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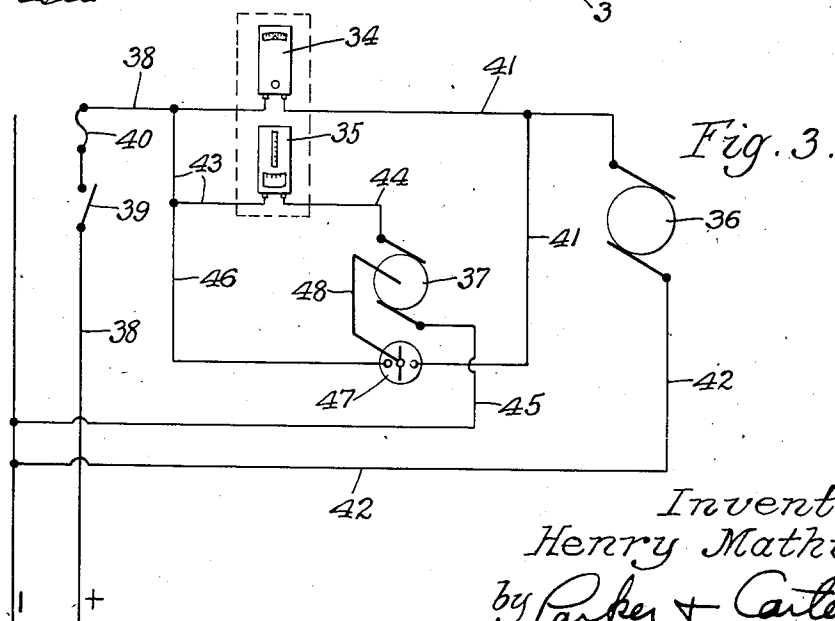
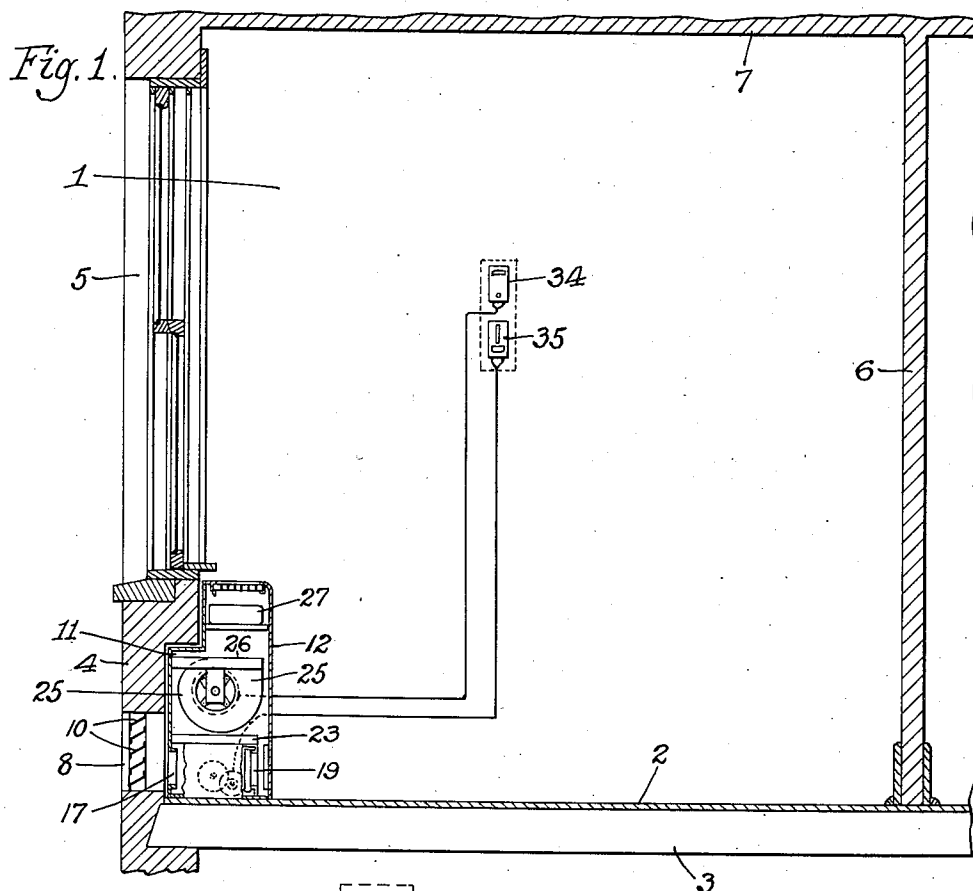
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MECHANICAL VENTILATION

