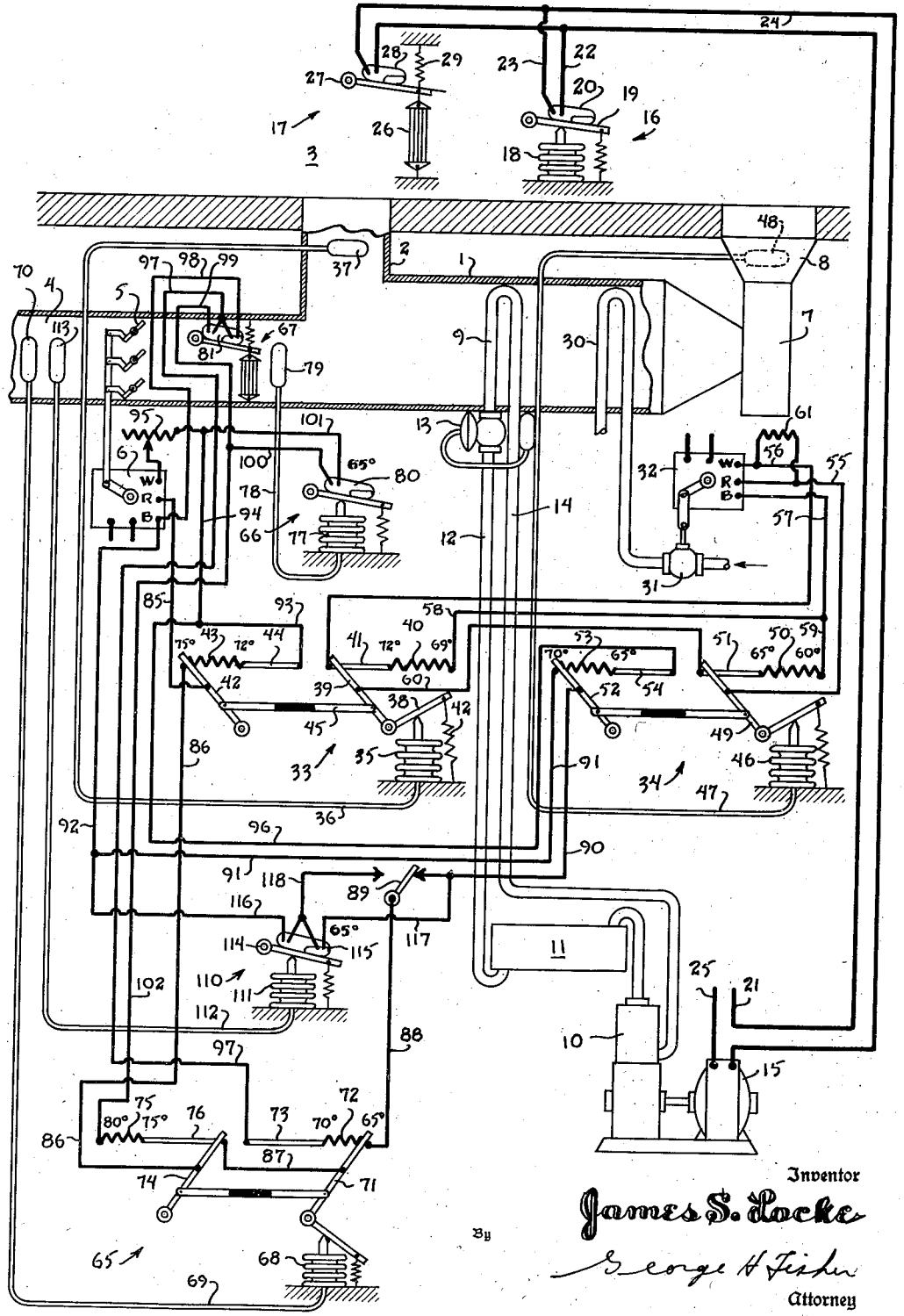
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AIR CONDITIONING SYSTEM

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AIR CONDITIONING SYSTEM

James S. Locke, Minneapolis, Minn., assignor to Minneapolis-Honeywell Regulator Company, Minneapolis, Minn., a corporation of Delaware

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This invention relates in general to air conditioning and is particularly concerned with the provision of automatic fresh air damper control apparatus for air conditioning systems.

It is the primary object of my invention to provide a fresh air damper control system for an air conditioning system which operates to automatically vary the supply of fresh air to a conditioned space during the entire year, the damper position being varied in accordance with the condition of the fresh air and also with the conditions existing within the space or conditioning system in a manner to maintain proper space conditions and secure economical operation of the air conditioning system as a whole.

More specifically, it is an object of this invention to provide a fresh air damper control system which varies the supply of fresh air in a manner to decrease the fresh air supply to a minimum when the outside temperature becomes excessive and to utilize the fresh air as a cooling medium for the space whenever its temperature is suitable for this purpose, the fresh air being controlled at this time in a manner to prevent the occurrence of cold drafts due to this cooling action.

Another object of this invention is the provision of a fresh air damper control system which acts to reduce the supply of fresh air to a minimum whenever the relative humidity of the fresh air becomes excessive, while at the same time preventing the reduction in fresh air supply due to its excessive humidity if its temperature is sufficiently low for improving the space conditions in spite of its high relative humidity.

Another object of this invention is the provision of an all-year fresh air damper control system including a discharge thermostat for reducing the supply of fresh air to the space during the heating or intermediate seasons if the temperature of the discharge air should fall too low, this discharge thermostat being automatically placed out of operation during the cooling season.

Other objects of this invention lie in various combinations and subcombinations of control apparatus and will become apparent from the following description and the appended claims.

For a full disclosure of my invention, reference is made to the following detailed description and to the accompanying drawing, the single figure of which illustrates diagrammatically one embodiment of my invention.

Referring to the drawing, reference character 1 indicates generally an air conditioning chamber connected to a return duct 2 leading from a space to be conditioned 3. The chamber 1 is also provided with a fresh air inlet duct 4, this duct having a fresh air damper 5 which is actuated by means of a fresh air damper motor 6. This fresh air damper motor may be of the type shown and described in Patent No. 2,028,110 issued to Daniel G. Taylor on January 14, 1936. The discharge end of the conditioning chamber 1 is connected to a fan 7 which acts to draw air through the chamber 1 and to discharge it through the discharge duct 8 leading to the space 3.

Located within the conditioning chamber 1 may be any suitable cooling means, this means being indicated as a direct expansion cooling coil 9. This cooling coil may be connected to a compressor 10, this compressor having its discharge connected to a condenser 11, the outlet of which is connected by a liquid line 12 to an expansion valve 13 at the inlet of the cooling coil 9. The outlet of this cooling coil may be connected by a suction line 14 to the suction side of the compressor 10. The compressor 10, condenser 11, cooling coil 9, and expansion valve 13 therefore comprise a conventional type of refrigeration system which causes chilling of the cooling coil 9 when the compressor 10 is in operation.

The compressor 10 may be driven by means of an electric motor 15, this motor being controlled by means of a space thermostat 16 and a humidity controller 17. Referring to the thermostat 16, this may be of any desired type and for illustrative purposes is indicated as comprising a bellows 18 containing a volatile fluid, this bellows actuating a pivoted member 19 carrying a mercury switch 20. It will be understood that as the space temperature increases, the bellows 18 will expand thereby causing tilting of the switch 20 to closed position. The switch 20 is arranged to place the compressor motor 15 in operation when this switch is tilted to closed position and this circuit is for illustrative purposes indicated as comprising line wire 21, wire 22, mercury swtch 20, wire 23, wire 24, compressor motor 15, and line wire 25. The space thermostat 16 may be set so as to place the compressor motor 15 into operation when the space temperature exceeds a predetermined value, for example 76° F.

