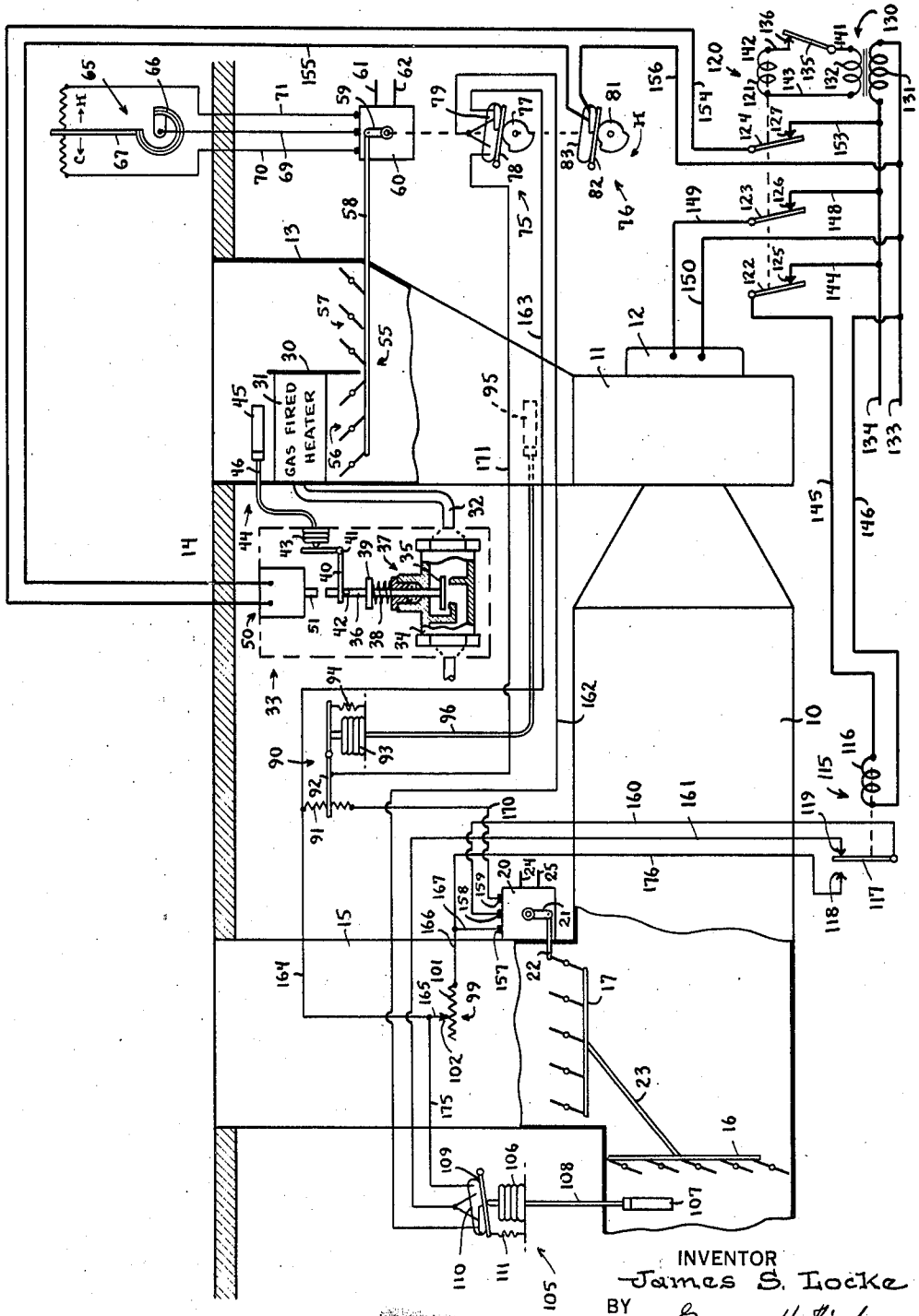
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GAS FIRED AIR CONDITIONING SYSTEM

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GAS FIRED AIR CONDITIONING SYSTEM

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The present invention relates to air conditioning systems and control arrangements therefor.

