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AIR CIRCULATING AND TEMPERING APPARATUS

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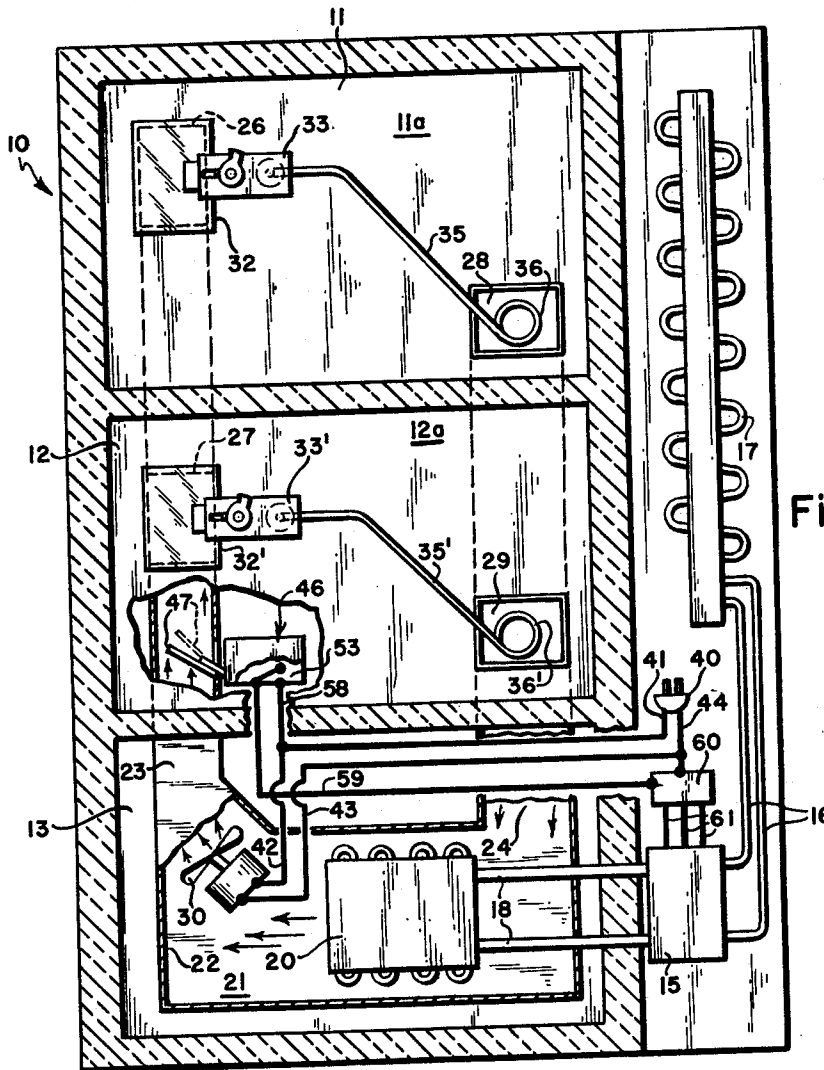


Fig. 1

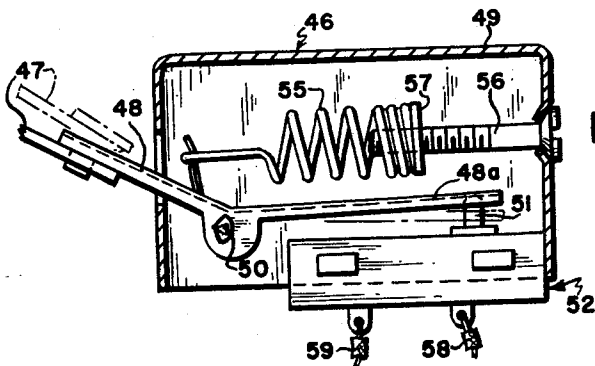


Fig. 2

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3,149,781 AIR CIRCULATING AND TEMPERING APPARATUS

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1 Claim. (Cl. 236—1)

This invention relates to improvements in refrigeration and air conditioning apparatus of the type comprising heating or cooling means such as an evaporator unit, and means including ducts for moving air in a controlled manner over the heating or cooling means and into a space or compartment to be tempered. More particularly, the invention is directed to such apparatus including control means for regulating the movement of air through said ducts and means for controlling the operation of the heating or cooling means.

A principal object of this invention is the provision of a particularly effective, economical, and reliable tempering system for embodiment in domestic refrigerators, air conditioners, and the like, the system providing means for controlling the energization or activation of the evaporator or other tempering unit in response to a demand for tempering air rather than by direct thermostatic control of the tempering unit, the improved system providing more effective distribution and utilization of heated or cooled air, thereby eliminating excessively high or low temperature overshoot at the tempering unit and resulting in increased efficiency and prolonged life thereof.

