

Sept. 5, 1933.

W. SHURTLEFF

1,925,822

METHOD OF HEATING AND VENTILATING

Filed May 8, 1931

3 Sheets-Sheet 1

Fig. 1.

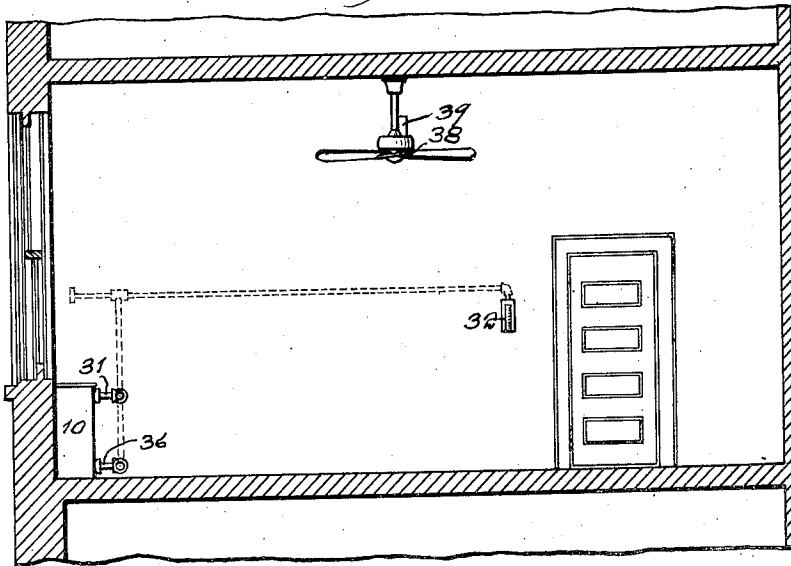
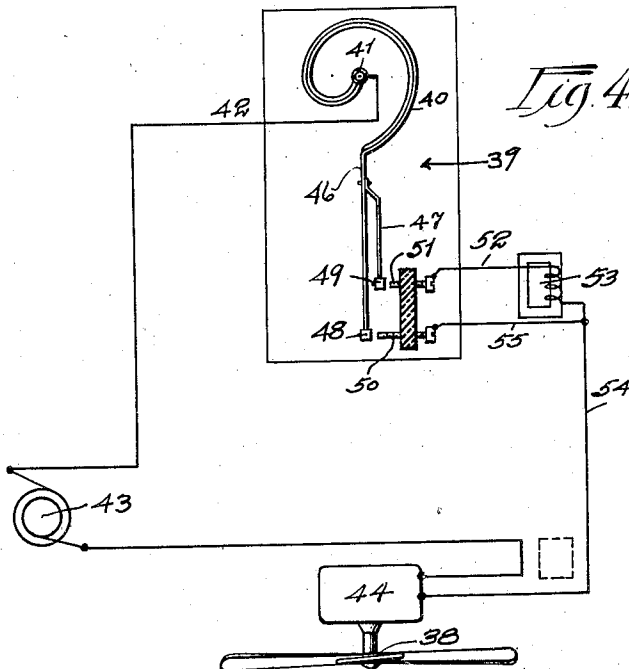


Fig. 4.



Inventor:
Wilfred Shurtleff,
By George I. Naught
Attorney

Sept. 5, 1933.