The primary object of the invention is to provide an improved control arrangement for conditioning apparatus employing a gas fired heater or the like wherein the volume of air being treated is modulatingly controlled in accordance with the temperature in a space being served, and the flow of gas or other corresponding medium is modulatingly controlled in accordance with the discharge temperature of the air, that is the temperature of the air passing over the heater.

Another object of the invention is to provide an arrangement comprising a gas fired heater having face and by-pass dampers associated therewith, with a space thermostat controlling the dampers and a discharge thermostat controlling the flow of gas to the heater.

Another object of the invention is to provide a control arrangement in an air conditioning system embodying fresh and return air dampers, a conditioning device having face and by-pass dampers associated therewith controlled by a space thermostat, and means for adjusting the fresh air damper in response to a discharge temperature controller after the face damper has been moved to a minimum position by the space thermostat.

Numerous other objects and advantages of my invention will become apparent from the following detailed description and annexed drawing.

Referring to the drawing, numeral 10 designates an air conditioning duct of the type as conventionally employed in air conditioning systems. The right end of the duct is connected to the inlet of a circulating fan 11 driven by an electric motor 12, the fan discharging into a duct 13 which communicates with a room or space to be conditioned 14. Fresh air from outdoors can be admitted through the left end of the duct 10 and return air from the room or space is admitted to the duct 10 through a return air duct 15 so that the fresh and return air can mix in the duct 10. The proportions of fresh and return air which are mixed in the duct 10 are controlled by a fresh air damper 16 and return air damper 17, both of these dampers being operated in a manner well known in the art by means of a proportioning type damper motor 20. The proportioning motor 20 comprises a reversible electric motor, this motor being of the type shown in detail in the proportioning control system disclosed in the patent to D. G. Taylor No. 2,028,110. The damper motor 20 has a shaft which operates a crank-arm 21 which through a link 22 and a link 23 connecting the two sets of dampers operates both sets of dampers at the same time. Power is supplied to the motor 20 through wires 24 and 25 which may be connected to any suitable source of power. The operation of the fresh and return air dampers and the controls for the damper motor will be described more in detail hereafter.

Disposed in the duct 13 is a partition member 30 which separates the flow of air in the duct 13 so that it follows two paths, one on either side of the partition member. On one side of the partition is a gas fired heater designated by the numeral 31. This heater may be of any well known type of gas fired heater common in the art. Gas is supplied to the heater through a pipe 32 and interposed in the pipe 32 is a control valve generally designated by the numeral 33. As shown, this control valve is a schematic representation of the gas control valve shown in detail in the patent of C. G. Kronmiller, No. 2,214,558. As disclosed, the gas valve comprises a body portion 34 having the usual partition member therein having an opening therethrough forming a valve seat with which cooperates a valve member 35. The valve member 35 is connected to a valve stem 36 which extends through a packing gland 37 and which is normally biased in an upward direction toward open position of the valve, by a coil spring 38 interposed between the packing nut of the packing gland and a collar 39 on the valve stem. Numeral 40 designates a bell-crank lever pivoted at 41, one arm of which normally engages a pin 42 on the upper part of the valve stem 36 and the other arm of which normally bears against the operating stem of an expansible and contractible bellows 43 forming part of a thermostatic controller 44. The thermostatic controller includes a thermal bulb 45 disposed in the path of air which passes over the heater 31, the thermal bulb being connected to the bellows 43 by a capillary tube 46. The thermal bulb 45 contains a volatile liquid which vaporizes and develops a pressure in the thermostatic controller, depending upon the temperature of the air passing over the bulb 45. The bellows 43 expands and contracts in accordance with the said temperature and through the bell-crank lever 40 urges the valve stem 36 downwardly when the bellows expands and permits it to move upwardly under the influence of spring 38 when the bellows contracts. In other words, the thermostatic controller 44 operates to throttle the position of the valve 33, depending upon the temperature of the air passing over the heater. The parts of the thermostatic controller are so adjusted that it

begins to throttle the valve toward closed position at a temperature somewhat less than 110° and as the temperature rises, the valve is gradually moved towards closed position and becomes completely closed at a temperature of 110°. The valve 33 may embody all of the details as shown in the above referred to Kronmiller patent, and these details may include special means for causing the valve to snap to closed position after it has been throttled to a minimum position. This is a common way of operating gas valves and is well known in the art as shown in the Kronmiller patent.

