May 23, 1944. E. S. KEMMER ET AL 2,349,627

MULTIPLE VENTILATING SYSTEM

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FIG. 1

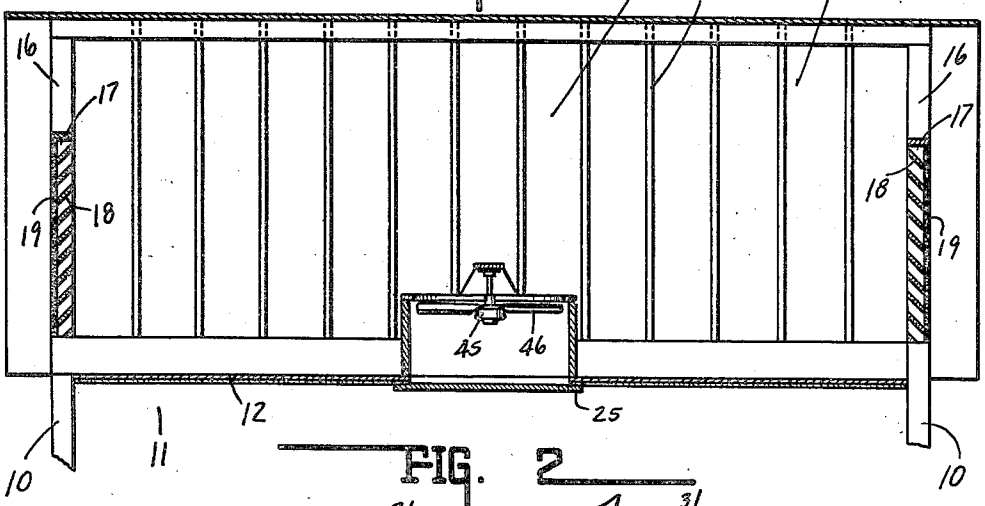


FIG. 2

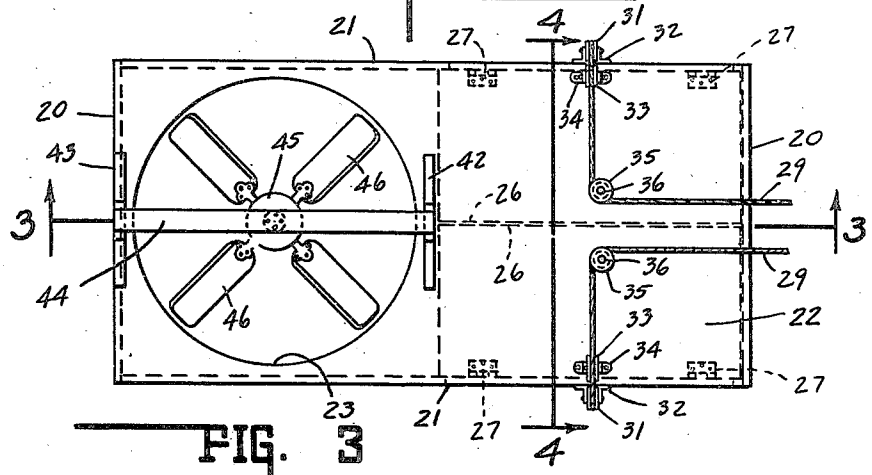
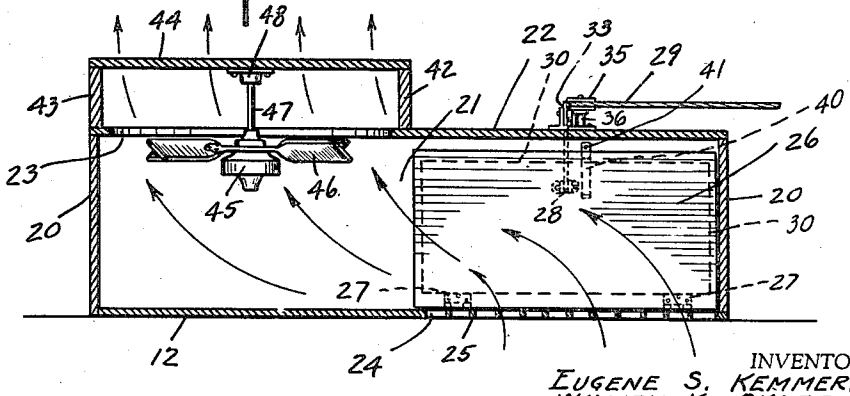