Filed June 15, 1939

2 Sheets-Sheet 1



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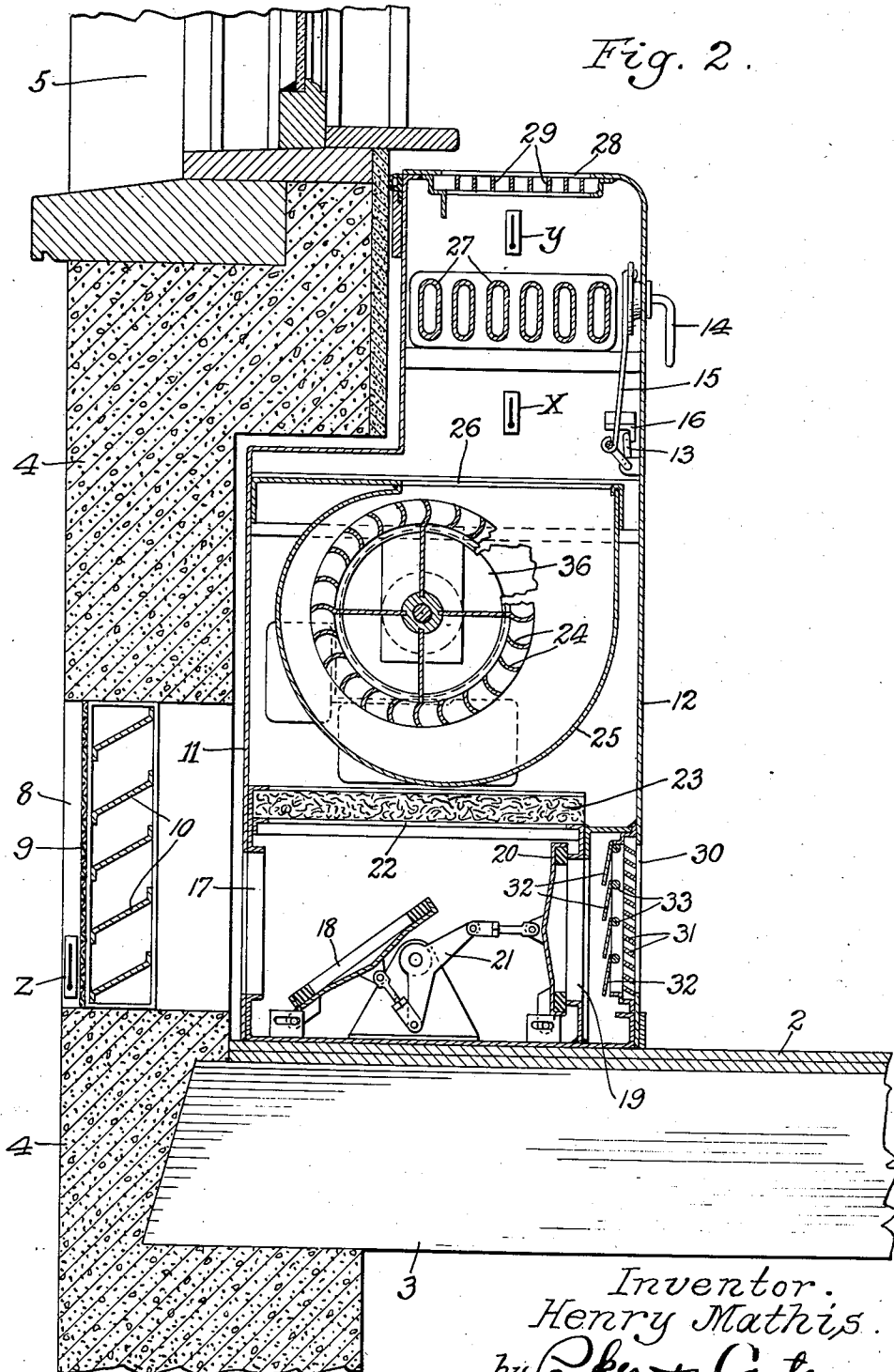
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UNITED STATES PATENT OFFICE