In addition to the thermostatic controller 44, the valve 33 may be closed by means of an electric motor driven mechanism 50. This mechanism includes an electric motor which operates a plunger 51 which moves up and down under the influence of the motor and a biasing spring, the plunger 51 moving down and engaging the upper end of the valve stem 36 and fully closing the valve when the motor of the device 50 is deenergized. When the motor of the device 50 is energized, the plunger 51 is retracted to the position as shown in the drawing and in this position the valve 33 can open under the influence of the biasing spring 38. As mentioned above, the valve 33 may include mechanism for causing it to immediately close after it has been throttled to a minimum position, and this mechanism may take the form of electrical contacts which deenergize the motor of device 50 when the valve has reached a minimum position. The details of this arrangement are shown in the Kronmiller patent.

Within the duct 13, associated with the partition 30 and the heater 31 are a set of face and by-pass dampers 55 including face dampers 56 and by-pass dampers 57. These dampers are operated by means of an operating arm 58 connected to the crank-arm 59 of a proportioning type damper motor 60 which is of the same type as the damper motor 20. Power is supplied to the damper motor 60 through wires 61 and 62 which may be connected to any suitable source of power, not shown.

The controls for the system include a proportioning type space thermostat 65 which controls the damper motor 60. The thermostat 65 comprises a coiled bimetallic element 66 which has attached thereto a blade 67 forming a slider adapted to be moved over a slide wire resistance 68 when the temperature affecting the bimetal element 66 rises and then falls. The bimetal element 66 is connected to the proportioning motor 60 by a wire 69 and the ends of the slide wire resistance are connected to the proportioning motor by wires 70 and 71, respectively. When the temperature affecting the thermostat 66 falls, the slider 67 is moved to the left along resistance 68 and when the temperature rises, the slider 67 is moved to the right along resistance 68. This operation is well known in the art in connection with proportioning control systems and is the same as set forth in detail in the Taylor patent. The controller 65 may operate over a range of from 70 to 72°, for example, the slider being at the midpoint of resistance 68 when the temperature is 71°. With the parts in the position shown, the slider is at the midpoint of resistance 68 and the dampers 55 are in an intermediate position. When the temperature falls, the damper motor 60 operates the dampers so as to increase the amount of air passing over the heater 31 and to decrease the amount going through the by-pass. When the temperature affecting controller 65 rises, the dampers are operated in the opposite manner.

The damper motor 60 has associated therewith two auxiliary switches designated by the numerals 75 and 76. The auxiliary switch 75 includes a cam 77 mounted on the shaft of the proportioning motor 60, the cam 77 having a single dwell, as shown, and being arranged to operate a pivoted switch carrying lever 78 carrying a double-ended mercury switch 79. Normally, the electrodes at the right end of the mercury switch 79 are bridged by the mercury and as the temperature in the space rises and the controller 65 operates the dampers 55 to cause less air to pass over the heater 31, the cam 77 is rotated in a clockwise direction, and as will presently appear more clearly, when the dampers 55 reach a predetermined position the cam 77 will actuate the mercury switch 79 to cause the electrodes at its left end to be bridged. This occurs after the gas valve 33 has been closed and only a small quantity of air is being passed over the heater 31.

The auxiliary switch 76 includes a cam 81 similar to cam 77 and having a single dwell. The cam 81 is arranged to actuate a pivoted switch carrying lever 82 carrying a mercury switch 83 having electrodes at its right end. As pointed out above, when the damper motor 60 is operated in a direction to cause less air to pass over the heater 31, the shaft of the motor rotates in a clockwise direction and as cam 81 rotates, its dwell will lift the lever 82 and open the mercury switch when the face dampers 56 have reached a minimum position wherein a minimum amount of air is passing over the heater 31. This minimum position is of course determined by the adjustment of cam 81 with respect to the drive shaft of motor 60. As will be presently pointed out, the mercury switch 83 controls the motor of the device 50 forming part of valve 33, and the mercury switch causes closure of the valve when the face dampers 56 have reached a minimum position. Mercury switch 79 is tilted slightly after mercury switch 83, that is, after the temperatures has risen slightly higher. This operation will be referred to more in detail hereinafter.