FIG. 3



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FIG. 4

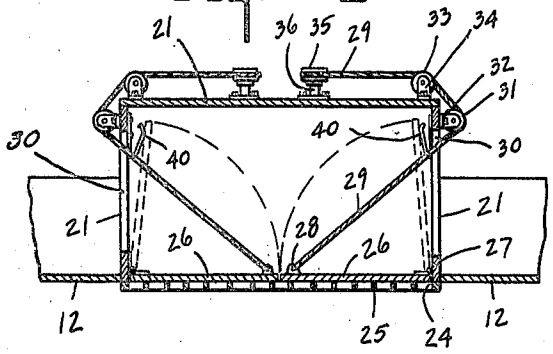
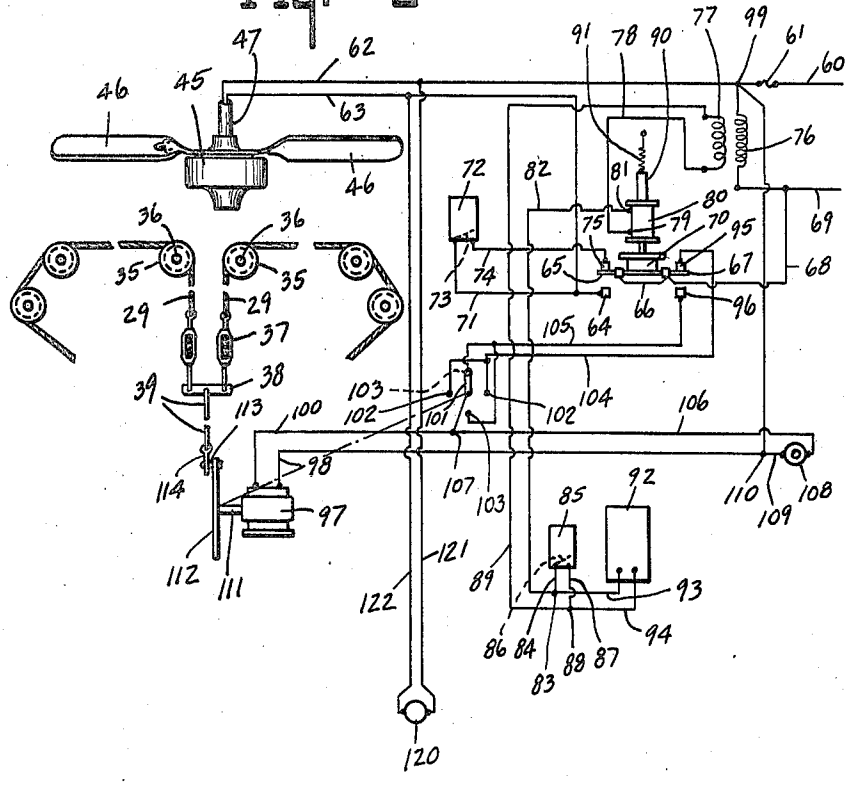


FIG. 5



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MULTIPLE VENTILATING SYSTEM

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Application November 17, 1939, Serial No. 304,896

12 Claims. (Cl. 98—43)

This invention relates to an air conditioning arrangement for building structures.

It is primarily intended to ventilate a dead air space, such as an attic arrangement when desired, and also when desired, to cool the floor or floors, below said attic.

The chief object of the invention is to provide a construction which is capable of ventilation in either manner, as desired, and which is automatically controlled so as to function in either manner when certain control conditions, as to time and temperature, for example, are attained.

Another object of the invention is to provide a single structural arrangement capable of functioning in either manner as above indicated.

The chief feature of the invention consists in the provision of a compartment having an outlet opening at one end and at one side and a plurality of closure controlled inlet openings offset therefrom and at the opposite end and one of which is upon what might be said to constitute an opposite side.

Another chief feature of the invention consists in the control arrangement whereby the aforesaid automatic selective action is obtained.

Other objects and features will be set forth more fully hereinafter.

The full nature of the invention will be understood from the accompanying drawings and the following description and claims:

In the drawings, Fig. 1 is a vertical sectional view through a conventional representation of an attic structure with a portion of the invention applied thereto, it being noted the lower central sectional portion of the apparatus shown in this figure is not a true vertical section, but is taken on a broken plane as will more fully hereinafter appear and which will be obvious from an examination of Fig. 3.

Fig. 2 is an enlarged top plan view of the major portion of the apparatus other than the controls.

Fig. 3 is a vertical sectional view taken on line 3—3 of Fig. 2 and in the direction of the arrows.

Fig. 4 is a transverse sectional view taken on line 4—4 of Fig. 2 and in the direction of the arrows, the full lines showing the closures or door structures in closed position and the dotted lines illustrating the same in the open position relative to the lower floor.

Fig. 5 is a diagram of wiring connection and control apparatus whereby the mechanical portions of the invention are automatically controlled as time and temperature requirements dictate.

