

July 5, 1932.

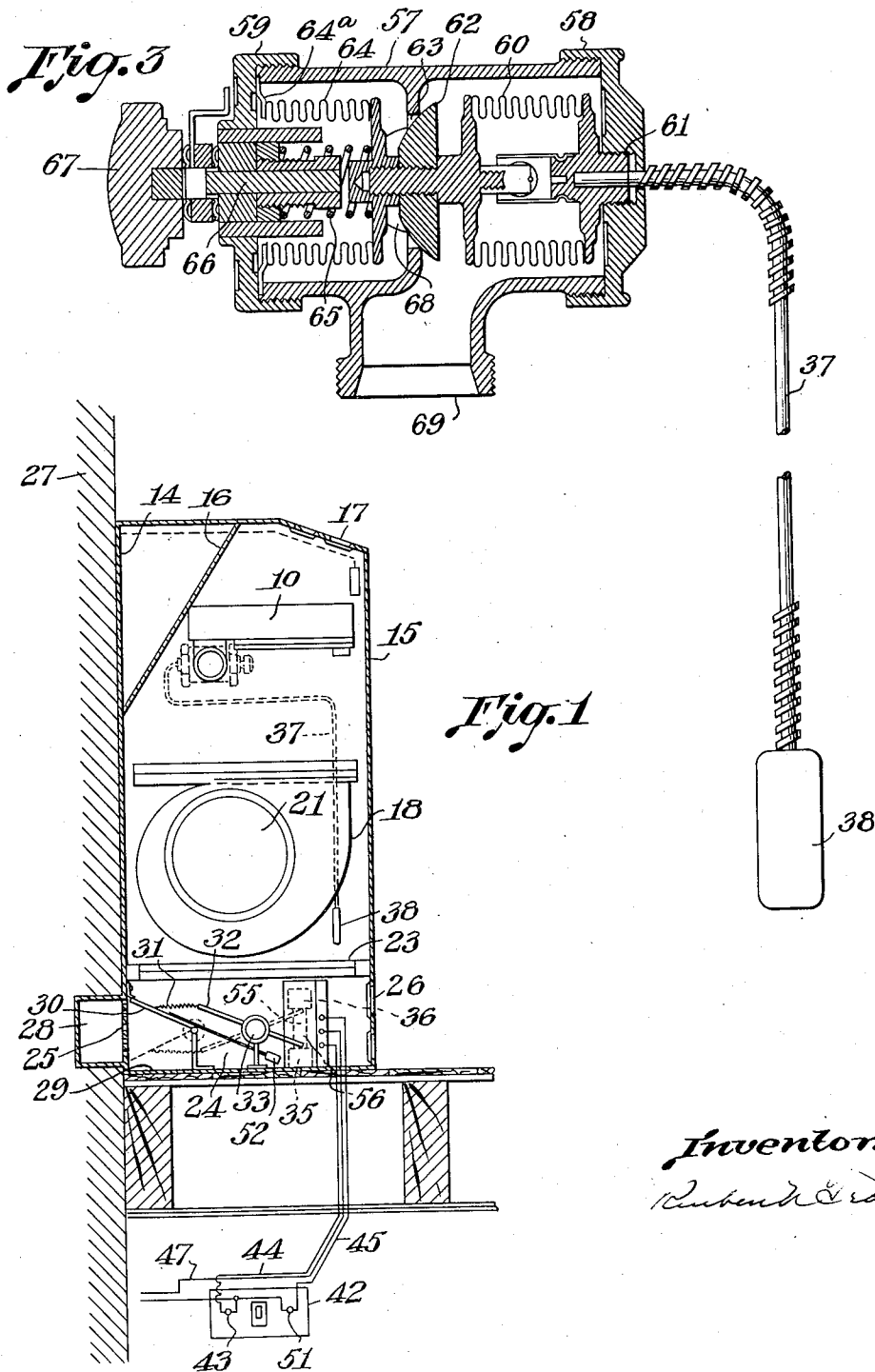
R. N. TRANE

1,865,981

AIR CONDITIONING UNIT

Filed July 6, 1931

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

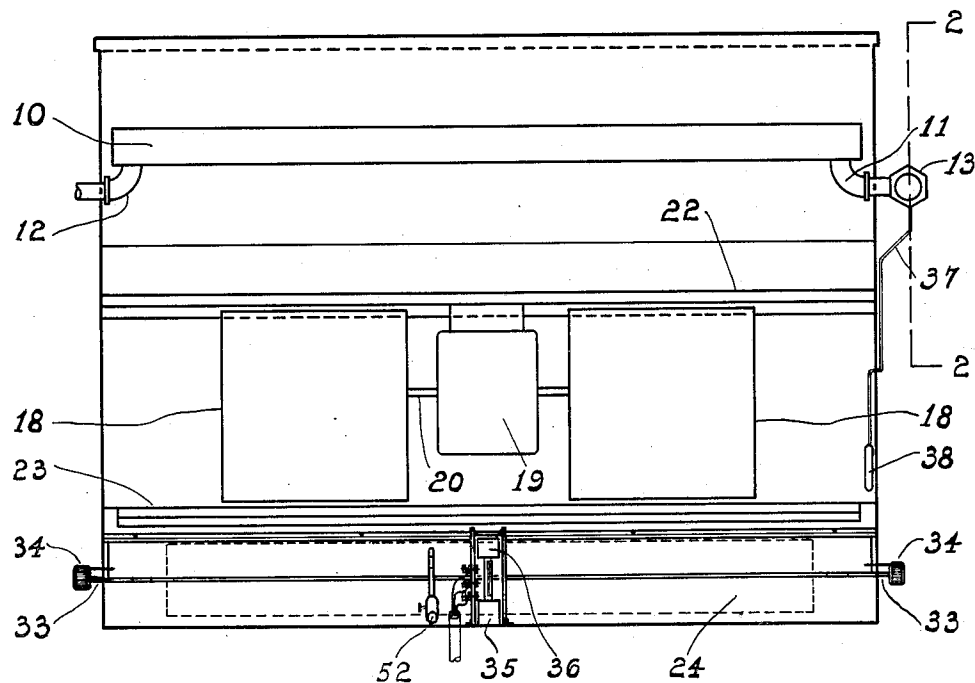


*Fig. 2*

*Inventor:*  
Rumbold Frame

## UNITED STATES PATENT OFFICE

REUBEN N. TRANE, OF LA CROSSE, WISCONSIN

## AIR CONDITIONING UNIT

Application filed July 6, 1931. Serial No. 549,079.

My invention relates to an air conditioning unit wherein the passage of the heating fluid through the heater is thermostatically controlled by means subject to the influence of both the inside and outside air.

Another object of my invention is to provide within an air conditioning unit a remotely operated damper within the unit whereby the flow of outside air may be regulated or entirely shut off.

Another object of my invention is an air conditioning unit, wherein the extended surface heater used for heating the air, is kept from freezing by the flow of extraordinary cold air through the fresh air inlet.

Another object of my invention is to have the extended surface heater controlled by a thermostatic valve which will remain wholly open at temperatures below 50 deg. F. so as to prevent freezing.

Another object of my invention is to have the heater in the air conditioning unit controlled by a thermostatic valve which is actuated by a saturated vapor pressure of such character that the valve is gradually closed as the temperature of the medium to which the thermostatic valve is responsive approximates a pre-determined temperature.

Another object of my invention is to gradually meter the flow of the steam through the heater as the temperature of the mixed air begins to approximate a pre-determined temperature.

Another object of my invention is to provide ample ventilation of outside air which, combined with the recirculated air, is heated to not more than a pre-determined temperature.

In the accompanying drawings which illustrate my invention, Fig. 1 is a side elevation sectional view of the air conditioning unit installed within the building, and Fig. 2 is a front elevation of the air conditioning unit with the front panel taken away. Fig. 3 is a cross sectional view taken on the line 2-2 of Fig. 2, showing thermostatic valve.

Referring to Figs. 1 and 2, 10 is a heater supplied with the heating fluid through the supply inlet 11, and 12 is the heating fluid outlet. The flow of the heating fluid is con-

trolled by a thermostatically controlled valve 13, hereafter further explained.