2,261,852

MECHANICAL VENTILATION

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Application June 15, 1939, Serial No. 279,281

1 Claim. (Cl. 236—44)

This invention relates to an apparatus for and process of mechanical ventilation. It has for one object to provide means for controlling the temperature in an enclosure such as a room in automatic response to variations and conditions within the room. Another object is to provide a method for regulating air conditions in an enclosed space such as a room in response to variations in the relative humidity within the closed space.

Other objects will appear from time to time throughout the specification and the claim.

The invention is illustrated more or less diagrammatically in the accompanying drawings, wherein:

Figure 1 is a vertical section through a room, showing one form of the apparatus installed;

Figure 2 is a vertical section on an enlarged scale showing further details of the apparatus;

Figure 3 is a schematic showing of the wiring for the apparatus disclosed.

Like parts are designated by like characters throughout the specification and the drawings.

1 is an enclosed space, here shown as a room, in which there is a floor 2 supported on a floor beam 3 which is at one end supported in an outer wall 4. This wall is pierced by a window 5. One or more partitions 6 and a ceiling 7 complete the room. The outer wall is pierced as at 8 to permit the entrance of air. A screen 9 may be positioned in this opening and a grill formed of members 10 may be positioned in the opening if desired. A unit ventilator apparatus is positioned in the room in communication with the opening 8. As shown, the apparatus includes a fixed housing portion 11 and a removable housing portion 12. The fixed housing portion is preferably made as a permanent part of the general assembly although it might, also, be removable and the removable portion 12 is preferably removable although it might be permanently fixed in place. Any suitable housing is within the contemplation of my invention. Where a removable closure such as that shown is used, a locking means 13 controlled by a handle 14 and a link 15 may be installed. The lock 13 engages an abutment 16 on some part of the housing or framework.

At its back or "wall side", the housing is pierced as at 17 to provide a path for the entrance of air from the outside through the opening 8. The opening 17 may be closed by a damper 18. The space into which the opening 17 leads communicates with a second or inward opening 19 which may, also, be closed by a

damper 20. The two dampers are joined together by a pivoted lever system 21 so arranged and proportioned that the two dampers move simultaneously. Either may be fully closed while the other is fully open or both may be equally or unequally partially open. Both cannot be simultaneously closed. The space into which the openings 17 and 19 lead has a third opening 22 through which air may move upwardly. A filter 23 of any suitable nature is positioned in this opening so that all air passing through the opening 21 is filtered.

One or more fans 24 may be positioned within the housing. Each fan is so arranged as to draw air into its casing 25 and discharge it through the opening 26. Positioned above the fans is a heating device 27 which may be a coil or any other suitable heating means. The air passing through it is finally discharged from the casing through an opening 28 in which a grill 29 may be positioned if desired.

The casing portion 12 is provided with an opening 30 in which a grill 31 may be positioned if desired. The members which form the grill may be inclined, as shown, or may have any other position. Slats or damper members 32 are pivoted as at 33 and arranged to control the passage of air through the opening 30. They normally hang downwardly by gravity. Air may enter the casing from the room and the back draft damper members 32 will not interfere with its movement in that direction. Should an excessive draft of air in the opposite direction occur, the damper members 32 will be forced in the closing direction so that they partially or fully close the opening 30 and prevent the passage of air through this opening from the casing into the room.

Suitable motor means are provided to operate the blower or fan and to operate the dampers 18 and 20, and suitable means are provided for controlling the operation of these motor means. As shown in Figures 1 and 3, a thermostat 34 and a humidistat 35 are used. They will ordinarily be opened in the room or enclosed space to be subject to conditions in the room. They may, as indicated in dotted lines, be mounted in a single housing or upon a single base where they may be separately mounted. In some installations and for some purposes it is desirable to have other thermostats or to have a single thermostat but to have its location changed from that shown in Figure 1. Thus, in Figure 2, a thermostat is indicated as at X in the space after the fans and before the heating means.