Referring to the humidity controller 17, this controller may be of any desired type and is illustrated as including a humidity responsive

device comprising a plurality of strands 26 of hair or other moisture responsive material, these strands being secured at their ends by means of clamping members. The lower clamping member may be connected to a fixed support as indicated, while the upper clamping member may be connected to a pivoted mercury switch carrier 27 which carries a mercury switch 28. It will be understood that upon an increase in relative humidity, the strands 26 will increase in length and the mercury switch 28 will be tilted to closed position by a spring 29. Upon a decrease in relative humidity, the strands 26 will decrease in length thereby tilting the mercury switch 28 to open position. This humidity controller 17 may be adjusted so as to cause the switch 28 to close when the space relative humidity rises to 60% while tilting the switch 28 to open position when the relative humidity is below this value. The switch 28, it will be noted, is connected in parallel with the mercury switch 20 of the thermostat 16. The arrangement just described will therefore place the compressor 10 into operation whenever either the space temperature or the relative humidity becomes excessive.

Also located within the conditioning chamber 1 may be a heating coil 30, the inlet of this coil being connected to a valve 31 which is actuated by means of a proportioning motor 32. This proportioning motor 32 may also be of the type shown in the Taylor patent. The proportioning motor 32 is illustrated as being controlled by the conjoint action of a return air thermostat indicated generally as 33, and a discharge duct thermostat indicated as 34.

Referring to the return duct thermostat 33, this instrument may comprise a bellows 35 which is connected by a capillary tube 36 to a control bulb 37 which is located within the return duct 2. This bellows, tube, and bulb contain a suitable volatile fill for thereby causing the pressure within bellows 35 to vary with changes in temperature at the bulb 37. The bellows 35 may actuate a suitable potentiometer controller, this controller being indicated as comprising a bell-crank lever having an actuating arm 38 and a control arm 39 which is adapted to engage a resistance 40 and a contact strip 41. It will be apparent that as the return air temperature decreases, the pressure within the bellows 35 will decrease, this causing clockwise rotation of the bell-crank lever formed of arms 38 and 39 under the action of a spring 42. Consequently, upon fall in return air temperature, the arm 39 will slide to the right across the contact strip 41, and upon further fall in temperature will engage and slide upon the resistance 40. The potentiometer formed of arm 39, resistance 40, and contact strip 41 is for the purpose of controlling the steam valve proportioning motor 32. The thermostat 33 is also provided with a second potentiometer controller formed of a control arm or slider 42, a control resistance 43, and a contact strip 44. The slider 42 may be arranged to be actuated simultaneously with the slider 39 in any suitable manner, such as by means of an insulated link 45. The potentiometer formed of slider 42, resistance 43, and contact strip 44 is for the purpose of controlling the fresh air damper motor 6, as will be described later. It should be noted that upon fall in return air or space temperature from a high value to a low value, the slider 42 will first travel across the resistance 43 while the slider 39 travels across contact strip 41. Then upon further fall in temperature, the slider 39 will travel across resistance 40 while the slider 42 will travel across contact strip 44. The purpose of this staggered arrangement is to provide for sequential control of the steam valve and the fresh air damper by the return air thermostat 33. This return air thermostat may be so designed and adjusted as to cause the slider 42 to engage the extreme left-hand end of resistance 43 when the space temperature is at 75°, while engaging the extreme right-hand end of resistance 43 when the space temperature falls to 72°. At this time, the slider 39 will engage the right-hand end of resistance 40, and when the space temperature falls to 69° the slider 39 will engage the extreme right-hand end of resistance 40.

The discharge duct thermostat 34 may be of the same type as the thermostat 33. This thermostat may include a bellows 46 which is connected by a tube 47 to a bulb 48 located within the discharge duct 8. This thermostat may also include a first potentiometer controller formed of slider 49, resistance 50, and contact strip 51; and a second potentiometer controller formed of a slider 52, resistance 53, and contact strip 54. The control potentiometer formed of slider 49, resistance 50, and contact strip 51 is connected to the steam valive proportioning motor 32, while the potentiometer controller formed of slider 52, resistance 53, and contact strip 54 is connected into the control circuit for the fresh air damper motor 6, as will be presently described. These two potentiometer controllers it will be noted, are staggered in the same manner as the potentiometer controllers of the thermostat 33 for providing sequential control of the fresh air damper and the steam valve. This discharge duct thermostat may be so designed and adjusted as to cause the slider 52 to engage the extreme left-hand end of resistance 53 when the discharge temperature is at 70°, while causing this slider to engage the right-hand end of resistance 53 when the discharge temperature falls to 65° F. This controller may also be arranged so as to cause the slider 49 to engage the extreme right-hand end of the resistance 50 when the discharge air temperature falls to 60° F.

Referring again to the proportioning motor 32, it will be noted upon reference to the Taylor patent that this proportioning motor is adapted to be controlled by a 3 wire control circuit, the control terminals being indicated as R, B, and W. This motor is adapted to be controlled by means of variable resistance type controllers and will assume intermediate positions depending upon the relative values of resistance connected between terminals R and B and between terminals R and W. For instance, if equal resistances are connected between terminals R and B and terminals R and W, the motor will run to the center of its operating range, this causing the valve 31 to be half open. If the resistance between terminals R and W is decreased, or if the resistance between terminals R and B is increased, or both, the motor will run in the direction for closing the valve to a new position, depending upon the relative values of resistance connected across the control terminals. Conversely, if the resistance between terminals R and B is decreased, or the resistance between terminals R and W is increased, or both, the motor will run to a new position in which the valve is opened further. This type of motor is therefore adapted to be controlled by means of potentiometers or variable resistance controllers.

Referring to the wiring between motor 32 and the thermostats 33 and 34, it will be seen that terminal R is connected to the slider 49 of the thermostat 34 by means of wire 55, and that terminal W is connected to the contact strip 41 of thermostat 33 by wire 56. Terminal B of the motor is connected by wires 57, 58, and 59 to the resistance 50 of thermostat 34 and the resistance 40 of the thermostat 33. The contact strip 51 of thermostat 34 is connected to the slider 39 of thermostat 33 by wire 60. The wiring arrangement just described therefore connects the resistance 40 of thermostat 32 across terminals W and B of the motor 32. When the discharge air temperature is above 65° F., the slider 49 of thermostat 34 will engage the contact strip 51 and this will directly connect the slider 39 of thermostat 33 to terminal R of the motor 32 as follows: terminal R, wire 55, slider 40, contact strip 51 and wire 60 to slider 39. With the return air temperature above 72° F., this slider 39 will engage the contact strip 41 for completing a short circuit from terminal R of the motor to terminal W. Also at this time, it will be noted that the entire resistance 40 is connected between terminal R of the motor and terminal B. For this condition, the motor will run to the extreme position for closing the valve 31 as shown. If the return air temperature should now fall below 72° F., the slider 39 will begin traversing the resistance 40 thereby placing part of this resistance 40 between terminals R and B and decreasing the portion of this resistance which is connected between terminals R and W, this causing the motor 32 to open the valve 31 an amount proportionate to the movement of slider 39 on resistance 40. When the return air temperature falls to 69° F., the slider 39 will have placed all of the resistance 40 between terminals R and W while completing a short circuit between terminals R and B, this causing the motor to run to a position at which the valve 31 is wide open. It will, therefore, be seen that when the discharge air temperature is above 65° F., the return air controller 33 will be placed in complete control of the steam valve 32 for thereby modulating the flow of steam to the coil 30 in a manner to maintain a substantially constant return air temperature.