W. SHURTLEFF

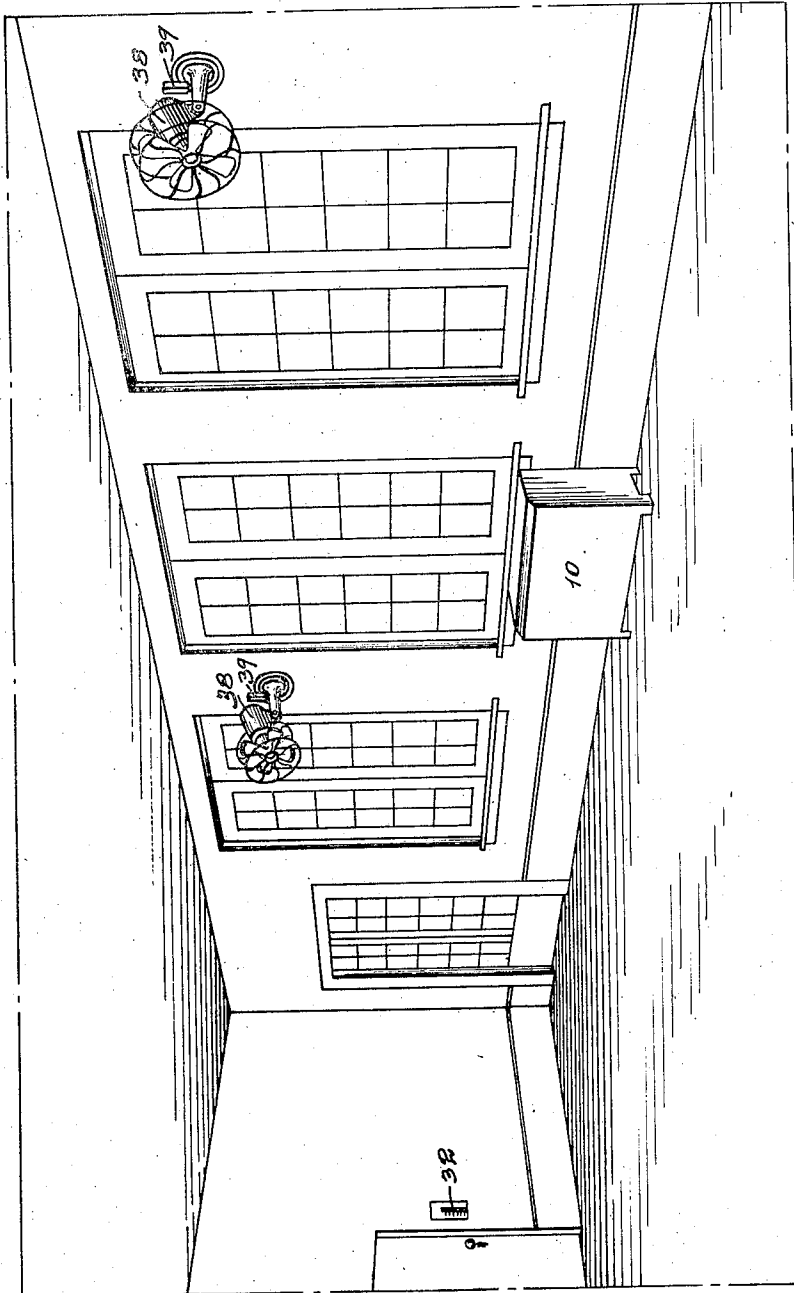
1,925,822

METHOD OF HEATING AND VENTILATING

Filed May 8, 1931

3 Sheets-Sheet 2

Fig. 2.



Inventor:
Wilfred Shurtleff,
By George Waight.
Attorney

Sept. 5, 1933.

