

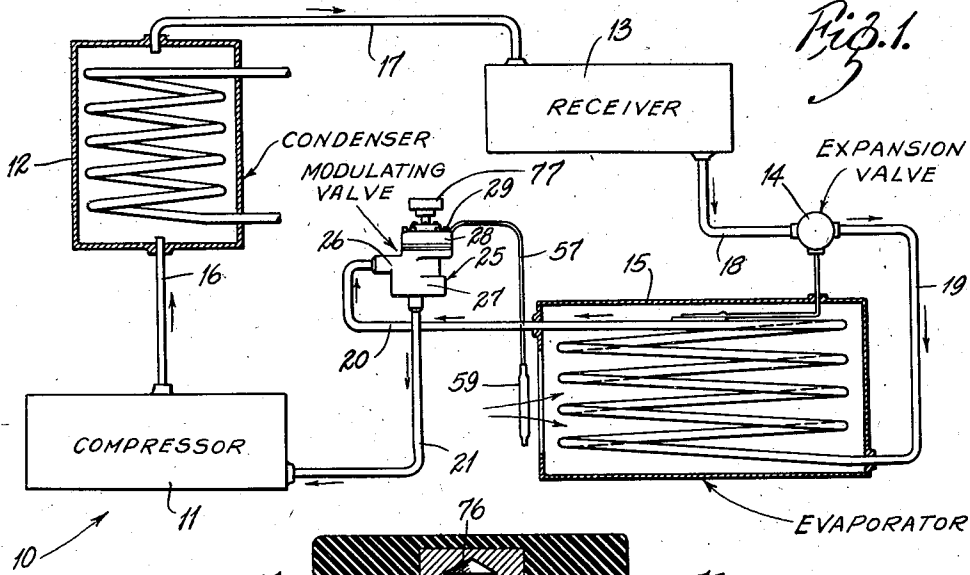
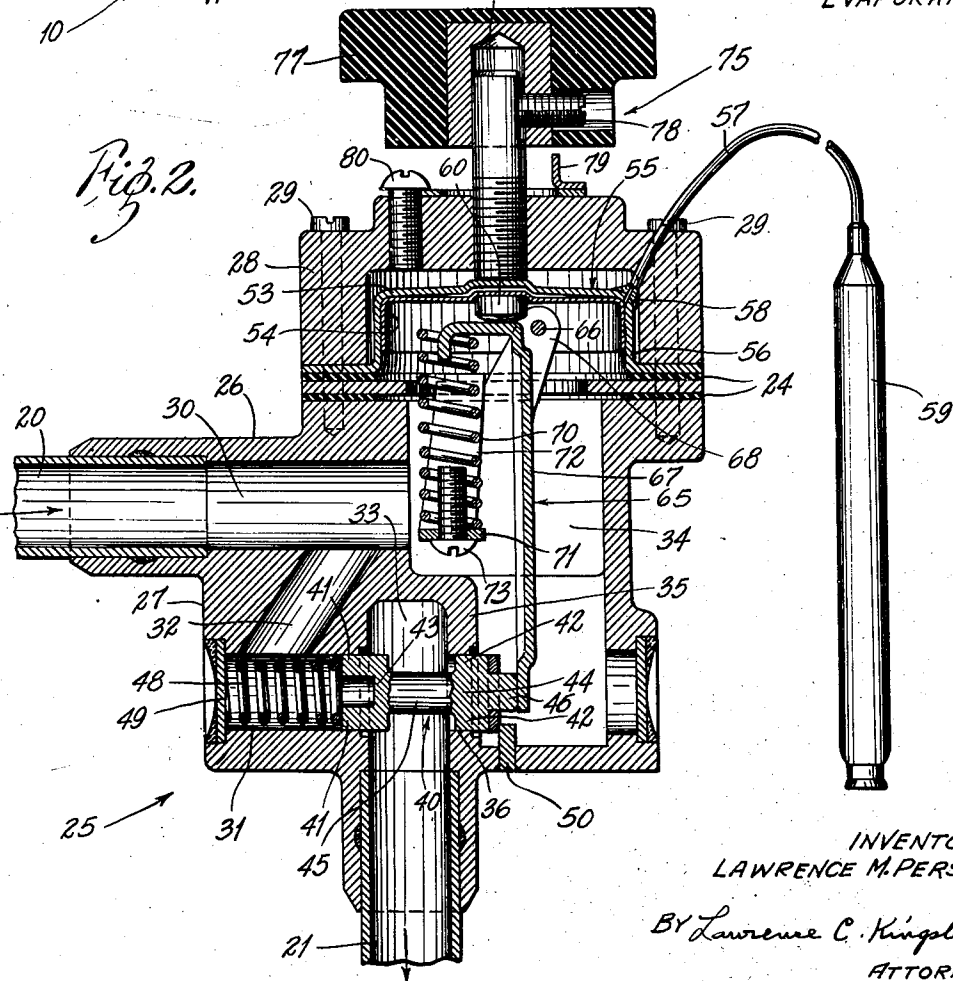
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CONTROL