Referring again to the discharge duct controller, it will be noted that due to the slider 49 of this controller being connected to terminal R by wire 55 and the resistance 50 being connected to terminal B by wire 57, the entire resistance 50 is connected across terminals R and B of the motor when the discharge temperature is below 65° F. The effect of this resistance on the motor 32, however, is balanced out by an equal resistance 61 which is connected between terminals R and W. However, when the return air temperature falls below 65° F., the slider 49 will begin traversing the resistance 50 thereby decreasing the portion of this resistance which is connected between terminals R and B. At the same time, this slider will insert a portion of the resistance 50 between slider 49 and the wire 60 which leads to the controller 33, thereby decreasing the effect of the controller 33 on the motor 32. Due to this double action, it will be apparent that as the discharge duct temperature decreases below 65° F., the controller 34 will cause the steam valve to be opened for preventing the discharge air temperature from becoming too cold, this action occurring even though the space temperature may be high. This action prevents the discharge of cold air into the space, thereby avoiding discomfort within the space due to cold drafts.

Referring now to the controls for the fresh air damper motor 6, this motor in addition to being controlled by the thermostats 33 and 34 is additionally controlled by means of an outdoor temperature responsive thermostat 65, a second outdoor temperature responsive thermostat 66 and an outdoor humidity responsive device 67.

Referring first to the outdoor thermostat 65, this thermostat may include a bellows 68 which is connected by a capillary tube 69 to a control bulb 70 located within the fresh air duct 5. The bellows 68 is arranged to actuate a pair of potentiometer controllers, the first potentiometer controller comprising a slider 71, a resistance 72, and a contact strip 73; and the second potentiometer controller comprising a slider 74, a resistance 75, and a contact strip 76. This instrument may be arranged so as to provide three separate cycles of operation. Thus when the outdoor temperature is at 65° F., or below, the slider 71 will engage the right-hand end of resistance 72, the slider 74 at this time engaging the contact strip 76. As the outdoor temperature increases from 65° F. to 70° F., the slider 71 will traverse the resistance 72 from its right-hand end to its left-hand end. Upon further increase in temperature from 70° F. to 75° F., the sliders 71 and 74 will both engage their respective contact strips. Upon increase in temperature above 75° F., the slider 74 will traverse the resistance 75 and will engage the left-hand end thereof when the outdoor temperature rises to 80° F. The purpose of this arrangement will become apparent as this description proceeds.

The thermostat 66 may be of any desired type and may comprise a bellows 77 which is connected by a capillary tube 78 to a control bulb 79 located within the fresh air duct 4. The bellows 77 may actuate through suitable means a mercury switch 80. This thermostat 66 is preferably designed and adjusted for causing the mercury switch 80 to open whenever the outdoor temperature falls below 65° F., while causing this switch to be closed when the outdoor temperature is above this value.

The humidity controller 67 may be similar to the humidity controller 17. This controller may be provided with a double acting mercury switch 81 and is so arranged as to cause this mercury switch to be tilted to make the right-hand electrodes when the relative humidity of the fresh air is below 60° while causing the switch to be tilted for making the left-hand pair of electrodes when the relative humidity arises above 60%.

With the various controllers in the positions shown, the outdoor temperature is below 65° F., as indicated by the mercury switch 80 of the controller 66 being opened and also by the slider 71 of the controller 65 engaging the right-hand end of resistance 72. Also, the relative humidity of the outdoor air is below 60%, as indicated by the mercury switch 81 being tilted for closing the right-hand electrodes thereof. Also, the return air temperature is at or above 75° F., as indicated by the slider 42 of controller 33 engaging the left-hand end of resistance 43. At this time also, the temperature of the discharge air is at or above 70° F., as indicated by the slider 52 of controller 34 engaging the left-hand end of

resistance 53. For the positions of controllers 33, 34, and 65 just described, the fresh air damper 5 is wide open, this being caused by a short circuit between terminals R and B of the motor 6 as follows: terminal R, wire 85, slider 42, wire 86, slider 74, contact strip 76, wire 87, slider 71, wire 88, switch arm 89, wire 90, slider 52, wire 91, and wire 92 to terminal B. Due to the space temperature being at 75° F., it is desirable to cool the space at this time and due to the fact that the fresh air temperature is below 65° F., this air is useful for cooling the space, and the opening of the fresh air damper as just described therefore provides for cooling the space without operation of the compressor 10.

If due to this cooling action of the fresh air, the space temperature begins falling below 75° F., the slider 42 of thermostat 33 will begin traversing resistance 43. The right-hand end of this resistance, it will be noted, is connected to terminal W of the damper motor 6 through the contact strip 44, wire 93, wire 94, and rheostat 95. Consequently, when the slider 42 engages the left-hand end of resistance 43 the entire resistance 43 is connected between terminals R and W of the motor. As the slider 42 shifts to the right across resistance 43 due to fall in space temperature, the portion of resistance 43 which is connected between terminals R and W of the motor will be decreased. At the same time, the resistance 43 will gradually be inserted into the circuit between terminals R and B thereby breaking the short circuit between these terminals previously described. Due to this decrease in resistance between terminals R and W and the increase in resistance between terminals R and B, the motor 6 will run in a direction for closing the damper 5, the amount of travel of the motor 6 being proportionate to the travel of slider 42 across resistance 43. When the space or return air temperature falls to 72° F., the slider 42 will engage the right-hand end of resistance 43 which will reduce the resistance between terminals R and W to a minimum while placing maximum resistance between terminals R and B. This would cause the motor 6 to move for completely closing the damper 5 were it not for the rheostat 95 which is connected in series with terminal W of the motor. Due to this rheostat, the various controllers cannot short-circuit terminals R and W of the motor and consequently the damper 5 will never completely close. This provides for a minimum supply of fresh air for ventilation purposes regardless of the various controllers. By adjusting the rheostat 95, this minimum position assumed by the damper may be varied to suit the requirements of the particular installation. From the description thus far, it should be apparent that the space temperature or return air controller 33 will act to close the damper 5 to a minimum position whenever the space temperature falls to 72° F.

If due to the cooling action of the fresh air being supplied, the temperature of the air being discharged into the space begins falling below 70° F., the slider 52 of thermostat 34 will begin shifting to the right across resistance 53. As pointed out previously, the short circuit established between terminals R and B for opening the damper 5 to its maximum, passes through the slider 52 to the left-hand end of resistance 53. Consequently, as the slider 52 begins to move to the right across resistance 53, a portion of the resistance 53 is inserted into the circuit between terminals R and B. It should be noted at this time that the right-hand end of resistance 53 is connected through the contact strip 54, wire 96, wire 94, and rheostat 95 to terminal W of the motor 6. Therefore, as the slider 52 traverses resistance 53 to the right, it decreases the portion of the resistance 53 which is connected between terminals R and W of the motor 6. Thus as the temperature of the discharge air decreases, the controller 34 acts to increase the portion of the resistance 53 which is connected between terminals R and B of the motor, while at the same time decreasing the portion of this resistance which is connected to terminals R and W. This action will cause operation of the motor 6 for closing the damper 5 an amount proportionate to the travel of slider 52 on resistance 53. When the discharge air temperature falls to 65° F., the slider 52 will engage the right-hand end of resistance 53 which will thus insert the entire resistance 53 between terminals R and B of the motor, and remove this resistance entirely from the circuit between terminals R and W. This substantial short circuiting of terminals R and W will cause the motor 6 to move the fresh air damper 5 to its minimum position as determined by the setting of the rheostat 95. It should, therefore, be apparent that the control system so far described will cause the fresh air damper to be wide open when the outside temperature falls to 65° F. unless the opening movement of the damper is limited by the return air thermostat 33 due to falling of return air temperature, or unless the opening movement of the damper is limited by the thermostat 34 due to falling in discharge temperature below a predetermined value.