As another object this invention aims to provide an improved room or compartment tempering system or apparatus including a tempering unit, duct means between the tempering unit and the compartment for conducting air thereto under the influence of a continuously running blower means, the movement of air in the duct means being controlled by thermostatically operated air gate or baffle means having open positions for modulating air flow through the duct means into the compartment for tempering thereof and a closed position in which air is prevented from entering the compartment and the blower means develops a head of static air in the duct means, and the system including a tempering unit control means which is responsive to changes between the static and flowing condition of air in the duct means so as to activate the tempering unit only when air is being delivered to the compartment.

Another object of this invention is the provision of a control device suitable for use in the foregoing system and which is responsive to air pressure or flow to perform a control operation such as activating the tempering unit, a preferred form of the device comprising a frame on which is pivoted a lever presenting a sail or vane to be moved by the force of moving air thereon, the lever being operative to actuate an electric switch, and having adjustable biasing means for selecting a predetermined force of air on the vane necessary to actuate the switch.

The invention further resides in certain constructions and arrangements of parts providing the foregoing objects and advantages, and other objects and advantages thereof will become apparent from the following detailed description of a preferred embodiment of the invention, read in conjunction with the accompanying sheet of drawings forming a part of this specification and in which:

FIG. 1 is a schematic illustration of refrigerating apparatus embodying the invention; and

FIG. 2 is a vertical sectional view of an enlarged scale of a control device forming part of the apparatus of FIG. 1.

In the form of the invention shown in the drawings there is provided a household refrigerator 10 containing a fresh food compartment 11, a freezer compartment 12, and a cooling apparatus compartment 13. Refrigerator 10 includes refrigerating apparatus of the conventional compressor-condenser-evaporator type, of which the compressor preferably forms part of a conventional hermetically sealed motor compressor unit 15. Compressor unit 15 is connected by suitable tubing 16 to a condenser 17, and by tubing 18 to an evaporator or cooling unit 20. Evaporator 20 is disposed in a chamber 21, defined by a suitable sheet metal shell 22 located in compartment 13.

Shell 22 is connected to an upwardly extending cold air duct 23 and a downwardly extending return air duct 24. Ducts 23 and 24 extend alongside the side walls 11a and 12a of compartments 11 and 12, respectively. Cold air duct 23 communicates with compartments 11 and 12 through inlet openings 26 and 27, while return air duct 24 is placed in communication with the compartments through return air openings 28 and 29.

A blower or fan 30 is disposed in chamber 21 and is arranged to cause movement of air over evaporator 20, up cold air duct 23 through cold air inlets 26 and 27 into compartments 11 and 12. Compartments 11 and 12 are tempered by giving up heat to the cold air entering from duct 23 under the influence of fan 30. After cooling the compartments the air passes through outlet openings 28 and 29 into return air duct 24 for return to chamber 21 and evaporator 20.

The amount of air entering the compartments through openings 26 and 27, and hence the temperature in compartments 11 and 12, is regulated by air gates or baffles 32 and 32' forming part of thermostatically operated control devices 33 and 33' secured to compartment walls 11a and 12a. Control device 33, an example of which is described more fully in copending United States patent application Serial No. 201,629, filed June 11, 1962, and assigned to the assignee of this application, includes means for positioning baffle 32 in accordance with the temperature of the air in compartment 11 as sensed by a temperature sensing capillary tube 35 terminating in a coiled end 36 at the outlet opening 28. Likewise, control device 33' includes means for positioning baffle 32' in accordance with the temperature of the air in compartment 12 at the outlet opening 29 as sensed by a temperature sensing tube 35' terminating in a coiled end 36'.

Control device 33 may be adjusted to cause baffle 32 to begin to open the inlet 26 to admit cold air when the temperature in the food compartment 11 rises above a predetermined temperature, such as 40° F., while the control device 33' may be adjusted to cause baffle 32' to open inlet 27 to admit cold air to freezing compartment 12 when the temperature therein rises above a different predetermined value such as 0° F.

Fan 30, which circulates the air over the evaporator and into compartments 11 and 12 whenever one of the baffles 32, 32' is open, is preferably energized continuously from a suitable source of electricity such as 110 v. A.C. A circuit for energizing fan 30 may be traced from a conventional plug 40 through a wire 41, a wire 42, the motor of fan 30, a wire 43, and a wire 44, returning to plug 40.

Compressor 15, on the other hand, is preferably energized to activate vaporator 20 only when one or both of the baffles 32 or 32' is opened to allow fan 30 to deliver air to the respective compartments. To this end, the energization of compressor 15 is controlled by an air flow responsive switch device 46 having a movable sail or vane 47 disposed in supply conduit 23 and movable by a

flow of air therein. As is best shown in FIG. 2, vane 47 is carried on a lever 48 pivoted in a frame or housing 49 by a pin 50 and having its inner end 48a in engagement with an actuating plunger 51 of a snap switch mechanism 52 mounted in housing 49. Snap switch mechanism 52 may be of any well known type comprising spring means biasing actuator 51 outwardly and wherein actuator 51 may be compressed inwardly to effect closing of the switch contacts, schematically shown at 53 in FIG. 1.