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CONTROL

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1 Claim. (Cl. 236—99)

The present invention relates generally to controls and to control methods, and more particularly to a method of operating a cooling unit, air conditioner, or the like, and to a control therefor.

The conventional cooling unit or air conditioner in use today includes a compressor which alternately compresses the cooling medium and stands idle. Hence, there are alternate periods of noise and of quiet. At the present time, cooling units are used in bedrooms during the summer for the purpose of maintaining the temperature substantially uniformly comfortable. The sleeper, therefore, is subjected to the continuous starting and stopping of the compressor which, even though muffled, comprises a positive disturbance. It has been ascertained through tests, however, that a compressor which runs continuously during the night does not materially disturb a sleeper.

Therefore, an object of the present invention is to provide a control for cooling units, air conditioners, and the like, which is adapted to maintain the temperature within a selected range and which permits continuous operation of the compressor.

Another object is to provide a method of operating a cooling unit, or the like, whereby the compressor runs continuously.

Another object is to provide a method of operating a cooling unit, or the like, wherein the compressor runs continuously and the amount of cooling medium passed to the compressor is determined by a valve disposed in the cooling medium line upflow thereof.

Another object is to provide a control for cooling units, and the like, which includes a thermally actuated modulating valve.

Another object is to provide a control for cooling units, and the like, whereby the compressor and expansion valve of the cooling unit are at all times operative and in which the amount of cooling medium passed directly to the compressor is determined by a valve in the cooling medium line which is controlled by a solid-charge thermostat.

Another object is to provide an efficient control system for cooling units, and the like, whereby the compressor runs continuously, even though at times it may not be compressing the cooling medium.

Another object is to provide a control system for cooling units, and the like, which is efficient and positive in operation.

Other objects and advantages will be apparent from the following description, taken in conjunc-

tion with the accompanying drawing, in which:

Fig. 1 is a diagrammatic view of a cooling unit including an embodiment of the present invention disposed in operative relation therewith; and

Fig. 2 is a central longitudinal section through a valve and its associated operating mechanism which regulates the flow of cooling medium to the compressor of the cooling unit.

Referring to the drawing more particularly by reference numerals, there is shown in Fig. 1 diagrammatically the several elements of a cooling unit generally designated 10. The cooling unit 10 includes a compressor 11, a condenser 12, a receiver 13, an expansion valve 14, an evaporator 15, and cooling medium line segments 16, 17, 18, 19, 20 and 21.

In the conventional type of cooling unit 10, the expansion valve is pressure and temperature controlled through suitable mechanism, whereby the compressor is alternately started and stopped. However, in the present invention, a control valve mechanism generally designated 25 is located in the system between the evaporator 15 and the compressor 11 at the juncture of the cooling line segments 20 and 21.