As the outside temperature begins rising above 65° F., the thermostat 66 will cause its mercury switch 80 to close. Also at this time, the slider 71 of the outside thermostat 65 will begin traversing the resistance 72 to the left. Assuming now that the space temperature is still above 75° F., slider 71 is directly connected to terminal R of the motor 6 as follows: terminal R, wire 85, slider 42, wire 86, slider 74, contact strip 76, and wire 87 to slider 71. The right-hand end of the resistance 72 it should be noted is connected by wires 88 and 90 to the slider 52 of the discharge thermostat 34. Thus as the slider 71 of controller 65 moves to the left across resistance 72, it inserts a portion of this resistance in series with the slider 52 of the discharge thermostat. Due to this insertion of resistance 72 in series with the slider 52, the effect of slider 52 on motor 6 is diminished. At this time, it should be noted the left-hand end of the resistance 72 is connected through contact strip 73, wire 97, mercury switch 81 of humidity controller 67, and wire 98 to terminal B of motor 6. Due to the slider 71 being directly connected to terminal R of the motor at this time, the movement of the slider 71 to the left across resistance 72 will decrease the portion of resistance 72 which is connected between terminals R and B. Thus when the outdoor temperature rises to 70° F., the slider 71 will engage the left-hand end of resistance 72 which will short-circuit terminals R and B of the motor. This will cause the motor 6 to run to a position for completely opening the damper 5. At this time, the entire resistance 72 will be connected into the circuit from slider 71 of controller 65 to the slider 52 of controller 34. Due to this resistance being thereby placed in series with the slider 52 of controller 34, the controller 34 is rendered substantially in-

effective to close the fresh air damper even though the discharge temperature falls below the 70° F. setting of this controller. It will therefore be seen that when the outside temperature is below 65° F., the thermostat **65** due to arm **71** engaging the right-hand end of resistance **72**, places the discharge thermostat **34** into control of the fresh air damper. This discharge duct thermostat at this time will cause the fresh air damper to be opened wide if the discharge temperature is above 70° F., while graduatingly closing this damper as the discharge temperature falls to 65° F. However, as the outside temperature rises above 65° F., the discharge controller **34** is gradually made ineffective to close the damper, and when the outside temperature rises to 70° F., the thermostat **34** will have but very slight effect upon the damper position. The discharge thermostat **34** may, therefore, be considered as being placed out of operation by the thermostat **65** as the outside temperature increases above 65° F. This placing of the discharge thermostat out of operation at this time is desirable, for when the outside temperature rises to this value, there is likely to be a cooling load within the space which causes operation of the cooling coil **9**. In other words, when the outdoor temperature is at 70° F., it may be necessary to reduce the discharge air temperature below the setting of thermostat **34** in order to maintain the desired space temperature. Also when the outdoor temperature is at 70° F. it is useful for cooling the space and consequently the fact that the discharge temperature is below 65° F. should not cause closing of the fresh air damper. The automatic operation of the thermostat **65** in placing the discharge controller **34** out of operation when the outside temperature rises to 70° F. therefore permits the use of cool outdoor air for cooling the space at this time.

As the outdoor temperature varies between the limits of 70° F. and 75° F., the sliders **71** and **74** contact the contact strips **73** and **76** and consequently there is no change in motor position caused by variation in outdoor temperature between these limits. In the event that the relative humidity of the outdoor air becomes excessive, it is desirable to reduce the fresh air supplied to a minimum even though its temperature may be at a proper value. If the relative humidity becomes excessive, that is, if it rises above 60%, for example, the mercury switch **81** of the humidity controller **67** will be tilted for closing the left-hand electrodes thereof. This will establish a substantial short circuit between terminals R and W of the motor as follows: terminal R, wire **85**, slider **42**, wire **86**, slider **74**, contact strip **76**, wire **87**, slider **71**, contact strip **73**, wire **97**, mercury switch **81**, wire **99**, wire **100**, mercury switch **80**, wire **101**, and rheostat **95** to terminal W. Due to the breaking of the right-hand electrodes of the mercury switch **81** at this time, the short circuit previously established between terminals R and B will be broken. Thus when mercury switch **81** tilts from the position shown to its other position, it removes the short circuit from between terminals R and B and substantially short-circuits terminals R and W. This will cause the motor **6** to run to the minimum open position for fresh air damper **5** as determined by the setting of the rheostat **95**.

From the description thus far, assuming the return air temperature is above 75° F., it will be apparent that when the fresh air temperature is between 70° F. and 75° F., and the relative humidity of the fresh air is below 60%, the fresh air damper **5** will be wide open as shown and this will occur irrespective of the temperature of the discharge air. However, if the relative humidity of the fresh air becomes excessive when the fresh air temperature is between the limits of 70° F. and 75° F., the humidity controller **67** will cause the damper to move from its wide open position to its minimum position. This action provides for operating economy of the system for it thereby reduces the dehumidifying load upon the system. However, it should be noted that when the outside temperature is relatively cool, it will be more economical to use this air even though it may be high in relative humidity. In accordance with my invention I provide for preventing the humidity controller **67** from closing the fresh air damper to its minimum position whenever the temperature of the fresh air is below 65° F. When the fresh air temperature is below 65° F., it should be noted that the mercury switch **80** of the thermostat **66** is open. The short circuit through the humidity controller switch **81** for closing the fresh air damper, it will be remembered passes through the mercury switch **80**. Consequently, when the switch **80** is open, the humidity controller **67** cannot short-circuit terminals R and W of the motor for closing the damper to its minimum position. Also when the fresh air temperature is below 65° F., the slider **71** of the controller **65** is engaging the right-hand end of resistance **72**. It will be remembered that the short circuit between terminals R and B caused by closure of the left-hand electrodes of the humidity controller switch **81** also passed from the slider **71** of controller **65** to the contact strip **73**. Thus due to the slider **71** now engaging the right-hand end of resistance **72**, the entire resistance **72** is now interposed into this circuit. This, therefore, provides an additional means for placing the humidity controller **67** out of operation whenever the outside temperature falls to 65° F. The potentiometer controller formed of slider **71** and resistance **72** of the controller **65**, therefore in addition to varying the damper position in accordance with changes in outdoor temperature, has two other functions, one function being to place the high limit humidity controller **67** out of operation when the outdoor temperature falls to 65° F. and the other function being the placing of the discharge duct thermostat **34** out of operation when the outside temperature is above 70° F. It should also be apparent that when the outdoor temperature is between 70° and 75° F., the damper will be open unless the humidity of the fresh air becomes excessive, or unless the space temperature falls too low, at which time the damper will be moved to its minimum position.