A tension spring 55 is connected between lever 48 and housing 49 by a tension adjusting screw 56 and biases lever 48 in a clockwise direction against switch actuator 51. Screw 56 is engaged in a nut member 57 lodged in the end turns of spring 55 and is adjusted to impose a biasing effect on lever 48 which is slightly less than that necessary to depress actuator 51 to close the contacts of switch 52. The vane 47 is disposed in conduit 23 above fan 30, and when in its normal full line position presents a substantial surface area to air moving up the conduit, although the vane does not completely close off the conduit when in its normal position.

When both baffles 32 and 32' are closed, substantially no air flows in conduit 23 although fan 30 is operating and vane 47 will be in the full line position shown in the drawing in which the contacts of switch device 46 open so that compressor 15 is inoperative. When the temperature in one of compartments 11 or 12 rises above the predetermined desired temperature therefor, the baffle 32 or 32', as the case may be, opens to establish a circulating flow of air from conduit 23 into the compartment and to return duct 24 in the manner described heretofore. Upon the opening of one or both of the baffles, the air within conduit 23 changes from a static condition to a flowing condition and hence exerts a force on vane 47 moving it from the full line position to the dotted line position. This movement of vane 47 causes lever 48 to depress actuator 51 to close the contacts of switch mechanism 52 completing an electrical circuit for energizing motor compressor 15 to activate cooling unit or evaporator 20. This circuit may be traced from plug 40 through wire 41, wire 58, switch device 46, a wire 59, a starting relay 60, and wire 44 to plug 40. Starting relay 60 is connected to motor compressor 15 by wires 61 for energizing the starting and running windings of the motor compressor unit in a manner well understood by those skilled in the art to which the invention pertains.

The activation of evaporator 20 causes the air circulated thereover by fan 30 to be cooled and the cooled air is forced by fan 30 through the now open baffle 32 or 32' as necessary to cool compartments 11 and 12 to their desired temperatures. When the desired temperature or temperatures is achieved the respective baffles close in the manner described above, closing off supply conduit 23 and causing the air therein to cease flowing and assume a static condition. As the air assumes a static condition, vane 47 is moved from its dotted line position to its full line position by biasing effect of the switch actuator 51 which moves to its contact opening position thereby deenergizing motor compressor 15 and deactivating evaporator 20.

From the foregoing detailed description it will be appreciated that there has been provided by this invention improved air circulating and tempering apparatus which

will provide particularly effective control of the circulation of the air and of the activation of the air tempering means in a novel manner. It will also be appreciated that the invention provides control devices, the operation of which are directly related to the flow of air, the control devices cooperating to supply air to compartments only when the temperatures therein vary from a predetermined desired temperature, and to activate the tempering unit only during those periods when tempering air is admitted to the chamber of chambers to be tempered.

While the foregoing description has been directed, by way of example, to an embodiment of the invention in a household refrigerator having two cooling compartments, it will be understood that the invention could as well be applied to refrigerators having only one or more than two compartments, and could be applied to heating or cooling of the rooms of a building. Accordingly, although the invention has been described in considerable detail with reference to a specific embodiment of the invention, it will be understood that the invention is not limited thereby, but rather the invention includes all those modifications, adaptations, substitutions, and uses as are reasonably embraced by the scope of the claim hereof.

Having thus described my invention, I claim:

An air conditioning system comprising:

- (a) air tempering means,
 - (b) conduit means for conducting a flow of air over said tempering means and having an air outlet opening into a space to be tempered,
 - (c) blower means for effecting said flow of air through said conduit means,
 - (d) thermally responsive baffle means disposed in said outlet for regulating said flow of air in accordance with temperatures in said space,
 - (e) control means for activating said tempering means in response to a predetermined rate of said air flow,
- and
- (f) said control means comprising a frame, a switch mounted on said frame and having an actuator member normally biased toward a first position for deactivating said tempering means, said actuating member being movable to a second position for activating said tempering means, a lever pivoted on said frame and engageable with said actuator member, a vane mounted on said lever and disposed in said conduit means for movement of said lever and of said actuator member to said second position when the air flow in said conduit exceeds said predetermined rate, and adjustable spring means acting between said frame and said lever for selecting said predetermined rate of flow, said actuator member being operative to overcome said spring means and return to said first position when said air flow falls below said predetermined rate.

References Cited in the file of this patent

UNITED STATES PATENTS

2,440,052	Lingen et al.	Apr. 20, 1948
2,495,861	Newton	Jan. 31, 1950
2,630,505	Copping	Mar. 3, 1953
2,740,858	Euler	Apr. 3, 1956
2,952,753	Kmiecik et al.	Sept. 13, 1960