The casing around the air conditioning unit comprises a rear wall casing 14, a front wall casing 15, an inclined top wall casing 16, and inclined top outlet 17. Inside the casing is a blower 18 in operative engagement with the motor 19 through the shaft 20 connecting the fan and the motor.

21 represents the blower inlet which is below the partition 22, which defines the lower portion of the heating chamber and the upper portion of the blower chamber. Within the blower chamber but below the blower is the filter 23, and below the filter in an air inlet chamber 24. At one side of the air inlet chamber 24 is a cold air inlet 25 and on the opposite side is a recirculating air inlet 26.

The air conditioning unit is positioned against the outside wall 27 with an opening 28 therein for the cold air inlet. Supported by the bottom of the casing 29 is a damper 30 controlling the flow of air through the inlet 28. The damper is shown in a closed position and the dotted line represents the open position. Attached to the upper portion of the damper 30 is a spring 31 which has one end attached to the lever arm 32, which pivots on the pivot bar 33, and the pivot bar extends through the casing so that it can be manually operated by means of the handle 34.

The damper may be also operated through means of a solenoid moving the lever arm 32, and in this operation there are two solenoids, 35 and 36, oppositely disposed, with a core 55 between the solenoids, the lever arm 32 being pivoted on the solenoid 55 at 56. The operation of the solenoid is controlled by electric currents either at the unit or remotely therefrom as is shown in Fig. 1. 42 represents a panel in an adjoining room, preferably in the basement and under the control of the janitor, and wherein 43 is a switch controlling the energization of the solenoid 35 through the circuits 44 and 47. 51 represents the switch controlling the energization of solenoid 36 through the circuit 45 and 47. The movement of the damper is facilitated by the counterweight 52 so that, for example, the downward movement of the end of the

lever arm 32 will through the spring 31 move the damper either up or down and into either an open or closed position.

The flow of the heating fluid through the heater 10 is controlled by the thermostatic valve 13 which is a vapor actuated valve wherein the valve is controlled by a saturated vapor pressure generated in the bulb 38 and conveyed to the valve through the medium 10 of a capillary tube 37. The bulb 38 is placed below the blower and in such a position within the unit that it is subject to the temperature of the air just prior to entering the blower entrance 21, so that the bulb 38 is subject to the temperature influence of both the recirculated air that comes through the entrance 26 and of the outside air through the inlet. It is manifest that the thermostatic bulb 38 may be positioned at any point within the casing wherein it is subject to the influence of the temperature of the mixed air before it enters the heater.

Referring to Fig. 3, the thermostatic valve is composed of a body 57 which is closed on the ends by bonnets 58 and 59. Within the body is a motor bellows 60 threaded into the bonnet 58 at 61. The metal bellows 60 is in operative engagement with the valve throttle 62 which opens and closes upon the seat 63. The other side of the throttle 62 is operatively engaged with the metal bellows 64, the flange 64a of which is secured between the bonnet 59 and the body 57.

Inside of the bellows 64 is a spiral spring 65 exerting pressure against the end of the bellows 64 and tending to open the valve. The pressure exerted by the spring 65 is directly controlled by the stem 66 passing through the bonnet 59. On one end of the stem 65 is mounted the handle 67 which controls the pressure exerted by the spring. The bellows 60 is operated by pressure of saturated vapor conveyed to it by the capillary tube 37 from a bulb 38 remotely situated from the valve.

The ports 68 and 69 represent inlet and outlet ports of the valve and are reversible so that the steam may flow either way.

Referring to the operation of the thermostatic valve, the pressure exerted by the spring 65 tending to open the valve, is opposed to the pressure of the saturated vapor in the bellows 60, and the pressure of the saturated vapor depends upon the temperature created in the bulb 38 by the evaporation of a volatile liquid, the vapor being conveyed from the bulb 38 to the bellows 60, and it is manifest that the pressure in the bulb 38 is variable. Upon determining the temperature at which it is desired that the thermostatic valve should close and stop the supply of the heating fluid to the heater, the valve is adjusted to that point, by balancing the pressure exerted by the spring 65 against the saturated vapor pressure, at the pre-