The control valve mechanism 25 includes a casing 26 of the configuration shown in the drawing. The casing 26 comprises a lower portion 27 and an upper portion 28 which are maintained in assembled relation by screws 29 (Fig. 1) and which portions are sealed by members 24.

The lower portion 27 of the casing 26 includes vertically spaced horizontal bores 30 and 31 which are connected by a passageway 32, a vertical bore 33, and a chamber 34. The several bores 30, 31 and 33 and the chamber 34 are in communication as is evident from an inspection of Fig. 2. The bore 33 and the chamber 34 are separated by a wall 35 through which is a circular aperture 36 aligned with the bore 31.

A double-ended valve 40 is disposed across the bore 33 with fins 41 disposed within the bore 31 and fins 42 within the aperture 36. The fins 41 extend from a valve head 43 adapted to close the bore 31 in one position thereof while the fins 42 extend from a valve head 44 adapted to close the aperture 36 in one position thereof. The valve heads 43 and 44 are adapted to be in closing positions simultaneously. A stem 45 connects the valve heads 43 and 44 and extends beyond the valve head 44 to form a projection 46. The valve 40 is biased to the right (Fig. 2) by a helical spring 48 which is disposed between the ends of the fins 41 and a cap 49 which closes the outward

end of the bore 31. A stop 50 limits the movement of the valve 40 to the right.

Within the upper portion 28 is a cup 53 and an associated nestled diaphragm 54 of a fluid actuated thermostat 55. The cup 53 includes a skirt 56 which extends between the upper portion 28 and the lower portion 27 of the casing 28 in a manner to maintain the thermostat 55 in its operative position. A fluid tube 57 is connected to the cup 53 at 58 and communicates between the cup 53 and the diaphragm 54. A fluid bulb 59 is connected to the tube 57. The bulb 59 is disposed in the intake air stream of the evaporator 15 in a manner shown by Fig. 1. A stub shaft 60 is fixed to the diaphragm 54.

A lever 65 of the configuration shown in Fig. 2 is pivoted to the cup 53 on a shaft 66. The lever 65 includes a J-shaped portion 67 and ears 68 which are pivotally connected to the shaft 66. The long leg of the J-shaped portion 67 terminates adjacent the projection 46 of the valve 40. A helical spring 70 has one end disposed about the short leg of the J-shaped portion 67 and the other end against the bight 71 of a U-shaped member 72 and around a screw 73 which extends through the bight 71. The U-shaped member 72 is fixed within the housing 26 in any preferred manner. The lever 65, therefore, is biased by the spring 70 towards clockwise movement.

An adjusting device 75 comprises a shaft 76, which threadedly engages the upper portion 28, and contacts the outer face of the cup 53. A knob 77 is fixed to the shaft 76 by a set screw 78. A stop 79, fixed to the upper portion 28 by a screw 80, limits the downward movement of the shaft 76.

Referring to Fig. 2, the cooling medium flows into the control valve mechanism from the inlet pipe 20 whence it flows both through the bore 30, the passageway 32, the bore 31, around the fins 41 into the bore 33 and out the exit pipe 21 and through the bore 30, the chamber 34, around the fins 42 into the bore 33 and out the exit pipe 21. The balanced valve 40 permits and requires this manner of flow of the cooling medium.

Operation

In the present set-up the compressor 11 of the cooling unit 10 is started with a switch and thereafter the compressor continues to operate. The valve mechanism 25 provides the means for preventing the cooling unit from reducing the temperature of the room, or other location, below a selected temperature.

The bulb 59 is disposed in the air stream directed into the evaporator 15 from the room or place the temperature of which is to be regulated by the cooling unit 10. In instances where small units are used for regulating the temperature of bedrooms, and the like, of course, the whole mechanism will be within the room. In all installations the bulb 59 is exposed in a manner to prevent bias from the heat of the compressor 11, so that it may function in accordance with the actual temperature of the room.