W. SHURTLEFF

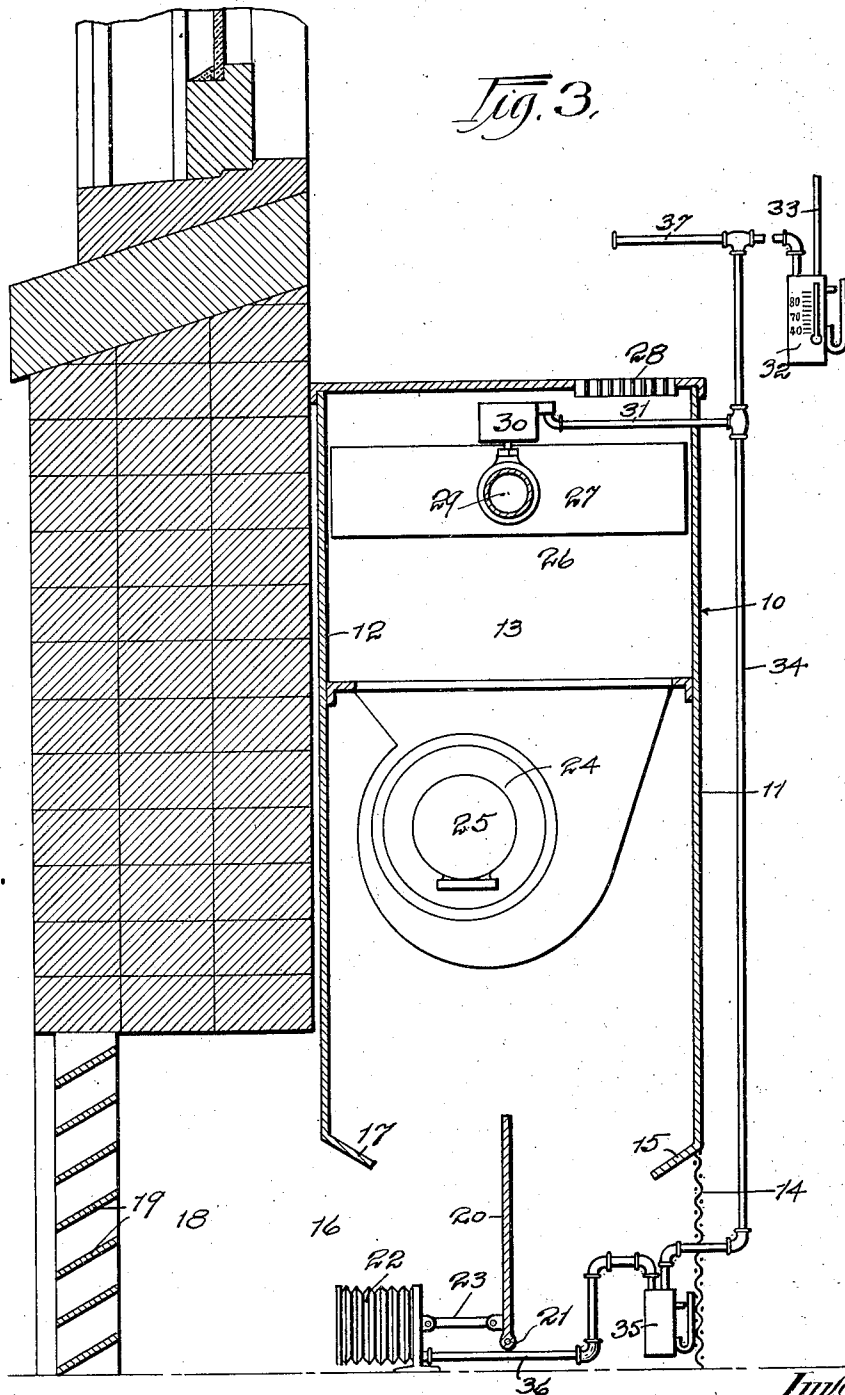
1,925,822

METHOD OF HEATING AND VENTILATING

Filed May 8, 1931

3 Sheets-Sheet 3

Fig. 3.



Inventor:
Wilfred Shurtleff,
By George J. Naight.
Attorney.

UNITED STATES PATENT OFFICE

1,925,822

METHOD OF HEATING AND VENTILATING

Wilfred Shurtleff, Moline, Ill., assignor to The
Herman Nelson Corporation, Moline, Ill., a cor-
poration of Illinois

Application May 8, 1931. Serial No. 535,834

4 Claims. (Cl. 237—12)

This invention relates to method and apparatus for heating and ventilating.

The present method relates to a method of heating and ventilating which has for its object to promote the maintenance of comfortable conditions within a room by so controlling the heat and recirculating indoor air and admission of outdoor air with maintenance of proper circulatory conditions within the room, that comfortable conditions will be maintained in so far as possible at all times.

The present system makes provision for thermostatic control of the heating appliances employed, in conjunction with thermostatic control of the indoor and outdoor inlets, so that the heating unit will be utilized solely for the purpose of heating recirculated indoor air, and outdoor air will be admitted solely for its cooling or tempering effect; and in addition to the proper control of the above mentioned factors, provision is also made for the automatically controlled down circulation of the room air, with the result that in cold weather, when the room air tends to stratify and the heated air to ascend to the ceiling, the positively controlled down circulation will tend to break up the stratification and utilize the heated air at the higher levels for the purpose of equalization and elevating the room temperature at the lower levels.

Furthermore, in warm or hot weather, the forced down circulation will be relied upon to disseminate the outdoor air admitted for cooling purposes, and at the same time to maintain a sufficient current flow of air, either at low speed or high speed, to best utilize the cooling effects of air in circulation to insure a quick removal of body heat and to equalize conditions in various parts of the room.

It is well known that moving air, especially where it is given a circulatory or vertical movement, greatly increases the comfort of occupants within a room in warm weather, by quickly disseminating the body heat and promoting evaporation from the body, with its consequent cooling effect. In the case of air at a mild or warm temperature, a moderate or even rapid circulation will promote comfort without danger of deleterious effects, where the air temperature is such as to merely remove the excess body heat without chilling, while "drafts" are caused by the chilling effects of rapidly moving air cold enough to remove an undue amount of body heat, particularly where it is directed upon a

portion only of the body with a resulting disturbance in distribution of body heat.