The controls for the fresh and return air damper motor 20 include a proportioning type discharge air temperature controller 90. The controller 90 includes a slide wire resistance 91 cooperating with which is a pivoted slider 92 which is movable about its pivot by an expansible and contractible bellows 93, the movable end of which carries a stem bearing against the slider 92. The slider is normally urged against the stem of the bellows 93 by a coil spring 94. The interior of the bellows 93 is connected to a thermal bulb 95 by a capillary tube 96. The thermal bulb 95 is disposed in the path of the air being discharged by the fan 11 so that the controller 90 is responsive to the temperature of the discharge air from the fan. The controller 90 is not normally in control of the motor 20 but it may be placed in control thereof by the mercury switch 79. The circuits whereby the controller 90 controls the motor 20 will be described in the complete description of the operation of the system as a whole hereinafter.

When the controller 90 is not controlling the motor 20, the fresh air damper 16 is normally in a minimum position admitting a minimum quantity of fresh air and the return air dampers 17 are in a given position. The minimum position

of the fresh air damper, that is the position of motor 20 establishing the minimum position of the fresh air damper 16 is determined by a manually adjustable rheostat 99 comprising a resistance 101 and a manually adjustable contact 102. The circuits whereby the rheostat 99 controls the minimum position of the fresh air damper will be traced presently.

When the fresh and return air dampers are under control of the discharge controller 90, the outdoor air temperature may rise to a relatively high value at which it is not desired that any more than a minimum amount of fresh air be admitted because the air is then too warm to effect any cooling in the spaces. In my arrangement, under these circumstances, if the damper motor 20 is under control of the controller 90, the control is taken away from the controller 90 and returned to the rheostat 99 which returns the dampers to minimum position of the fresh air damper. This function is produced by an outdoor temperature responsive controller 105 comprising an expansible and contractible bellows 106 connectd to a thermal bulb 107 located in the left end of the duct 10 by means of a capillary tube 108. The bulb 107 responds to outdoor temperature and it contains a volatile liquid which vaporizes and develops a pressure in bellows 106, depending upon outdoor temperature, the bellows 106 expanding and contracting accordingly. The movable end of bellows 106 carries a stem which engages a pivoted switch carrying lever 109 carrying a double ended mercury switch 110, the lever 109 normally being biased in a counterclockwise direction by a coil spring 111. The mercury switch 110 has electrodes at its left end which are normally bridged when the temperature affecting the controller 105 is below a predetermined value. When the outdoor temperature rises to a predetermined value ,the bellows 106 expands rotating lever 109 in a clockwise direction to cause the mercury to move to the right end of switch 110 bridging the electrodes at the right end. The controller 105 may be so adjusted that this occurs at a temperature of 77°, for example. In addition to the controls as so far described, the controls include a relay designated by the numeral 115, this relay comprising a winding 116 having an armature associated therewith attached to movable switch blade 117 which moves to the left into engagement with a fixed contact 118 when the relay is deenergized and which is moved to the right into engagement with a fixed contact 119 by the armature when the relay is energized.

Numeral 120 designates another relay comprising a winding 121 having an armature associated therewith attached to three movable switch blades 122, 123 and 124 which are moved to the right into engagement with fixed electrical contacts 125, 126 and 127, respectively, when the relay is energized. Both the relays 115 and 120 are normally energized.

Power for operation of the relay 120 is supplied by a step-down transformer 130 having a primary winding 131 and a secondary winding 132, the primary winding having a greater number of turns. Power is supplied to the primary winding 131 through line conductors 133 and 134 which may be connected to any suitable source of power, not shown. The winding 121 of relay 120 is controlled by a manual switch including a manually movable switch blade 135 which normally engages a fixed electrical contact 136.

