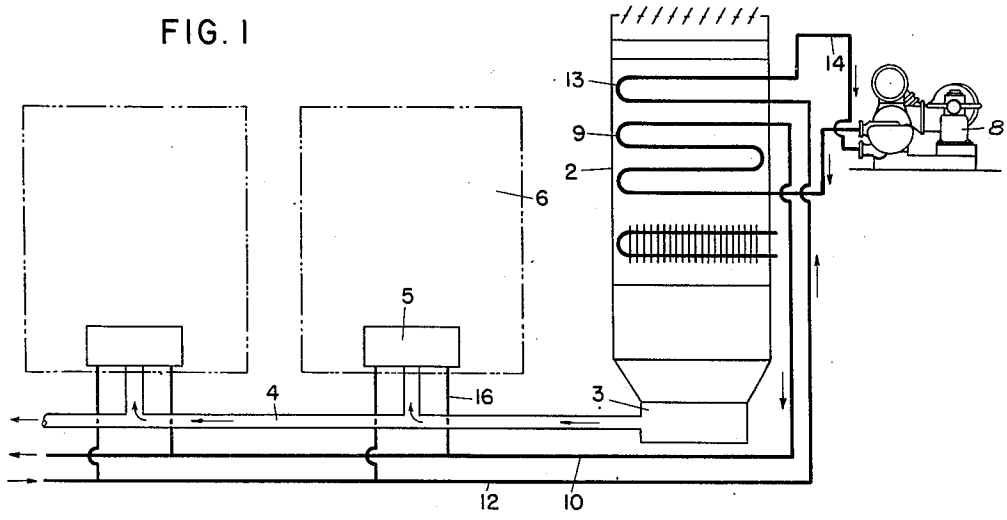
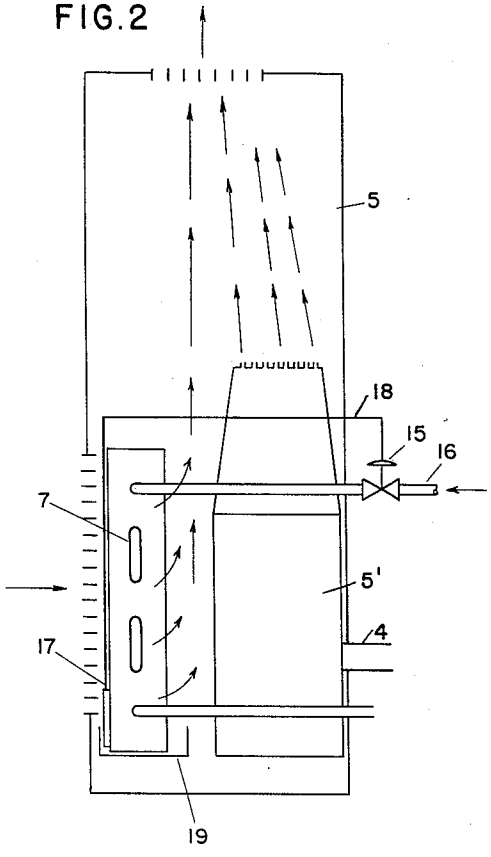


FIG. 2



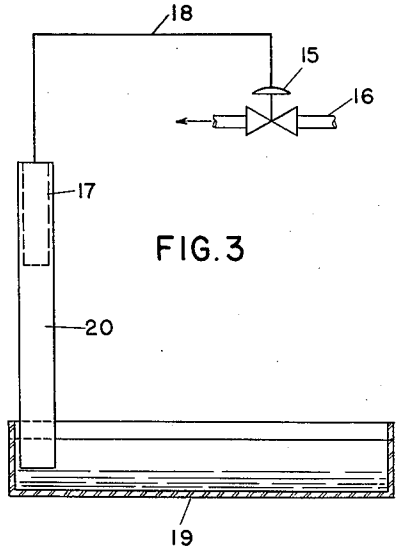


FIG. 3

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ROOM COOLING UNITS EMBODYING CONTROL TO LIMIT CONDENSATION

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5 Claims. (Cl. 62—6)

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This invention relates to room cooling units and more particularly to room cooling units including an economical control to limit condensation.