The system of the present invention makes provision for the automatic starting of the overhead fan or fans only when the circulating temperature has risen to a degree which will permit the safe down circulation of the air with adequate control to increase the speed of the fans as the temperature increases, so that the cooling effect of the rapidly moving air will be provided for only in cases where rise in temperature indicates the desirability of a quick removal of excess body heat in order to maintain comfortable living conditions within the room.

The present invention is designed primarily for use in school rooms or places of assembly for large numbers of people where the amount of body heat given off is considerable and tends to quickly overheat the room, and where it is highly desirable to maintain an equalized circulation of air to all portions of the room, although the invention is thoroughly adapted for use in homes or in single rooms.

The system consists essentially in the provision of a heating and ventilating unit with suitable thermostatic controls located at or near the breathing line (approximately five feet from the floor), which regulate the heat supply and also regulate the opening and closing of the indoor and outdoor dampers.

The system also includes the provision of overhead fans suitably located, with thermostatic control for regulating the starting and stopping of the fan or fans and the speed thereof to conform to overhead temperature conditions, so that in cold weather the rising heated air, which is needed for heating purposes at or near the floor, will be downwardly directed, as a warm current, while in hot weather the overhead air admitted from out of doors will be downwardly directed to establish and maintain proper circulatory conditions at and below the breathing line, so that the body heat of the occupants will be rapidly disseminated and comfortable conditions maintained.

In order to better illustrate the features of the present invention, reference is made to the accompanying drawings, wherein,—

Figure 1 is a diagrammatic view of a typical school room, illustrating mechanism adapted to operate in conformity with the method constituting the present invention;

Fig. 2 is a perspective view of the interior of a school room, showing a modified arrangement of the fans;

Fig. 3 is a sectional elevation of a heating unit conformable to the requirements of the system of the present invention; and

Fig. 4 is a diagram showing the thermostatic element adapted to afford a two-speed control of the fan or fans.

In the present embodiment of means for effectuating the invention, which serves merely by way of illustration, a unit heater and ventilator 10 is provided, which is located immediately below the level of a window, which unit comprises a housing having a front wall 11, a rear wall 12, and end walls 13.

The interior arrangement of the heating and ventilating unit is modified in various ways to provide for the inlet of air either from the room or from an exterior source, and to provide for the heating and discharge of the air into the room.

In the present embodiment, the front wall of the housing is provided near its base with a recirculation air inlet 14 provided along its upper margin with an obliquely disposed inwardly extending flange 15. Exterior air is admitted through an exterior air inlet 16 having an oblique flange 17.

The air inlet 16 communicates with a fresh air duct 18 extending through the exterior wall of a building and guarded at its intake by louvers 19. Between the flanges 15 and 17 is located a flap valve 20 which is pivoted at its base 21 and actuated by means of a motor 22 which is connected with the flap valve by a link 23.

Air admitted to the interior of the housing, either from the room or from outdoors, or from both sources of supply, is drawn into a fan 24 operated by a motor 25 and discharged upwardly into a heating chamber 26, in which is located a light weight high efficiency radiator 27, preferably of non-ferrous highly conducting metal and having a large radiating surface in proportion to its volume, as is customary according to the present practice in the construction of heating and ventilating units of the character here in question. The air is ultimately discharged through an upwardly directed air discharge outlet 28.

A heating medium, usually steam, is supplied to the radiator through a supply pipe 29, which is controlled by a compressed air valve motor 30 which is actuated by compressed air admitted through a pipe 31 leading to what may be termed the upper thermostat 32 which controls the admission of pressure to the valve line 31.

The thermostat is connected with an air pressure main 33, and the line 31 has leading therefrom a branch line 34 which supplies compressed air to a thermostat 35 located in or near the recirculation air inlet located at or near the floor level. The thermostat 35 may be termed the lower thermostat and serves to control the supply of air pressure through the pipe line 36 to the damper motors 22.

If desired, the air line 31 controlled by the upper thermostat may be extended to provide a supply pipe 37 leading to the control valve of a direct radiator, where it is desired to employ direct radiation in conjunction with the heating and ventilating afforded by a unit of the character involved in the present invention.

The apparatus shown permits the room temperature to be controlled in various ways, depending upon the setting of the respective thermostats, so that a considerable range of adjustment is possible to adapt the mechanism to op-

erate most effectively under varying conditions.