If the outside temperature rises above 75° F., the slider **74** will begin traversing the resistance **75**. The slider **74**, it will be remembered, is at this time directly connected to terminal R of the motor through wire **85**, slider **42**, and wire **86**. The left-hand end of resistance **75**, it should be noted, is connected to terminal W of the motor at this time by wire **102**, wire **100**, mercury switch **80**, wire **101**, and rheostat **95**. Therefore, when the slider **75** engages the contact strip **76** the entire resistance **75** is connected between terminals R and W of the motor. As the outside temperature increases above 75° F., however, the resulting movement of slider **74** on resistance **75** will decrease the portion of this resistance which is

connected between terminals R and W. At the same time, a portion of the resistance 75 will be inserted into the circuit previously traced between terminals R and B. Consequently, as the slider 74 moves across resistance 75 to the left, the damper motor 6 will move a corresponding amount in a direction for closing the damper. This closing of the fresh air damper as the outside temperature rises above 75° F. decreases the fresh air supply and consequently provides for economical operation of the system as the cooling load increases. In other words, the control arrangement just described utilizes the benefits of fresh air for cooling and ventilating when the fresh air is suitable for this purpose and restricts the flow of fresh air into the space when its temperature becomes excessive.

While the thermostat 66 functions to prevent the humidity controller 67 from closing the fresh air damper, another purpose of this thermostat is to balance out the control system during both summer and winter operation in a manner to provide for equal minimum damper positions at both times. During the cooling cycle of the system when the outdoor temperature is above 80° F., and the relative humidity is below 60%, the coil 75 of controller 65 will be connected between terminals R and B as follows: terminal R, wire 85, slider 42, wire 86, slider 74, resistance 75, contact strip 76, wire 87, slider 71, contact strip 73, wire 97, right-hand electrodes of mercury switch 81, and wire 98 to terminal B. Also at this time the resistance 53 of the controller 34 will be connected across terminals R and B as follows: terminal R, slider 42, wire 86, slider 74, wire 102, wire 100, mercury switch 65, wire 101, wire 94, wire 96, contact strip 54, resistance 53, wire 91, and wire 92 to terminal B. Therefore when the outdoor temperature is above 80° F., the damper will be moved to its minimum position and at this time the resistances 75 and 53 will be connected in parallel between terminals R and B.

During the heating cycle of the system, the fresh air damper will be closed to its minimum position by the return air thermostat 33. At this time, the slider 71 of the thermostat 65 will engage the right-hand end of resistance 72 due to the outside temperature being below 65° F. Also at this time, the slider 52 of thermostat 34 will engage the left-hand end of resistance 53 due to the discharge temperature being above 70° F., this being caused by the action of the heating coil 30. For this condition of the controllers, the resistance 53 will still be connected between terminals R and B of the motor, the circuit being now as follows: terminal R, wire 85, slider 42, contact strip 44, wire 93, wire 96, contact strip 54, resistance 53, wire 91, and wire 92 to terminal B. Also at this time the resistance 43 will be connected between terminals R and B as follows: terminal R, slider 42, contact strip 44, resistance 43, wire 86, slider 74, contact strip 76, wire 87, wire 88, switch 89, wire 90, slider 52, wire 91, and wire 92 to terminal B. In addition to the resistances 43 and 53 being connected across terminals R and B, the resistance 75 would also be connected across these terminals if the mercury switch 80 were closed, this circuit being as follows: terminal R, wire 85, slider 42, contact strip 44, wire 93, wire 94, wire 101, mercury switch 80, wire 100, wire 102, resistance 75, contact strip 76, wire 87, slider 71, wire 88, switch 89, wire 90, slider 52, wire 91, and wire 92 to terminal B. Therefore it will be seen that when the outdoor temperature is above 80° F., resistances 75 and 53 are connected in parallel between terminals R and B, while when the outside temperature is below 65° F., resistances 43 and 53 are connected in parallel across terminals R and B and the resistance 75 would also be connected across terminals R and B were it not for the presence of the thermostat 66. Therefore if it were not for thermostat 66, there would be three resistances connected between terminals R and B when the outdoor temperature is below 65° F., while there would only be two resistances connected across terminals R and B when the outdoor temperature is above 80° F. This variation in resistance would have the effect of providing a different minimum position of the damper for summer operation than occurs for winter operation. The controller 66 avoids this undesirable result by automatically breaking the circuit through resistance 75 during winter operation of the system, thus causing only two resistances to be connected between terminals R and B at all times. While the thermostat 80 is shown as cutting out the resistance 75, during winter operation it will be apparent that if desired, this thermostat could be arranged so as to cut in an additional resistance between terminals R and B during summer operation of the system.

Referring again to the action of the controls on the summer cycle, it should be noted that when the damper is closed to its minimum position due to the outside temperature being above 80° F. and when the relative humidity of the fresh air is below 60%, the resistance 72 will be placed into or out of the circuit between terminals R and B of the motor by the discharge thermostat 34. For instance, when the temperature of the discharge air is below 65° F., the slider 52 of the thermostat will engage the contact strip 54. This will place the resistance 72 across terminals R and B as follows: terminal R, wire 85, slider 42, wire 86, slider 74, wire 102, wire 100, mercury switch 80, wire 101, wire 94, wire 96, contact strip 54, slider 52, wire 90, switch 89, wire 88, resistance 72, contact strip 73, wire 97, right-hand electrodes of mercury switch 81, and wire 98 to terminal B. When the discharge air temperature rises to 70° F., however, the slider 52 will engage the left-hand end of resistance 53 and this will interpose the entire resistance 53 into the circuit just traced which will materially increase the resistance now connected across terminals R and B of the motor. Therefore, as the discharge temperature increases, the resistance between terminals R and B is increased, while when the discharge temperature decreases, the resistance between terminals R and B is decreased. Therefore, as the discharge temperature falls below 70° F., the minimum position of the damper 5 will vary, the damper being opened wider as the discharge temperature decreases. I have found that when the minimum position adjusting rheostat 95 is set so that the minimum position is less than 25% of wide open position, the effect of the thermostat 34 on the minimum position is not objectionable. However, when the minimum position for the damper is greater than 25% of wide open position, the effect of the thermostat 34 is undesirable and necessitates the use of an additional controller which will be described later.

Whenever the fresh air temperature is between 70° F. and 75° F. and the fresh air damper is moved to minimum position by the humidity controller 67 due to the relative humidity of the fresh air being above 60%, the discharge ther-

mostat 34 will have the effect of closing the damper further as the discharge temperature falls below 70° F. At this time, the damper will be caused to assume minimum position by a substantial short circuit between terminals R and W of the motor as follows: terminal R, wire 85, slider 42, wire 86, slider 74, contact strip 76, wire 87, slider 71, contact strip 73, wire 97, left-hand electrodes of mercury switch 81, wire 99, wire 100, mercury switch 80, and wire 101 to rheostat 95. Assuming now that the discharge temperature is at 70° F., the slider 52 of thermostat 34 will engage the left-hand end of resistance 53 and connect the resistance 72 between terminals R and B of the motor as follows: terminal R, wire 85, slider 42, wire 86, slider 74, contact strip 76, wire 87, slider 71, contact strip 73, resistance 72, switch 89, wire 90, slider 52, wire 91, and wire 92 to terminal B. Now as the discharge air temperature falls below 70° F., the slider 52 will traverse the resistance 53 to the right and thereby insert the resistance 53 into the circuit just traced out. This will decrease the current flow through the resistance 72 and consequently will decrease the current flow between terminals R and B of the motor, which will cause the motor to run to a position for closing the damper still further. This result, however, is not objectionable for when the outside temperature is between 70° F. and 75° F. and its humidity is above 60%, the decrease in temperature of the discharge air will be caused by operation of the cooling coil 9 by the humidity controller 17. In other words, the action of the discharge controller will be to reduce the minimum open position of the damper when the relative humidity is excessive, and when this excessive relative humidity of the fresh air causes operation of the cooling coil 9. This action tends to reduce the operating expenses of the system.