In Fig. 1 of the drawings, 10 indicates the end walls of a building structure, a lower floor arrangement compartment being indicated by the numeral 11, and separated from the same by a combination floor and ceiling structure 12, is an attic arrangement 13 formed by the rafters 14 and roofing material 15. Opposite ends 16 of the attic include openings 17 and these openings are patrially closed by outwardly and downwardly inclined slots 18 in spaced relation for water and snow shedding purposes. The outer portion of this opening 17 is closed by one or more screen arrangements 19 which offers a material obstruction to the passage of water and snow unless the same be directly driven thereagainst, in which event the same will be trapped by the slats or louver arrangement 18 and shed downwardly and outwardly so that the interior of the attic is protected against these elements, yet the interior of the attic is ventilated since air passage through openings 17 is relatively unrestricted.

Preferably centrally between these openings 17, although not necessarily so positioned but positioned as reasonably close to a central point as possible, having due regard for the construction of the building, there is provided a well arrangement having two end walls 20 and two side walls 21 which may be said to be divided into two parts. A cover 22 closes the compartment or well arrangement thus formed with the floor 12. The cover at one end is provided with a circular aperture 23. The combined floor and ceiling 12 forming the bottom of this well or compartment, is apertured as at 24, this aperture being closed by a suitable grate or grillage 25 providing communication through the well or compartment between the attic and the floor therebelow.

A pair of doors 26 is arranged to normally seal the opening 24 resting, if desired, when closed, upon the grillage. The doors are hinged as at 27 and centrally thereof are provided with anchorages 28 to which are connected flexible elements, such as the relatively non-extensible cables 29.

This cable 29 passes through an opening or aperture 30 in the adjacent side wall 21. This opening 30—see Fig. 3—is normally closed by the adjacent door 26 when elevated. This cable 29 then passes over a pulley arrangement 31 mounted on brackets 32 suitably supported upon the adjacent side wall 21—see Figs. 2 and 4. The cable thence passes upwardly to the pulley 33 supported by brackets 34 carried by the top or cover 22. The cable then passes about a pulley 35 rotatably supported upon member 36 suitably supported or secured to the top 22.

The two cables 29 of the two door structures are extended—see Fig. 5—and are connected through slack adjusting means, such as turnbuckles 37, or the like, to a single-tree 38, in turn connected to a rod or link member 39. Thus, longitudinal movement of the rod 39—see Fig. 5 and in the downward direction in this figure—will cause opening or upward movement of the doors upon their hinge supports 27.

Herein two openings 30 are provided in the opposite side walls 21 and these openings constitute intake openings for attic ventilation only, being normally open when the doors 26 close the ceiling intake opening 24 and being normally closed by the doors 26 when said ceiling opening 24 is operative for lower floor ventilation.

As will be apparent from Fig. 4, in order to insure initial closing movement of the doors when the rod 39 is moved to the retracted position or the position closest to the pulleys 35, there is provided a tensioning member 40 which is in the form of a spring of V-shape anchored as at 41 to the inside of the member 21 adjacent the opening 30 and to one side thereof and having its operative portion bearing upon the door when opened and being under a constraint when the door is fully opened. Thus, when the rod 39 is moved to the ceiling closing position, these springs overcome the friction of the cable on the pulleys and overcome the inertia of the doors in their upper position and any tendency to lock in off or overcenter position and insure positive movement of said doors beyond the overcenter position so that gravity becomes effective thereon for closing of said doors for ceiling closing.

Suitable bumper means—not shown—may be interposed between the grillage and the doors so as to minimize the shock in this closing and to silence the same in closing. It is, of course, to be understood that the motion of the rod 39 is not a rapid one and, therefore, the cables are not released instantaneously from the full open position to the full closed position but this release is gradual and occupies several seconds. Hence, after the doors have been initially caused to move beyond the center so that gravity becomes effective thereon, the doors do not drop, as it were, but are lowered, the lowering operation being proportional to and regulated by the cable movement in the door movement to ceiling closing position.

Reference now will be had more particularly to Figs. 1 to 3, inclusive. In these figures, it will be observed that the top 22 substantially intermediate its ends is provided with a bearing member 42. Parallel thereto and diametrically opposite the same with reference to the exhaust opening 23 is a similar bearing member 43. A cross-member 44 is suitably supported thereby for fan and motor support purposes.

This fan may be of the type conventionally employed in restaurants and is of the suspended motor type. In said Figs. 1, 3 and 5, it will be noted that the motor is indicated by the numeral 45 and thereabove is the propeller arrangement 46, the latter being rotatable with respect to the motor support structure 47, the latter being carried as at 48, in turn carried by the cross member 44.

The current supplied to the motor is supplied thereto in any usual manner and one method may be through the supports 47 and 48. Since structures of this kind are well known in the ventilating art, no detailed description of the same is believed necessary other than that hereinbefore set forth.