The apparatus heretofore described relates to the provisions for heating and recirculating indoor air and admitting outdoor air, which may be modified in detail to a considerable extent without departing from the spirit of the invention. Although by regulating the air in the damper by a thermostat located near the floor level, a very accurate control may be maintained, the structure may be simplified by thermostatic controlling elements otherwise positioned and operated, or by a single thermostat located at or near the breathing line and operable throughout a range of temperatures to regulate the heat supply and the dampers in the proper sequential order, so that it will be understood that the present invention contemplates various installations which need not in all cases include the refinements involved in the installation just described.

In addition to the heating and ventilating unit, the system includes one or more elevated fans 38, which may be located either directly overhead as in Fig. 1, or at the sides of the room as in Fig. 2, or in any other way which is customary or convenient for the location of fans designed to maintain a down draft, particularly in warm weather.

Where side fans are employed, they will preferably be of the oscillating type in order to currently vary the direction of movement of the air from overhead, in a manner well understood in the art. Irrespective of the type of fan or fans chosen, or the point of location, it is desirable to provide a thermostatic control for each fan, which will be located at or near the elevation of the fan itself, so that it will be immediately responsive to thermal conditions at a high level, irrespective of conditions at the breathing line. For this purpose, as shown, each of the fans is provided with a thermostatic controlling element 39 which is secured to the frame of the fan itself, which is a convenient and satisfactory method of supporting the thermostatic element and locating it within the most desirable region.

A suitable form of thermostat is shown in Fig. 4, which is adapted to maintain either of two speeds, depending upon thermal conditions. The thermostat comprises a thermostatic convoluted bar 40 which is suitably supported at its end 41, to which is secured a circuit wire 42 leading through a current source 43 and thence to a fan motor 44 which operates the fan 38.

The motor is operable either at a slow speed or at a fast speed, and in order to provide for proper control of the motor, the thermostatic element is provided with a conductive stem 46 provided with a flexible spring conductor 47. The conductor 46 is provided with a contact 48, and the conductor 47 is provided with a contact 49, which contacts cooperate respectively with fixed contacts 50 and 51.

The contact 51 connects with a wire 52 which leads through an impedance 53 and thence to a current wire 54 leading to the motor. The contact 50 is connected by means of a branch wire 55 to the wire 54.

The fixed contacts are in the form of adjustable screws, so that the positions of the fixed contacts with respect to the movable contacts can be regulated to provide for whatever variation in temperature is desired between the slow speed and fast speed of the motor. As the temperature rises, the thermostat will expand and

ultimately bring the spring contact 47 against the fixed contact 51, establishing a current through the impedance which will start the fan and maintain it running at reduced speed.

5 Thereafter, a continued rise in temperature will flex the light spring contact 47 and bring the contact 48 into engagement with the fixed contact 50 which will establish a strong current flow past the impedance and thus increase the
10 speed of the motor, which is desirable at high temperatures.

As an example of a suitable arrangement, the contacts may be adjusted to start the motor at low speed, at 75° F., and speed up the motor
15 when the temperature rises to 80°, it being desirable in most cases to provide for a substantial increase of temperature before the motor speed is increased to the utmost.

In operation, the thermostatic control of the
20 fans will be independent of the thermostatic control of the heating and ventilating unit, so that whenever the temperature at the high fan level rises to a predetermined degree above the temperature desired for room comfort, and ir-
25 respective of whether or not the heating medium is turned on, the fan will start and at slow speed operate to diffuse the overheated air at the fan level and commingle the same with the under-heated air at the lower levels, so that
30 particularly in cold weather, the air at the breathing line will be quickly brought up to the desired temperature, as for instance 70° F. This will have the effect of shutting off or re-
35 stricting the admission of heating fluid to the radiator, or otherwise controlling the dissemination of heat, with a resultant saving in fuel. This tends to break up the stratification of air in cold weather and to utilize the air to heat
40 the room in the most desirable manner.

After the radiator or other heating device has been shut off, if the room temperature continues to rise, outdoor air in the required amount will be admitted for cooling purposes, and the overhead fan may continue to operate in
45 the dissemination of the admitted air and in the maintenance of a cooling air current, particularly in warm weather. If the temperature still continues to rise, the overhead fan or fans will be speeded up to add the cooling effect or
50 rapid air motion to the air admitted from out of doors.

The system of the present invention is designed to predetermine the volume of fresh air admitted and velocity of air motion that is safe and comfortable at three or more comparatively
55 widely spread steps in room temperatures, and to provide for the automatically regulated starting and stopping or speed change to maintain comfortable conditions for the occupants under widely varying room air conditions. In so
60 far as is practicable, the usual desirable room temperatures are maintained as long as possible, and when the room actually overheats, the overhead fan or fans are relied upon to maintain the
65 necessary air motion to carry away excess body heat and equalize the room conditions.