However, if this result is not desired or if it is necessary to have the minimum position for the damper more than 25% of the wide open position, it becomes desirable to eliminate the above described actions of the discharge controller 34 when the system is operating on the cooling cycle. For this purpose, an additional outside thermostat 110 may be employed. Thermostat 110 may include a bellows 111 connected by a capillary tube 112 to a control bulb 113 located in the fresh air duct 4. This bellows 111 may actuate a pivoted switch carrier 114 which carries a double pole type mercury switch 115. The thermostat 110 may be so designed and adjusted as to cause the right-hand electrodes of the mercury switch 115 to be made when the fresh air temperature is below 65° F. while causing the left-hand electrodes of this switch to be closed when the fresh air temperature is above 65° F. The left-hand electrode of the switch 55 may be connected by wire 116 to the wire 92 while the right-hand electrode of this switch may be connected by wire 117 to the wire 90. The common terminal of the mercury switch may be connected by wire 118 to the switch 89. If the switch 89 is moved to its opposite position, the thermostat 110 will be cut into the control circuit and will be interposed between the wire 88 and the wire 90 which leads to the slider 52 of the thermostat 34. When the outside temperature is below 65° F., a circuit will be completed from the resistance 72 through wire 88, switch 89, wire 118, right-hand electrodes of mercury switch 115, and wire 117 to the wire 90, this action causing the control circuit to act in exactly the same manner as previously described in detail. However, when the outdoor temperature increases above 65° F., the mercury switch 115 will be tilted so as to break the right-hand electrodes and make the left-hand electrodes. The breaking of the right-hand electrodes will interrupt the circuit between wire 88 and the slider 52 and consequently movement of the slider 52 upon the resistance 53 will have no effect whatsoever upon the control system. Due to making of the left-hand electrodes of the switch 115, a circuit will be completed directly from wire 88 through switch 89, wire 118 and wire 116 to the wire 92. This circuit, it should be noted, is in parallel with the previously described circuit which had been established from wire 88, switch 89, wire 118, right-hand electrodes of mercury switch 115, wire 117, wire 90, slider 52, and wire 91. The thermostat 110 therefore disconnects the slider 52 from the control circuit and establishes a new circuit which is equivalent of that established when the slider 52 engages the left-hand end of resistance 53, this action occurring when the system begins operating on the cooling cycle as indicated by the outdoor temperature rising above 65° F. The controller 110 may or may not be employed in the circuit depending upon the condition of the particular installation to which the control system is applied.

From the foregoing description, it should be apparent that I have provided an automatic fresh air damper control system for automatically varying the supply of fresh air to a conditioned space during both summer and winter, this system acting to provide a large volume of fresh air when outside temperature is between predetermined values while closing the fresh air damper to a minimum position if either the fresh air temperature or relative humidity should become excessive, and which also closes the damper to a minimum position whenever the temperature within the conditioned space falls to a predetermined value, or if the temperature of the air being discharged to the space falls too low during mild weather.

Summarizing the operation of the system, when the outdoor temperature is between 70° F. and 75°F., the damper will be wide open unless the space temperature falls below 75° F. or unless the relative humidity of the outside air is excessive. If the temperature within the space begins falling below 75° F., the return air controller 33 will cause the damper to be closed an amount proportionate to the amount that the space temperature is below 75° F., and will close the damper to its minimum position if the space temperature falls to 72° F. This arrangement positively provides against undercooling of the space by ventilation during intermediate seasons. If the relative humidity rises above 60° F., the humidity controller 67 will cause the damper to assume its minimum position. Also, when the outside air is between 70° F. and 75° F., the discharge controller 34 will be inoperative to close the damper, and consequently the cooling coil 9 may be placed into operation for providing additional cooling without reducing the supply of fresh air which also has a cooling action due to its temperature being lower than space temperature.

When the outside temperature rises above 75° F., the controller 65 will act to cause closing of the fresh air damper, and will cause this

damper to assume its minimum position when the outside temperature increases to 80° F. This provides for economical operation of the system during the cooling cycle. At this time, the discharge duct controller **34** will still be out of control, and consequently, as the outside temperature decreases below 80° F., the damper may be opened slightly for increasing the ventilation even though the temperature of the air being discharged to the space may be below 65° F.

As the outside temperature decreases below 70° F., the slider **71** will gradually close the damper if the temperature of the discharge air is below 70° F. If the temperature of the discharge air is above 70° F., however, the thermostat **34** will maintain the damper wide open irrespective of outdoor temperature, and will gradually close the fresh air damper to its minimum position as the discharge air temperature falls to 65° F. Also, as the outside air temperature falls below 70° F., the action of the humidity controller **67** is graduatingly restricted, due to traversing of resistance **72** by slider **71**, and this humidity controller is prevented from having any material closing effect on the damper when the outside temperature falls to 65° F. This provides for supplying large amounts of fresh air for cooling and ventilating the space when necessary, even when its humidity is high, provided that its temperature is relatively low. The controller **65**, it will be noted, in addition to varying the damper position under some conditions in accordance with outside temperature, also has the effect of placing the humidity controller out of operation when outdoor temperature is low, and of placing the discharge thermostat out of control of the damper when outside temperature is above 70° F., while placing the discharge controller into substantially complete control when the outside temperature is below 65° F.

It should also be noted that due to the staggered relationship of the potentiometers on the controllers **33** and **34**, the fresh air damper will always be closed to its minimum position before the steam valve begins to open. This, of course, provides for economical operation of the system.

While for purposes of illustration I have mentioned specific values of temperature and humidity at which the various controllers may be set, it is to be understood that I do not limit myself to these specific values, as these values will vary depending upon the particular conditions encountered in each installation. Furthermore, while I have shown and described a preferred form of my invention, it will be apparent that many modifications of the various novel combinations and subcombinations of my invention will occur to those skilled in the art. I, therefore, desire to be limited only by the scope of the appended claims and the prior art.

I claim as my invention:

1. In an air conditioning system, in combination, a conditioning chamber through which air is adapted to be passed for conditioning a space, return duct means for delivering air from said space to said conditioning chamber, fresh air duct means for delivering fresh air to said chamber, flow control means for varying the relative proportions of fresh and return air delivered to said chamber, means for discharging air from said conditioning chamber to said space, means influenced by a psychrometric condition of the fresh air for controlling said flow control means in a manner to decrease the amount of fresh air supplied to said chamber upon increase in the psychrometric condition of the fresh air to which it responds, and means influenced by the temperature of the air in said space and by the temperature of the air being discharged to said space for controlling said flow control means in a manner to reduce the supply of fresh air upon decrease in either the space temperature or the discharged air temperature.

2. In an air conditioning system, in combination, means for supplying outside air to a space to be conditioned, flow control means for varying the flow of outside air to said space, outside temperature influenced means for controlling said flow control means to reduce the flow of outside air upon rise in the temperature to which said temperature responsive means responds, means responsive to the humidity of the outside air for additionally controlling said flow control means, said humidity responsive means being arranged to reduce the flow of outside air to a minimum when its humidity becomes excessive, and means influenced by the temperature of the outside air for preventing said humidity responsive means from reducing the flow of outside air when the outside air temperature is below a predetermined value.