Such a thermostat would, of course, be affected by the temperature of the air before the latter reaches the heating means and would be considered "an air stream thermostat". Similarly, "an air stream thermostat" might be mounted in the housing at the position Y of Figure 2. There it would be affected by the temperature of the air stream after it passes the heating means. Also, for some purposes, it is desirable to mount a thermostat out-of-doors. Such a thermostat is indicated diagrammatically as at Z and would, of course, be affected by the out-door temperature.

As indicated in Figure 3, there are included in the system the thermostat 34 and the humidistat 35 and a blower motor 36 and damper motor or engine 37. These motors are not shown in detail since a wide variety of motors or engines might be used and the invention is not limited to any particular power medium, but may employ electric, pneumatic or any other systems, or a combination of two or more.

As shown in Figure 3, a wire or conductor 38 leads through a switch 39 and a fuse 40 to the thermostat. Thence, a wire 41 leads to the blower or fan motor 36 from which a wire 42 completes the circuit.

The humidistat is connected to the wire or conductor 38 by a wire 43, and a wire 44 leads from the humidistat to the damper motor 37 from which a wire 45 completes the circuit for that motor. The wire 46 is connected to the wire 43 and to the wire 41. An auxiliary switch 47 is inserted in this portion of the circuit and "makes or breaks" this circuit, depending upon the position of the dampers operated by the damper operating motor 37. The damper motor or engine 37 is connected to the auxiliary switch 47 so that movement of the motor or engine 37 correspondingly moved the switch. Thus, the motor 36 is controlled independently of the thermostat 34 by the humidistat 35 inasmuch as when the humidistat operates to energize the damper motor 37 the switch 47 is actuated to effect operation of the motor 36 irrespective of the position of the contacts of the thermostat 34. The exact details of the connection between the engine and the switch are not shown as many different arrangements may be used.

Although I have shown an operative form of my device, it will be understood that many changes in the form, shape and arrangement of parts might be made without departing from the spirit of my invention; and I wish that my showing be taken, as in a sense, diagrammatic.

The use and operation of this invention are as follows:

The apparatus substantially as shown operates to control ventilation of a class room or other enclosed space. When the room is empty, one set of conditions prevails and relatively little ventilation is needed and frequently none is needed. When the room is occupied by people, a different and a varying set of conditions prevails. The presence of the people in the room alters the ventilation need and the apparatus disclosed acts in response to conditions brought about by the presence of people in the room to accomplish suitable mechanical ventilation.

Presence of people within the room may alter the humidity in the room and will influence the dry-bulb temperature. The condition of the out-door air from time to time and from day to day will vary as to temperature and humidity and the ventilation requirements within the

room must take into account the condition of the out-door air because some of this air will be normally taken into the room while at some times no outside air will be taken in. At some times it is necessary to heat the air in the room and at others, it is not.

With the general conditions and requirements above mentioned in mind, it is possible to see that the following steps occur in the control of the mechanical ventilation of the present invention:

1. Heating of the air is stopped or started automatically in response to the temperature condition of the air within the room.

2. Mechanical ventilation is stopped or started or continued in response to the humidity condition of the air within the room.

3. Either heating or mechanical ventilation may be stopped, started or continued by stopping, starting or continuing the motion of the fan to move the air. With the heating element active and the fan stationary, obviously less heating occurs than with the fan in motion.

4. The expression "ventilating air" is considered in this discussion to be the air coming from the outside and the "heating air" is considered to be the room air which is recirculated.

5. Controlling means such as the dampers shown are provided for controlling the passage or opening through which ventilating air reaches the apparatus and, also, for controlling the passage or opening through which the recirculated room air reaches the fan.

6. When neither heating nor ventilating is occurring, the fan will ordinarily be stationary because no air need be positively circulated through the machine.