termined temperature with the valve in a closed position, so that with a decrease in the saturated pressure due to a decreased temperature, the tendency of the spring would be to open the valve. This valve closes gradually, and at a low temperature, for example, a temperature of 50 deg. F., which is the boiling point of ethyl chloride, the volatile liquid used, the spring tension would keep the valve entirely open, and as the temperature increases, for example, up to 70 deg., there is an increased saturated vapor pressure which gradually moves the throttle of the valve towards a closed position. Thus at 50 deg. there is an unobstructed flow of steam through the valve, but as the temperature approaches 70 deg. the throttle of the valve gradually closes furnishing an additional obstruction to the flow of steam through the valve. This action becomes important just prior to the time that the pre-determined temperature of the medium surrounding the bulb 38 is reached, because at that point the valve is so far closed as to allow only a small quantity of steam to pass through the valve.

If it is desired that no heat should be imparted to any of the mixed air which enters the blower at over 70 deg., then as the temperature of the mixed air approaches the temperature of 70 deg. very little heat is required to be imparted to the mixed air temperature in order to bring it up to 70 deg.

In this invention it is important that the thermostatic valve be controlled by the temperature of the mixed air entering the unit. It is manifest that when the mixed air is below the temperature of 70 deg. that heat should be imparted to it before entering the room, but that after the temperature in the room builds up from other heaters or from the heat of persons in the room, then the temperature of the recirculated air when mixed with the incoming fresh air will gradually approximate the desired temperature of 70 deg., and less heat is required to maintain a constant, even and desired temperature, and the same is true when the days outside get warmer, and the temperature of the incoming fresh air when mixed with the recirculated air very nearly approximates the desired temperature of 70 deg. In this case it is obvious that very little heat should be added to the incoming mixed air and this has been accomplished as shown herein. Sometimes it becomes advisable, as at night, to entirely shut off the flow of the incoming fresh air, and this I prefer to accomplish by means of a damper which is controlled by the solenoids 35 and 36 moving the lever arm 32. This may be accomplished automatically, but in public buildings I prefer that the dampers be operated from some remote and preferably a central position.

In Fig. 1 the janitor may close the damper

by operating switch 51 and may close the damper by switch 43.

While I have shown my invention as embodied in the specific form shown and described and having suggested only the specific alternatives, I contemplate that many changes may be made without departing from the scope or spirit of my invention.

I claim:

1. A heating and ventilating unit having a casing divided into an air inlet chamber, a blower chamber, a heater chamber and a discharge chamber, a recirculated air inlet and a fresh air inlet, and means for mixing the fresh air and recirculated air before entering the blower, an extended surface heater in said heating chamber and a thermostatic valve responsive to the temperature of the mixed air before such air enters the heater proportionately controlling the flow of heating fluid to said heater in relation to the different temperatures of such air.

2. A heating and ventilating unit having a casing divided into an air inlet chamber, a blower chamber, having a blower therein, a heater chamber, a recirculated air inlet and a fresh air inlet, an extended surface heater in said heating chamber, a substantially balanced thermostatic valve proportionately controlling the supply of heating fluid to said heater, according to changes in temperature of the mixed incoming air, said valve having a throttle actuated by vapor pressure from a communicating thermostatic element which is directly responsive to changes in temperature of the mixed air, said thermostatic element located below the surface heater in the path of the mixed air.

3. A heating and ventilating unit having a casing divided into an air inlet chamber, a blower chamber, a heater chamber, a fresh air inlet and a recirculated air inlet, an extended surface heater in said heating chamber and a thermostatic valve proportionately controlling the supply of heating fluid to said heater inversely, according to changes in temperature of the incoming air, said valve comprising a body having a valve seat, throttle, and an expansible and collapsible vessel filled with a saturated gas said vessel adapted to contact and move the valve throttle, a container having a volatile liquid therein supplying a saturated gas to said vessel through the pressure of such saturated gas, said container being located in the stream of mixed incoming air and subjected to the temperature of such air whereby variations in temperature of air before it enters the heater will control the movement of the throttle.

In witness whereof, I hereunto subscribe my name this 2d day of July, 1931.

REUBEN N. TRANE.