Assume that the selected temperature for the room is 75° F., that the valve 40 will be fully closed to stop flow of the cooling medium when the temperature of the room drops to 70° F., and that it will be fully opened when the temperature of the room rises to 80° F. Were there no interfering conditions, the temperature of the room would be maintained constantly at the selected 75° F. and hence the valve 40 would be maintained in

one specified position relative to its valve seat. However, ideal operating conditions seldom exist, since unexpected and unusual inflows of hot air, and the like, make demands upon the cooling unit, necessitating the passage to the compressor 11 of a greater amount of cooling medium. Similarly, certain conditions give rise to an excess of cool air, necessitating a diminution of the cooling medium passing to the compressor 11.

When the temperature within the room is 75° F., the elements of the valve mechanism 25 will be disposed in an initial relationship. Should the temperature of the room rise to 77° F., then the thermally sensitive fluid within the bulb 59 expands in accordance therewith to move the stub shaft 60 downwardly (Fig. 2), thereby pivoting the lever 65 counterclockwise against the force of the spring 70 to permit the balanced valve 40 to be moved to the right by the force of the spring 48. Movement of the valve 40 to the right allows more cooling medium to pass to the compressor 11 and subsequently to the evaporator 15, thereby supplying more means for removing the heat from the air passed through the evaporator 15. When sufficient heat has been removed from the atmosphere of the room, the temperature falls to the selected temperature of 75° F., thereby causing a reversal of the movement train just described, which restores the valve 40 to its initial position.

Should the temperature of the room drop below 75° F., the thermally sensitive fluid within the bulb 59 contracts to allow the stub shaft 60 to be moved upwardly, thereby permitting the lever 65 to pivot clockwise through the force of the spring 70 to move the valve 40 to the left, thereby shutting down on the flow of cooling medium passing the valve 40. This closing movement of the valve 40, of course, cuts down on the amount of cooling medium passing to the compressor 11 and to the evaporator 15. Hence, the amount of heat taken from the atmosphere of the room is reduced, which permits the temperature to return to the selected temperature of 75° F. As the selected temperature of 75° is regained, expansion of the thermally responsive fluid within the bulb 59 effects a reversal of the movement train just described and restores the valve 40 to its initial position.

The adjusting mechanism 75 provides a means for selecting the temperature to be maintained by the cooling unit. The shaft 76 is moved by means of the knob 77 upwardly or downwardly to increase or to decrease the space between the cup 53 and the diaphragm 54. Since this space is connected by means of the tube 57 with the bulb 59 this movement of the knob 77 lowers or raises the temperature range through which the valve 40 acts. In other words, by means of the adjusting mechanism 75, the valve 40 can be set to maintain the temperature of the room at any selected temperature.

It is apparent that the lever 65 is of a configuration and is located relative to the stub shaft 60 and the valve 40 to effect a movement of the valve 40 which is a multiple of the movement of the stub shaft 60. The ratio of movement is determined by the distances of the stub shaft 60 and the valve 40 from the pivot shaft 66. This ratio is, of course, predetermined for an instant assemblage.

It is to be understood that the present invention contemplates the use of specific constructions other than those shown. Further, the con-

trol valve mechanism may be disposed elsewhere in the system than as shown.

It is to be understood further that the foregoing description and accompanying drawing have been given by way of illustration and example and not for purposes of limitation, the invention being limited only by the claim which follows.

What is claimed is:

A control valve comprising a housing, means for introducing a fluid into said housing, means for exiting a fluid from said housing, two passages for fluid between said means, a balanced valve disposed in said housing adapted to close

both passages in one position and to open both passages in another position, a bellcrank lever pivoted in said housing having one arm contiguous to the balanced valve, thermostatic means for positively pivoting said lever to move said arm away from said valve, spring means disposed in one passage acting on said valve to force said valve to follow the contiguous lever arm, and separate spring means acting on the other arm of the lever to force the valve in the other direction upon reverse movement of the thermostatic means.

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