The operation of the system as a whole will now be described. With the parts in the position shown, the valve 33 is in an open position so that the gas is being supplied to the heater 31 and the controller 65 is substantially in a satisfied position. The motor of the device 50 is energized so that the plunger 51 is retracted, the fan 11 is in operation, and the damper motor 20 is in minimum position of the fresh air damper 16. As mentioned above, the relays 115 and 120 are normally energized. The energizing circuit for relay 120 is as follows: from secondary 132 of transformer 130 through wire 141, switch blade 135, contact 136, wire 142, winding 121 and wire 143 back to the secondary 132. The energizing circuit for relay 115 is as follows: from line conductor 134 through wire 144, contact 125, blade 122, wire 145, winding 116 and wire 146 back to line conductor 133. The circuit for fan motor 12 is as follows: from line conductor 134 through wire 148, contact 126, blade 123; wire 149, the fan motor, and wire 150 back to line conductor 133. The circuit for the motor of device 50 is as follows: from line conductor 134 through wire 153, contact 127, blade 124, wire 154, the motor of device 50, wire 155, mercury switch 83, and wire 156 back to line conductor 133.

With the parts in the position shown, the controller 90 is not in control of the damper motor 20 because the slider 92 is not connected to the damper motor inasmuch as the electrodes at the left end of mercury switch 79 are unbridged.

The damper motor 20 has three control terminals designated 157, 158 and 159. As is well known with this type of motor if terminals 157 and 158 are shunted the motor operates to one extreme position, and if the terminals 158 and 159 are shunted the motor operates to its other extreme position. The motor is so arranged that when terminals 157 and 158 are shunted, the motor will operate to an extreme position wherein the fresh air damper is fully closed and the return air damper is wide open. With the parts in the position shown, the terminals 157 and 158 are partly shunted through the rheostat 99 so that the motor has operated toward an extreme position stopping with the fresh air dampers in a minimum position determined by the adjustment of the rheostat 99. The circuit whereby terminals 157 and 158 are partly shunted is as follows: from terminal 158 through wire 160, blade 117 of relay 115, contact 119, wire 161, the left end of mercury switch 110, wire 162, the right end of mercury switch 79, wire 163, wire 164, wire 165, contact 102, part of resistance 101, wire 166, and wire 167 back to terminal 157.

As the system now operates, the controlled 65 will position the dampers 55 to control the relative volumes of air passing over the heater 31 so as to maintain the desired temperature in the space, the controller 65 as pointed out above, on a fall in temperature causing more air to pass over the heater 31 and upon a rise in temperature causing less air to pass over the heater 31. When the temperature in the space tends to become satisfied, that is, as the temperature therein rises, the controller 65 will position the dampers 55 so as to cause less air to pass over the heater 31, that is, as the temperature rises towards 72° wherein the slider 67 approaches the right end of resistance 68. As the amount of air passing over the heater 31 is reduced, its temperature will of course rise and as it rises towards 110°, the controller 44 will begin throttling the valve 33 towards closed position. If the temperature at

the bulb 45 reaches 110° before the face damper 56 has reached its minimum position, the gas valve 33 will be fully closed, as pointed out above. The purpose of the controller 44 is of course to prevent the heater 31 from being operated at excessively high temperatures. Normally, however, the controller 65 will cause the damper 56 to be positioned to a minimum position before the controller 44 closes valve 33, and when the damper 56 has reached this minimum flow position, cam 81 will open mercury switch 83 which will interrupt the circuit of the motor of device 50 and thereupon the plunger 51 will immediately move downwardly engaging the upper end of valve stem 36, closing the valve 33. When this occurs, heating of the air is of course discontinued. If the weather conditions are such that the temperature affecting controller 65 continues to rise, the dampers 55 will be positioned to cause still less air to pass over the heater 31 and cam 77 will now tilt mercury switch 79 so that the electrodes at its right end are unbridged and the electrodes at its left end are bridged. When this occurs, the rheostat 99 will be deprived of full control of the motor 20 and control of motor 20 will be placed under command of the controller 90. The upper end of slide wire resistance 91 of controller 90 is connected to terminal 157 of the damper motor 20 by the following connection: wire 164, wire 165, contact 102, a portion of resistance 101, wire 166, and wire 167. The lower end of resistance 91 is connected to terminal 159 of motor 20 by wire 170. The slider 92 is now connected to the terminal 158 of motor 20 by the following connection: from slider 92 through wire 171, the left end of mercury switch 79, wire 162, the left end of mercury switch 110, wire 161, contact 119, blade 117 and wire 160 to terminal 156. Thus the controller 90 is now in control of the motor 20 and the rheostat 99 is not in full control because the circuit whereby rheostat 99 had full control is interrupted due to unbridging of the electrodes at the right end of mercury switch 79. Rheostat 99 prevents the dampers from being moved to fully closed position of the fresh air damper 16 when controller 90 is in control. The fresh and return air dampers will now move out of minimum position of the fresh air damper because there is less resistance between terminals 158 and 159 than between terminals 157 and 158. The damper motor 20 will now be positioned in accordance with the demands of the thermostatic controller 90, and as the temperature affecting thermal bulb 95 rises bellows 93 will expand, moving slider 92 downwardly over resistance 91 tending to shunt the terminals 158 and 159 so as to move the fresh and return air dampers into a wider open position of the fresh air damper. In other words, as the discharge temperature of the air from the fan rises, the dampers are operated to admit more and more fresh air. Conversely, as the temperature affecting bulb 95 falls, slider 92 moves upwardly along resistance 91 so as to cause motor 20 to operate in the opposite direction to move the fresh and return dampers towards minimum position of the fresh air damper.