In Carrier Patent No. 2,363,294 granted November 21, 1944, there is disclosed an air conditioning system to which the present invention is particularly adapted. In such system outside air is conditioned at a central station and is supplied at relatively high velocity and relatively high static pressure to a plurality of induction units disposed in areas being conditioned. Discharge of such primary air at relatively high velocity within the inductfon unit induces secondary air from the area being conditioned within the unit. A heat exchanger is disposed within the unit. Cold or hot water is circulated through the heat exchanger depending upon whether the system is operated under summer or winter operating conditions. The water circulated through the heat exchange member is disposed in heat exchange relation with the secondary air induced within the unit and serves to vary the sensible heat thereof. The mixture of primary and secondary air is then discharged within the area being conditioned. Under some circumstances condensation occurs, moisture from the induced air being precipitated upon the heat exchanger. To prevent such water from draining into the area being conditioned, a pan is provided in the unit; such pan may be connected to a suitable drain line in order to remove the water from the pan. Provision of the required drainage system increases the initial cost of the system; if a large amount of moisture is present in the secondary air, the condensate may overflow the pan and flow within the area being conditioned.

The chief object of the present invention is to provide a room cooling unit containing economical and efficient means to limit condensation.

An object of the present invention is to provide a condensation limit control adapted for use with cooling units of an air conditioning system or for use with self-contained air conditioning units.

A further object is to provide a method for limiting precipitation of moisture in the operation of a room cooling unit. Other objects of my invention will be readily perceived from the following description.

This invention relates to a room cooling unit which comprises, in combination, a heat exchanger through which conditioning medium is routed in heat exchange relation with air to be conditioned, means for regulating flow of conditioning medium through the heat exchanger

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and an element such as a bulb for actuating the flow regulating means. Such element is disposed to respond to dry bulb temperature of air to be conditioned. A condensate pan is disposed within the unit to receive moisture precipitated on the heat exchanger from the air being conditioned. Absorbent material is provided which contacts the element and extends within the condensate pan. Upon collection of condensate within the pan in a predetermined quantity, the absorbent material serves as a wick to wet the actuating element permitting it to reflect in effect the wet bulb temperature of the air to be conditioned, thereby actuating the flow regulating means in accordance with such temperature rather than dry bulb temperature of the air to be conditioned.

The attached drawing illustrates a preferred embodiment of my invention, in which

Figure 1 is a diagrammatic view of an air conditioning system including the present invention;

Figure 2 is a diagrammatic view of a room cooling unit including the condensation limit control; and

Figure 3 is a diagrammatic view in exaggerated scale of the condensation limit control shown in Figure 2.

Referring to the drawing, there is shown an air conditioning system including a central station conditioner 2 containing required heating and cooling coils and filter for conditioning air to predetermined conditions of temperature and humidity. Conditioned air is forced by fan 3 of conditioner 2 through conduits 4 to plenums 5' of induction units 5 disposed in a plurality of areas 6 to be conditioned, at least one unit being disposed in each area being conditioned. The air is discharged in such units 5 at relatively high velocity and serves to induce secondary air from the area being conditioned within the unit; the mixture of primary and secondary air is then discharged within the area being conditioned. A heat exchanger 7 is provided in each unit 5 as hereinafter described.

A refrigeration machine 8 is provided to supply conditioning medium such as cold water at a desired temperature to conditioner 2 the conditioning medium passing through cooling coil 9 therein and then flowing through line 10 to heat exchangers 7 disposed in units 5. After passage through exchangers 7 the conditioning medium is returned through line 12 to conditioner 2, passing through pre-cooling coil 13 therein, and returning to the refrigeration machine 8 through line 14.

To regulate the supply of conditioning medium passing through each heat exchanger 7, a valve 15 is disposed in line 16 connecting line 10 with each unit 6. Valve 15, preferably, is actuated automatically by means of a thermal bulb 17 disposed in any suitable position in the unit in which it comes in contact with air induced therein. Bulb 17 and capillary tube 18 which connects it to valve 15 are filled with any suitable liquid or gas capable of reflecting changes in temperature of air induced within the unit as reflected by bulb 17.

Under some conditions, operation of heat exchanger 7 cools the induced air to such an extent as to precipitate moisture therein upon the heat exchanger. Such condensate may be collected in pan 19 disposed below heat exchangers 7.

In order to limit condensation when such condensation becomes excessive, I provide absorbent material 20 contacting bulb 17 and extending within pan 19 as best shown in Figure 3. When condensate has collected in a predetermined quantity as indicated by the dotted line, an end of absorbent material 20 is soaked, material 20 serving as a wick to conduct the absorbed moisture to bulb 17, in effect, rendering bulb 17 responsive to wet bulb temperature of the air being conditioned, rather than to dry bulb temperature of such air. Wet bulb temperature is lower than dry bulb temperature and hence, bulb 17 immediately reflects a lower temperature, actuating valve 15 to tend to reduce or to discontinue flow of conditioning medium to heat exchanger 7. The reduction in the quantity of conditioning medium passing through heat exchanger 7 reduces the quantity of moisture precipitated from the air passing in heat exchange relation therewith, thus reducing the condensate. When a sufficient quantity of condensate has evaporated, thereby discontinuing wetting of absorbent material 20, bulb 17 is again free to respond to dry bulb temperature of the area being conditioned.