3. In an air conditioning system, in combination, a conditioning chamber through which air is adapted to be passed for conditioning a space, return duct means for delivering air from said space to said conditioning chamber, fresh air duct means for delivering fresh air to said chamber, flow control means for varying the relative proportions of fresh and return air delivered to said chamber, means for discharging air from said conditioning chamber to said space, means responsive to the temperature of the air discharged to said space for controlling said flow control means to reduce the supply of fresh air upon fall in discharge temperature, humidity responsive means influenced by the outside air cooperating with said discharge temperature responsive means in controlling said flow control means to reduce the supply of fresh air upon high relative humidity, and temperature responsive means influenced by the outside air for also controlling said flow control means to reduce the supply of fresh air if the temperature to which said last-named temperature responsive means responds rises above a predetermined value.

4. In an air conditioning system, in combination, a conditioning chamber through which air is adapted to be passed for conditioning a space, return duct means for delivering air from said space to said conditioning chamber, fresh air duct means for delivering fresh air to said chamber, flow control means for varying the relative proportions of fresh and return air delivered to said chamber, a first motor in control of said flow control means, heating means in said conditioning chamber, a second motor in control of said heating means, means for discharging air from said conditioning chamber to said space, means including a pair of control devices for sequentially controlling the flow control motor and the heating control motor in a manner first to reduce the flow of outside air and then to place the heating means in operation upon fall in space temperature, and means including a pair of controllers actuated in accordance with the temperature of said discharge air for sequentially actuating said flow control motor and the heating control motor first to reduce the flow of outside air and then to place said heating means in

operation when the discharge temperature falls below a predetermined value.

5. In an air conditioning system for conditioning a space, in combination, air conditioning apparatus including a conditioning chamber and duct means for connecting said conditioning chamber with said space, means for supplying fresh air to said chamber, means for supplying return air to said chamber, flow control means for varying the proportions of fresh and return air supplied, means responsive to the temperature of the air being discharged from said conditioning chamber for controlling said flow controlling means in a manner to reduce the supply of fresh air upon decrease in said discharge temperature, and means influenced by outside temperature for rendering said discharge temperature responsive means inoperative to cause reduction in fresh air supply when outside temperature rises above a predetermined value.

6. In a summer-winter air conditioning system, in combination, air conditioning apparatus including a conditioning chamber containing cooling means, discharge duct means for connecting said conditioning chamber with said space, means for supplying fresh air to said chamber, means for supplying return air to said chamber, flow control means for varying the proportions of fresh and return air supplied, means responsive to the temperature of the air being discharged from said conditioning chamber for controlling said flow control means in a manner to reduce the flow of fresh air upon decrease in discharge temperature, and means influenced by outside temperature for rendering said discharge temperature responsive means inoperative to reduce the supply of fresh air when outside temperature rises to a value indicating that operation of said cooling means may be desirable, to thereby prevent operation of said cooling means from causing said discharge temperature responsive means to reduce the supply of fresh air.

7. In a summer-winter air conditioning system, in combination, air conditioning apparatus including a conditioning chamber containing cooling means, discharge duct means for connecting said conditioning chamber with said space, means for supplying fresh air to said chamber, means for supplying return air to said chamber, flow control means for varying the proportions of fresh and return air supplied, means responsive to the temperature of the air being discharged from said conditioning chamber for controlling said flow control means in a manner to reduce the flow of fresh air upon decrease in discharge temperature, means influenced by outside temperature for rendering said discharge temperature responsive means inoperative to reduce the supply of fresh air when outside temperature rises to a value indicating that operation of said cooling means may be desirable, to thereby prevent operation of said cooling means from causing said discharge temperature responsive means to reduce the supply of fresh air, and means for reducing the supply of fresh air upon further rise in outside temperature.

8. In an air conditioning system, in combination, a conditioning chamber through which air is adapted to be passed for conditioning a space, return duct means for delivering air from said space to said conditioning chamber, fresh air duct means for delivering fresh air to said chamber, flow control means for varying the relative proportions of fresh and return air delivered to said chamber, means for discharging air from said conditioning chamber to said space, means influenced by the condition of the fresh air for controlling said flow control means in a manner to reduce the amount of fresh air supplied to said chamber upon fall in temperature of the fresh air and to increase the amount of air supplied to said chamber upon increase in the temperature of the fresh air, means influenced by the temperature of the air being discharged to said space for also controlling said flow control means, said discharge air temperature influenced means being arranged to actuate said flow control means in a manner to reduce the flow of fresh air into said chamber when the discharge air temperature falls to a predetermined value, and means influenced by the temperature in said space for also controlling said flow control means, said space temperature influenced means being arranged to reduce the flow of fresh air when the space temperature falls to a predetermined value.

9. In a system of the class described, in combination, a conditioning chamber, duct means for connecting said chamber with a space, heating means in said chamber, a first motor for controlling said heating means, means for supplying fresh air to said chamber, means for supplying return air to the chamber, flow control means for varying the proportions of the fresh and return air supplied, a second motor for controlling said flow control means, thermostatic means responsive to the demand for heat in said space for controlling said heating means, discharge thermostatic means responsive to the temperature of the air being discharged to said space for controlling said second motor in a manner to decrease the flow of fresh air and increase the flow of return air upon fall in air discharge temperature below a predetermined value which is lower than the temperature maintained in said space, and means for also controlling said second motor, said last mentioned means causing the supply of fresh air to be decreased to a predetermined minimum when said heating means is in operation, while placing said second motor under the control of said discharge thermostatic means when said heating means is out of operation.

10. In a system of the class described, in combination, a conditioning chamber, duct means for connecting said chamber with a space, heating means in said chamber, a first motor for controlling said heating means, means for supplying fresh air to said chamber, means for supplying return air to the chamber, flow control means for varying the proportions of the fresh and return air supplied, a second motor for controlling said flow control means, thermostatic means responsive to the demand for heat in said space for controlling said heating means, discharge thermostatic means responsive to the temperature of the air being discharged to said space for controlling said first motor conjointly with said first thermostatic means and for controlling said second motor in a manner to prevent the temperature of the discharge air from falling below a predetermined value, and means for causing said second motor to reduce the supply of fresh air to a minimum when the heating means is in operation while placing said second motor under the control of said discharge thermostatic means when the heating means is out of operation.

11. In a system of the class described, in combination, a conditioning chamber, duct means

for connecting said chamber with a space, heating means in said chamber, a first motor for controlling said heating means, means for supplying fresh air to said chamber, means for supplying return air to the chamber, flow control means for varying the proportions of the fresh and return air supplied, a second motor for controlling said flow control means, thermostatic means responsive to the demand for heat in said space for controlling said heating means, a first control device actuated in accordance with the temperature of the air being discharged from the conditioning chamber to the space, said first control device controlling said first motor conjointly with said thermostatic means in a manner to prevent the discharge temperature from falling below a predetermined value, a second control device actuated in accordance with the temperature of the discharge air for controlling said second motor in a manner to decrease the supply of fresh air and to increase the supply of return air upon fall in discharge temperature below a predetermined value, and means for causing said second motor to reduce the supply of fresh air to a minimum when the heating means is in operation while placing said second motor under the control of said second control device when the heating means is out of operation.