In the event that the outdoor temperature should rise to 77°, for example, such that the fresh air is not suitable for cooling of the spaces, the controller 105 will respond in the manner described above and tilt mercury switch 110 so as to unbridge the electrodes at its left end and to bridge the electrodes at its right end. When this occurs, the controller 90 is deprived of control of the motor 20 because the connection from the slider 92 to the terminal 158 is interrupted. When this occurs, the rheostat 99 is again placed in control of the damper motor 20 so that it again assumes its position wherein the fresh air damper is in minimum position. Terminals 157 and 158 of motor 20 are now again partly shunted by rheostat 99, the connections being as follows: from terminal 158 through wire 160, blade 117, contact 119, wire 161, the right end of mercury switch 110, wire 175, wire 165, contact 102, a portion of resistance 101, wire 166, and wire 167 back to the terminal 157.

Upon falling temperatures in the space, cams 77 and 81 will tilt their mercury switches back into the positions shown wherein the fresh air damper is in minimum position and the motor of device 50 is energized to permit opening of the gas valve 33. The controller 65 will modulate the dampers 55 as before.

Whenever the fan 11 is to be manually stopped, the manual switch blade 135 is moved away from contact 136. This deenergizes the relay 120 and switch blades 122, 123, and 124 move away from their associated contacts. When this occurs, the circuit of fan motor 12 is of course interrupted, the circuit of the motor of device 50 is interrupted, and the circuit of relay 115 is opened so as to deenergize the relay 115. When relay 115 is deenergized, blade 117 moves away from contact 119 and into engagement with contact 118. When this occurs, terminals 157 and 158 are fully shunted so as to cause motor 20 to operate to an extreme position wherein the fresh air dampers are fully closed and the return air damper is wide open. The connections whereby terminals 157 and 158 are shunted are as follows: from terminal 158 through wire 160, blade 117, contact 118, wire 176, and wire 167 to terminal 157. Thus whenever the fan is stopped, the fresh air damper is moved to closed position and the gas valve is closed if it was open at the time.

From the foregoing those skilled in the art will appreciate the advantages of my invention and the economies which may be gained by utilization thereof. By reason of my particular arrangement of controls associated with the gas fired heater, modulating control of the space temperature is provide for and also modulating control of the flow of gas to the heater. The thermostatic controller 44, by acting as a limiting device prevents the heater from being operated at excessive temperatures. The arrangement whereby the fresh air damper will be moved out of minimum position and controlled by the discharge temperature controller 90 provides an economizer control feature which is automatically brought into use in response to the space controller 65. By reason of this arrangement, the best advantage is taken of outdoor air by utilizing it for improving the conditions of the space without treatment of the air.

If desired artificial cooling means may also be provided for cooling the air in warm weather.

The single embodiment of my invention which I have disclosed is representative of its preferred form. Numerous variations and modifications of the invention will occur to those skilled in the art, and therefore the invention is to be interpreted in the light of the disclosure, the disclosure being illustrative rather than limiting upon the invention. The invention is to be limited only in accordance with the scope of the claims appended hereto.