In operation, outside air is conditioned at conditioner 2 and is supplied to induction units 6 disposed in the areas being conditioned. The conditioned primary air is discharged in such units at relatively high velocity thereby inducing secondary air from the areas being conditioned within the unit. Induced air passes through heat exchangers 7 and moisture precipitated therefrom is collected in pan 19. When a sufficient quantity of moisture has collected in pan 19, absorbent material 20 is wet. Material 20 serves as a wick to conduct such condensate to bulb 17. Bulb 17 then reflects substantially wet bulb temperature of the air being conditioned rather than the dry bulb temperature of such air. The lower temperature so reflected actuates valve 15 to tend to reduce the flow of conditioning medium through heat exchanger 7, reducing the amount of moisture precipitated from the induced air, and preventing collection of condensate within the unit.

While I have described my invention with particular reference to a condensation limit control for an air conditioning system in which water is passed through a heat exchanger in heat exchange relation with air to be conditioned, it will be understood my invention is adapted for use with self-contained air cooling units. In such units the present control may be employed to shut down the refrigeration system, to discontinue operation of the evaporator fan, etc., when condensate has collected in a predetermined amount.

The present invention provides a ready and simple condensation limit control for room cooling units. The invention permits the elimination of condensate drain piping from the various units to a point of disposal and serves as a safety control to prevent flooding of water on the floor of the area being conditioned. The control so provided may be readily installed in existing systems at slight expense. The control provided regulates automatically the flow of conditioning medium through a heat exchanger of a room cooling unit when condensate is formed greater than a predetermined quantity.

While I have described a preferred embodiment of my invention it will be understood my invention is not limited thereto since it may be otherwise embodied within the scope of the following claims.

I claim:

1. In a room cooling unit, the combination of a heat exchanger through which conditioning medium is routed in heat exchange relation with air to be conditioned, means for regulating flow of conditioning medium through the heat exchanger, a single temperature responsive member for governing the flow regulating means in response to dry bulb temperature of air to be conditioned, a member to collect condensate resulting from the heat exchange relation of the conditioning medium and the air, and means for wetting the temperature responsive member with condensate when a predetermined quantity of condensate is collected whereby said temperature responsive member reflects substantially the wet bulb temperature of the air being conditioned so that the flow regulating means is actuated in accordance with the wet bulb temperature of the air to be conditioned.

2. In a room cooling unit, the combination of a heat exchanger through which conditioning medium is routed in heat exchange relation with air to be conditioned, means for inducing flow of air to be conditioned over the exchanger, a valve member for regulating flow of conditioning medium through the heat exchanger, a thermal responsive system for actuating said valve, said system including only one temperature responsive bulb, said bulb being disposed to respond to the dry bulb temperature of air to be conditioned, a pan for collecting condensate precipitated on the exchanger from the air passing therethrough, and an absorbent wick contacting the bulb and extending into the pan, collection of condensate in a predetermined quantity in said pan wetting the bulb through said wick whereby the bulb reflects substantially wet bulb temperature of the air to be conditioned, the thermal system in response thereto governing the valve member to decrease the flow of conditioning medium to the heat exchanger.

3. In an air conditioning system for conditioning a plurality of areas, a conditioner remote from the areas, a plurality of induction units in said areas, at least one of said units serving each area to be conditioned, means for routing conditioned air from the conditioner to said units, a heat exchanger for placing conditioning medium in heat exchange relation with air in said units, means for regulating passage of conditioning medium in heat exchange relation with air in each unit, a single temperature responsive member for each flow regulating means to govern the same in response to dry bulb temperature of

air to be passed in heat exchange relation with the conditioning medium, and means for rendering said temperature responsive member responsive to wet bulb temperature of such air upon collection of a predetermined amount of condensate whereby the flow regulating means is actuated in accordance with the wet bulb temperature of such air.

4. A system according to claim 3 in which air from the conditioner is discharged within each unit at relatively high velocity thereby inducing secondary air from the conditioned area within the unit, the heat exchanger being disposed in the path of the induced air.

5. A system according to claim 4 in which the regulating means comprise a valve actuated by the temperature responsive member, a condensate pan is provided to collect condensate draining from the heat exchanger, and absorbent material contacts the temperature responsive member and extends within the pan whereby collection of condensate in a predetermined amount wets the temperature responsive member so that it reflects wet bulb temperature.

WALTER A. GRANT.

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The following references are of record in the file of this patent:

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