12. In a summer-winter air conditioning system, in combination, a conditioning chamber, discharge duct means connected to said chamber for delivering air to a conditioned space, means for supplying fresh and return air to said conditioning chamber, flow control means for controlling the proportions of fresh and return air supplied to said chamber, a motor for controlling said flow control means, discharge thermostatic means responsive to the temperature of the air discharged to said space for controlling said motor, heating and cooling means in said chamber for heating or cooling the air being supplied to said space, and means normally operative to control said motor conjointly with said discharge thermostatic means in a manner normally to place said discharge thermostatic means in control of said motor only when the heating and cooling means is out of operation.

13. In a summer-winter air conditioning system, in combination, a conditioning chamber, discharge duct means connected to said chamber for delivering air to a conditioned space, means for supplying fresh and return air to said conditioning chamber, flow control means for controlling the proportions of fresh and return air supplied to said chamber, a motor for controlling said flow control means, discharge thermostatic means responsive to the temperature of the air discharged to said space for controlling said motor in a manner to decrease the flow of fresh air upon fall in discharge air temperature below a predetermined value, conditioning means in said chamber for heating or cooling the air, control means for said motor and normally operative when said conditioning means is placed in operation for heating the space to reduce the supply of fresh air to a predetermined minimum independently of said discharge thermostatic means, and control means normally operative when the conditioning means is placed in operation for cooling the space to render said discharge thermostatic means incapable of reducing the supply of fresh air upon fall in discharge temperature below said predetermined value.

14. In a summer-winter air conditioning system, in combination, a conditioning chamber, discharge duct means connected to said chamber for delivering air to a conditioned space, means for supplying fresh and return air to said conditioning chamber, flow control means for controlling the proportions of fresh and return air supplied to said chamber, a motor for controlling said flow control means, discharge thermostatic means responsive to the temperature of the air discharge to said space for controlling said motor in a manner to decrease the flow of fresh air upon fall in discharge air temperature below a predetermined value, conditioning means in said chamber for heating or cooling the air, control means for said motor and normally operative when said conditioning means is placed in operation for heating the space to reduce the supply of fresh air to a predetermined minimum independently of said discharge thermostatic means, control means normally operative when the conditioning means is placed in operation for cooling the space to render said discharge thermostatic means incapable of reducing the supply of fresh air upon fall in discharge temperature below said predetermined value, and means influenced by the temperature of the fresh air for reducing the supply of fresh air to a predetermined minimum when the temperature of the fresh air rises to a value higher than maintained in said space.

15. In a summer-winter air conditioning system, in combination, a conditioning chamber, discharge duct means connected to said chamber for delivering air to a conditioned space, means for supplying fresh and return air to said conditioning chamber, flow control means for controlling the proportions of fresh and return air supplied to said chamber, a motor for controlling said flow control means, discharge thermostatic means responsive to the temperature of the air discharged to said space for controlling said motor for reducing the supply of fresh air upon fall in the temperature of the discharged air, conditioning means in said chamber for heating or cooling the air delivered to said space, thermostatic means responsive to the temperature of said space for placing said conditioning means in operation to cool the space upon rise in space temperature above a predetermined high value and for placing said conditioning means in operation to heat the space upon fall in space temperature to a predetermined lower value, and means for controlling said motor conjointly with said discharge thermostatic means in a manner to reduce the flow of fresh air to a minimum when said heating means is placed into operation, while placing said motor under the control of said discharge thermostatic means when said heating means is out of operation.

16. In an air conditioning system, in combination, means for supplying fresh air to a space, flow control means for varying the flow of fresh air to the space, a motor for adjusting said flow control means, said motor having a control line, a first two position type controller connected into said control line, said controller having a first position which causes the motor to reduce the supply of fresh air to a minimum and a second position which permits the motor to increase the supply of fresh air, humidity responsive means influenced by humidity of the fresh air for actuating said first controller to its second position when the humidity is below a predetermined fixed value while actuating said first controller to

its first position for reducing the supply of fresh air when the humidity rises above said value, a second two position type controller connected into said control line, said second controller having a first position which renders said first controller effective in its first position and a second position which renders the first position of said first controller ineffective, and means responsive to the temperature of the fresh air for placing said second controller in its second position when the temperature of the fresh air falls below a predetermined fixed value.

17. In an air conditioning system, in combination, means for supplying fresh air to a space, flow control means for varying the flow of fresh air to the space, a motor for adjusting said flow control means, said motor having a control line, a first two position type controller connected into said control line, said controller having a first position which causes the motor to reduce the supply of fresh air to a minimum and a second position which permits the motor to increase the supply of fresh air, a second two position type controller connected into said control line, said second controller having a first position which renders said first controller effective in its first position and a second position which renders the first position of said first controller ineffective, humidity responsive means influenced by the humidity of the fresh air, temperature responsive means influenced by the temperature of the fresh air, one of said responsive means actuating said first controller to its first position upon rise in the condition to which it responds and the other of said responsive means actuating said second controller to its first position upon fall in the condition to which it responds.

18. In an air conditioning system, in combination, means for supplying outside air to a space to be conditioned, flow control means for varying the flow of outside air to said space, a motor for adjusting said flow control means, said motor having a control line, a space thermostat responsive to space temperature connected into said control line, said space thermostat causing said motor to graduatingly adjust said flow control means to reduce the supply of outside air as the space temperature falls, means responsive to humidity and influenced by the humidity of the outside air connected into said control line in a manner to cause said motor to adjust said flow controller for minimum supply of outside air independently of said space thermostat upon rise in humidity above a predetermined value, and a thermostat responsive to the temperature of the outside air for rendering said humidity responsive means ineffective when the temperature of the outside air is below a predetermined fixed value.

19. In an air conditioning system for a space in combination, a conditioning chamber, means for passing air through said chamber and discharging it into said space, means for supplying fresh air to said chamber, flow control means for controlling the flow of fresh air, a condition changer for changing the condition of the air as it flows through said chamber, control means for controlling said condition changer in a manner to maintain a desired condition of the air in said space, discharge condition responsive means responsive to the condition of the air discharged to said space, and means for placing said discharge condition responsive means into control of said flow control means when the condition changer is out of operation while placing said discharge condition responsive means out of control of said flow control means when the condition changer is in operation.

20. In an air conditioning system for a space in combination, a conditioning chamber, means for passing air through said chamber and discharging it into said space, means for supplying fresh air to said chamber, flow control means for controlling the flow of fresh air, heating means in said chamber for heating the air, a space temperature responsive thermostat for controlling said heating means in a manner to maintain the space temperature at a predetermined value, a discharge thermostat responsive to the temperature of the air being discharged to said space, and means for controlling said flow control means in a manner to place said discharge thermostat in control of said flow control means when the space temperature rises above a predetermined value while placing said discharge thermostat out of control of said flow control means when the space temperature is below said last mentioned value.

21. In an air conditioning system for a space, in combination, a conditioning chamber, means for passing air through said chamber and discharging it into said space, means for supplying fresh air to said chamber, flow control means for controlling the flow of fresh air, heating means in said chamber for heating the air, a space temperature responsive thermostat for controlling said heating means in a manner to maintain the space temperature at a predetermined value, a discharge thermostat responsive to the temperature of the air being discharged to said space, and means for controlling said flow control means in a manner to maintain a minimum supply of fresh air when the space temperature is below a predetermined value while placing said discharge thermostat in control of said flow control means when the space temperature is above said last mentioned value.

JAMES S. LOCKE.