I claim as my invention:

1. In an air treating system, in combination,

temperature changing means of a type wherein the temperature is varied by regulating the flow of a fluid medium, means for passing air in heat exchange relationship with said means, means for regulating the amount of air being treated by the first means, said regulating means comprising a device responsive to a condition representative of the amount of temperature changing effect necessary to maintain the temperature of the treated air at a desired value, means responsive to the temperature of air passing the temperature changing means for modulatingly adjusting the temperature changing effect thereof, said temperature responsive means comprising a fluid flow control valve controlling a fluid medium associated with said temperature changing means; and means for causing said valve to close when said air regulating means has assumed a position wherein a minimum volume of air passes the temperature changing means.

2. In an air treating system, in combination, temperature changing means of a type wherein the temperature is varied by regulating the flow of a fluid medium, means for passing air in heat exchange relationship with said means, means for regulating the amount of air being treated by the first means, said regulating means comprising a device responsive to a condition representative of the amount of temperature changing effect necessary to maintain the temperature of the treated air at a desired value, means responsive to the temperature of air passing the temperature changing means for modulatingly adjusting the temperature changing effect thereof, means for admitting outdoor air into said system, and means for automatically adjusting said last mentioned means when said air regulating means reaches a position indicative of a minimum demand for temperature change of the air.

3. In an air treating system, in combination, temperature changing means of a type wherein the temperature is varied by regulating the flow of a fluid medium, means for passing air in heat exchange relationship with said means, means for regulating the amount of air being treated by the first means, said regulating means comprising a device responsive to a condition representative of the amount of temperature changing effect necessary to maintain the temperature of the treated air at a desired value, means responsive to the temperature of air passing the temperature changing means for modulatingly adjusting the temperature changing effect thereof, means for admitting outdoor air into said system, means for automatically adjusting said last mentioned means when said air regulating means reaches a position indicative of a minimum demand for temperature change of the air, and means responsive to outdoor air temperature for causing said outdoor air admitting means to assume a minimum position when the temperature of the outdoor air reaches a predetermined value.

4. In an air conditioning system, in combination, means forming an air conditioning duct, a gas fired heater in said duct, valve means controlling a flow of gas to the heater, face and by-pass dampers associated with said heater, means responsive to a condition representative of heating requirements of a space controlling said dampers, means responsive to temperature of air passing the heater arranged to modulatingly control the valve means, and means for causing the valve means to fully cut off the flow of gas when the dampers have been positioned to a position causing a minimum amount of air to pass over the heater.

5. In an air conditioning system, in combination, means forming an air conditioning duct, a gas fired heater in said duct, valve means controlling a flow of gas to the heater, face and by-pass dampers associated with said heater, means responsive to a condition representative of heating requirements of a space controlling said dampers, means responsive to temperature of air passing the heater arranged to modulatingly control the valve means, means for admitting outdoor air to said duct, damper means controlling the amount of outdoor air admitted, and means for automatically adjusting said last damper means from a minimum air admission position to a wider open position when said face damper reaches a position causing a minimum flow of air over said heater.

6. In an air conditioning system, in combination, means forming an air conditioning duct, a gas fired heater in said duct, valve means controlling a flow of gas to the heater, face and by-pass dampers associated with said heater, means responsive to a condition representative of heating requirements of a space controlling said dampers, means responsive to temperature of air passing the heater arranged to modulatingly control the valve means, means for admitting outdoor air to said duct, damper means controlling the amount of outdoor air admitted, and means for automatically adjusting said last damper means from a minimum air admission position to a wider open position when said face damper reaches a position causing a minimum flow of air over said heater, said automatic means for adjusting the outdoor air damper means comprising a device responsive to the temperature of air passing through the duct.

7. In an air conditioning system, in combination, means forming an air conditioning duct, a gas fired heater in said duct, valve means controlling a flow of gas to the heater, face and by-pass dampers associated with said heater, means responsive to a condition representative of heating requirements of a space controlling said dampers, means responsive to temperature of air passing the heater arranged to modulatingly control the valve means, means for admitting outdoor air to said duct, damper means controlling the amount of outdoor air admitted, means for automatically adjusting said last damper means from a minimum air admission position to a wider open position when said face damper reaches a position causing a minimum flow of air over said heater, and means responsive to the temperature of outdoor air for causing said outdoor air damper means to assume a minimum air flow position when the temperature of the outdoor air reaches a predetermined value.