From the above, it is evident that the ventilation is regulated by the relative humidity within the room. The importance and economy of this is evident when it is considered that many rooms that must be mechanically ventilated, and, particularly, school rooms, are occupied only a small percentage of the day. By making the ventilation depend on the moisture content of the air within the room, needless ventilation is dispensed with and this is an economy, particularly since it avoids the needless introduction of heat into cold out-door air which might be needlessly drawn into the room while unoccupied. Therefore, in conjunction with the apparatus shown, it is economical and advantageous to adjust the damper which controls the entrance of out-door air by means of an apparatus or in response to an apparatus which is itself responsive to the moisture content of air within the room. As the number of persons within the room increases, the relative humidity within the room increases because of the moisture which is given off naturally by the persons in the room. As the humidity increases within the room, need for ventilation occurs because of the presence of persons and the apparatus operates to supply that need. As the number of people in the room decreases, the need for ventilation is decreased, the humidity within the room decreases and ventilation is decreased. Ventilation is unnecessary when the room is unoccupied. It may be said, therefore, that the relative humidity within the room, since it varies with the presence of people in the room, indicates definitely the ventilation need for that room and the relative humidity within the room is, thus, a safe and definite guide for ventilation needs and it is upon that guide that the operation of the present invention depends. The in-

vention insures optimum air conditions in a room at all times regardless of season, of outside weather conditions or of room occupancy and of windward or leeward or solar exposure location of the room.

In its operation, the unit ventilator, which is shown herewith, carries out effective mechanical ventilation, as above described, and in response to the variable conditions indicated. In the particular form shown, the unit ventilator comprises means for replenishing the air in the room by introducing added air from out-doors and, also, provides means for recirculating the air already within the room, and all of the air that passes through the unit ventilator may be heated or not in response to the conditions prevailing in the room at the time, since the heating means may be turned off or on.

The details of the controlling apparatus are not shown because such apparatuses are known in the art. Thus, thermostatic mechanisms and humidistatic mechanisms and motors for driving fans or for controlling and moving dampers are all known in the art, and connections between humidistats and thermostats and the motors which they control are known in the art and are accomplished by pneumatic systems or electric systems or otherwise. The invention herewith disclosed is not limited to any particular details of this sort. It is within the contemplation of the invention to use any such mechanisms. Preferably, the control devices are located in the room itself, as shown in Figure 1, where they are directly responsive to the "air result"; that is to say, responsive to the actual condition of the air within the room. Means for controlling the heat imparted to the air by the heating coil or other heating means may be of any desired type, and may include additional or auxiliary means for limiting or controlling, within desirable range, the temperature of the air recirculated, or delivered into the room, by use of a thermostat located in the air stream, either in the fresh air intake or in the path of the air discharged by the fan or blower before or after its passage through

its heating element; said thermostat operating upon a valve, of either quick-action or modulating type, which controls steam or other heating medium supplied to the heating element. Optional locations of such "limiting control" thermostats have been suggested in Figure 2, devices X, Y and Z.

The heat requirements of the room itself are not limited to the heat introduced by the unit ventilator but may also be served by supplementary heat-introducing means such as auxiliary or supplementing radiators, and the like.

The presence or absence of occupants in a room may not alter the temperature of the room and, hence, a ventilating system which operates in response only to temperature variations will not satisfy all conditions of need but occupants of a room will inevitably change its humidity and to accomplish ideal ventilation conditions, the controls must act in response to humidity variations. That is done in the present invention.

I claim:

In combination in a ventilating apparatus for ventilating a room, a unit ventilator including air moving means therein, an outlet means therefor to the room, air heating means therein, an air inlet passage between said unit ventilator and the exterior of the building adapted for the transmission of untreated outside air to the ventilator, an air inlet passage from the ventilator to the room to be treated, damper means adapted to control said passages, motor means for said damper means, a humidistat and a thermostat positioned within the room, an actuating connection from said thermostat to said air moving means whereby said thermostat operates to control the air moving means in response to temperature variations within the room, and an actuating connection between said humidistat and said damper motor means adapted to move said dampers to vary the supply of outside air in relation to the supply of recirculated inside air in proportion to the humidity variations within the room.

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