By regulating the thermostatic controls of the fans to operate at a considerable spread in tem-
70 peratures, it is possible to secure the beneficial effects of low fan speed at temperatures at which it would be unsafe to increase the fan to maximum speed, and to utilize the latter speed only when the temperature has risen suffi-
75 ciently to warrant the increase in air motion, without danger of draft effects.

Although for most purposes the thermostatic control at the breathing line may be set at 70°, and final acceleration at 80°, nevertheless, if for any reason the desired temperatures are
80 basically higher or lower, the steps may be higher or lower in proportion. For instance, at a desired temperature of 68°, the overhead fan may be started at 73° and accelerated at 78°. Similarly, if the desired temperature is 73°, the fan may be started at 78° and accelerated at
85 83°.

The system is one which is designed to in-
crease to a maximum the heating effect of the radiator in cold weather, and to utilize to a
90 maximum the cooling effects of vigorously circulated outdoor air in warm weather under proper thermostatic control to operate the various instrumentalities in response to thermal conditions in a region most conducive to ade-
95 quate control and harmonized functioning of the apparatus in such a way as to maintain comfortable room temperatures under all conditions.

I claim:

1. The method of heating and ventilating rooms, which consists in heating room air under
100 thermostatic control responsive to thermal conditions at or below the breathing line, and in thermostatically initiating the discharge of downwardly directed air currents when the tem-
105 perature above the breathing line rises to a predetermined degree in excess of the controlled temperature at the breathing line, and in ultimately increasing the speed of dissemination of said downwardly directed currents under said
110 last mentioned thermostatic control when the temperature at the high level reaches a predetermined maximum to break up stratification of air in cold weather and provide for the dis-
115 semination from above of cooling air currents in warm weather.

2. The method of heating and ventilating rooms, which consists in heating indoor air under
115 thermostatic control responsive to thermal conditions at or below the breathing line, and in thermostatically initiating the discharge of two velocities of downward directed air cur-
120 rents when the temperature above the breathing line rises to two predetermined widely spread temperatures above the controlled temperature at the breathing line, by a two contact thermostat,
125 making the first electric circuit to the fan motor through an impedance and a second circuit, short circuiting said impedance, on a further
130 rise in temperature to break up stratification of air in cold weather and provide for the dissemination from above of cooling air currents in warm weather.

3. The method of heating and ventilating rooms, which consists in recirculating and heat-
135 ing indoor air under thermostatic control responsive to temperatures at the breathing line until the temperature at said point of control rises to a degree desired for comfort and in
140 thereafter, upon further rise of temperature and under the same control, admitting outdoor air for cooling purposes and to maintain said pre-determined comfort temperature at the breath-
145 ing line, and, conformable to the maintenance of said desired breathing line temperature, in downwardly directing air currents from an elevated region above the breathing line under
150 thermostatic control responsive to temperature changes at such elevated region when the temperature of such region reaches a predetermined degree in excess of the comfort tempera-

ture at the breathing line to assist in elevating the breathing line temperature when below the degree desired for comfort by the downward discharge of warm air from above, and to secure the cooling effect of moving air currents from above when the breathing line temperature rises above the degree desired for comfort.

4. The method of heating and ventilating rooms, which consists in recirculating and heating indoor air under thermostatic control responsive to temperatures at the breathing line until the temperature at said point of control rises to a degree desired for comfort and in thereafter, upon further rise of temperature and under the same control, admitting outdoor air for cooling purposes and to maintain said predetermined comfort temperature at the breathing line, and, conformable to the maintenance of said desired breathing line tempera-

ture, in downwardly directing air currents from an elevated region above the breathing line under thermostatic control responsive to temperature changes at such elevated region when the temperature of such region reaches a predetermined degree in excess of the comfort temperature at the breathing line to assist in elevating the breathing line temperature when below the degree desired for comfort by the downward discharge of warm air from above, and to secure the cooling effect of moving air currents from above when the breathing line temperature rises above the degree desired for comfort, and in increasing the rapidity of discharge of downwardly directed air when the temperature at said elevation reaches a predetermined maximum degree.

WILFRED SHURTLEFF.

20	95
25	100
30	105
35	110
40	115
45	120
50	125
55	130
60	135
65	140
70	145
75	150