8. In an air conditioning system, in combination, means forming an air conditioning duct, a gas fired heater in said duct, valve means controlling a flow of gas to the heater, face and by-pass dampers associated with said heater, means responsive to a condition representative of heating requirements of a space controlling said dampers, means responsive to temperature of air passing the heater arranged to modulatingly control the valve means, means for admitting outdoor air to said duct, damper means controlling the amount of outdoor air admitted, means for automatically adjusting said last damper means from a minimum air admission position to a

wider open position when said face damper reaches a position causing a minimum flow of air over said heater, said automatic means for adjusting the outdoor air damper means comprising a device responsive to the temperature of air passing through the duct, and means responsive to the temperature of outdoor air for causing said outdoor air damper means to assume a minimum air flow position when the temperature of the outdoor air reaches a predetermined value.

9. In an air conditioning system, in combination, means forming an air conditioning duct, a gas fired heater in said duct, valve means controlling a flow of gas to the heater, face and by-pass dampers associated with said heater, means responsive to a condition representative of heating requirements of a space controlling said dampers, means responsive to temperature of air passing the heater arranged to modulatingly control the valve means, means for admitting outdoor air to said duct, damper means controlling the amount of outdoor air admitted, means whereby upon said face damper reaching a position causing a minimum flow of air over the heating means the valve means are moved to fully closed position, and means whereby upon said face damper reaching substantially said position said outdoor air damper means are moved from a minimum position to a wider open position.

10. In an air conditioning system, in combination, means forming an air conditioning duct, a gas fired heater in said duct, valve means controlling a flow of gas to the heater, face and by-pass dampers associated with said heater, means responsive to a condition representative of heating requirements of a space controlling said dampers, means responsive to temperature of air passing the heater arranged to modulatingly control the valve means, means for admitting outdoor air to said duct, damper means controlling the amount of outdoor air admitted, means whereby upon said face damper reaching a position causing a minimum flow of air over the heating means the valve means are moved to fully closed position, and means whereby upon said face damper reaching substantially said position said outdoor air damper means are moved from a minimum position to a wider open position, and means responsive to temperature in said duct for automatically adjusting said outdoor air damper means.

11. In an air treating system, in combination, a fresh air duct, a return air duct, a third duct connected to said other ducts for conducting the mixture of fresh and return air back to a space to be conditioned, temperature control means including a heat exchanger in one of said ducts, temperature responsive means in control of said temperature control means for regulating the temperature in said space, a fresh air damper, means for causing said fresh air damper to move to its minimum open position when said temperature control means is operative, and means for positioning said fresh air damper in accordance with the temperature of the air discharged to said space when said temperature control means is inoperative.

12. In an air treating system, in combination, a fresh air duct, a return air duct, a third duct connected to said other ducts for conducting the mixture of fresh and return air back to a space to be conditioned, temperature control means including a heat exchanger in one of said ducts, temperature responsive means in control of said temperature control means for regulating the temperature in said space, a fresh air damper, means for causing said fresh air damper to move to its minimum open position when said temperature control means is operative, means for positioning said fresh air damper in accordance with the temperature of the air discharged to said space when said temperature control means is inoperative, and means causing said fresh air damper to move to its minimum open position when the temperature of the fresh air is such that it is not suitable for mixture with return air for maintaining the temperature of the air discharged to said space at a proper value.

13. In an air treating system, in combination, a fresh air duct, a return air duct, a third duct connected to said other ducts for conducting the mixture of fresh and return air back to a space to be conditioned, temperature control means including a heat exchanger in one of said ducts, temperature responsive means in control of said temperature control means for regulating the temperature in said space, a fresh air damper, means for causing said fresh air damper to move to its minimum open position when said temperature control means is operative, means for positioning said fresh air damper in accordance with the temperature of the air discharged to said space when said temperature control means is inoperative, means causing said fresh air damper to move to its minimum open position when the temperature of the fresh air is such that it is not suitable for mixture with return air for maintaining the temperature of the air discharged to said space at a proper value, fan means for causing a flow of air through said ducts, an energizing circuit for said fan means, and means for closing said fresh air damper and rendering said temperature control means inoperative when said fan means is deenergized.

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