Basically, the operation is as follows:

Whenever it is desired to ventilate the attic and attic only, the doors 26 remain in the ceiling closing position as shown in Fig. 4 by the full lines, thereby opening openings 30 in walls 21. Thereupon when the fan motor is energized, the fan draws air into the well or compartment through openings 30 and throws air out of the chamber through exhaust 23. This causes air movement in the attic and insures that the air circulates therein, the air being free to enter and leave the attic through the louvre arrangements at openings 17.

During the heat of the day in hot weather, the structure as thus described, functions automatically, the fan motor being operated whenever the temperature of the air in the attic attains that for which a thermostat switch in the attic is set. This closes the motor circuit of the fan and the fan is operated and will operate just so long as the temperature of the air in the attic insures circuit closed relation by holding the thermostat switch closed. This is an automatic control for the fan motor and contrary to normal expectations, the positioning of the fan and the construction of the well is such that there is obtained therefrom a positive circulation of the air in the attic with the result that the temperature of the attic can be lowered to that of the outside air.

It is to be noted that the temperature of air in the attic if the air is relatively stagnant or trapped, will rise during the day higher than the outside air incident to the absorption of heat by the roof structure, such additional heat being transmitted to the air trapped in the attic by the roof. The present invention, therefore, to this extent insures that what heat normally is absorbed by and passes through the roof to the air in the attic is subsequently dissipated incident to air circulation in the attic, which is of positive character by reason of motor fan operation.

During the evenings when the outside air temperature is much cooler and it is desired to cool the bedrooms on the floor immediately below the attic and the main floor of the home, the windows of the various rooms may be opened and then with the door closures 26 elevated to open position and the motor fan energized, the fan will draw air from adjacent the ceiling of the story next to the attic and draw it through the well chamber, as shown by the arrows in Fig. 3, and discharge the same upwardly into the attic and the air finally passes outwardly through the louvered openings 17. The air drawn through the opening 24 is replaced by air obtained from the open windows, doors and like openings, thus the house and especially the upper floors thereof are cooled to that of the outside air temperature. As evidence of this action in actual practice, the curtains over the open windows of a house equipped with such an installation are caused to move inwardly away from their normal vertical hanging position an amount approximately 12" to 18" at their free and lower ends. In some instances this drawing of air from the upper story is of such suction character that it is necessary to block the bedroom doors leading to the hall so as to prevent those doors being closed by said suction.

It is to be understood the preferred position

of the opening 24 is in a central hallway so that the air from all the floors and from all the rooms leading from the hallway on successive floors will be in operative relation for air movement therethrough so that all rooms will be cooled. Whenever one room is not desired to be cooled, all that is necessary is to close all of the outside openings, such as windows and/or doors and if desired, the door into the hall may also be closed but the same is not generally necessary.

This fan motor is controlled manually for the aforesaid operation or automatically. Automatically it may be energized whenever a thermostat in the hall below ther attic calls for energy. It may also be energized at a predetermined time and deenergized at a later time whevener a time operable switch, such as that known as a "time-o-stat" is employed.

Incorporated in the control system there is a signal for visually indicating whether or not the fan motor is energized and, therefore, operating, whether the doors 26 be opened or closed.

It also will be apparent that the attic thermostat control is in effect in multiple with the hall thermostat and/or the hall time-o-stat control.

Reference now will be had to Fig. 5 wherein one form of connection and the aforesaid apparatus are diagrammatically illustrated. In said figure the numeral 60 represents one supply main protected by a fuse 61 and a line 62 therefrom leads to the motor 45. A line 63 therefrom leads to a terminal 64 of a switch structure, and a contacting member 65 of said switch structure is connected by a jumper 66 to a contact 67 and is connected in turn by line 68 to the other power line 69.

When the switch member 70 carrying the contacts 65 and 67 is in lowered position, current flows through the motor 45 for energizing same and this circuit is the one which is responsive to the hall thermostat or the time-o-stat, as hereinafter described.

Connected to the line 63 is a line 71 which leads to the attic thermostat 72 including a temperature responsive switch member 73. When the temperature of the surrounding medium attains that for which this thermostat is adjusted, a circuit is closed by the member 73 to the line 74 connected to the contact 75, then normally engaged by the contact 65 of the movable switch member 70. This is the arrangement for attic ventilation with the doors closed, the circuit being as follows:

Line 60, fuse 61, line 62, fan motor 45, line 63, line 71, thermostat switch 73, line 74, contact 75, switch member contact 65, jumper 66, switch member contact 67, line 68, main 69.

Across the lines or mains 60 and 69, is the primary 76 of a transformer and adjacent thereto is the secondary 77 thereof connected by a line 78 to one terminal 79 of a coil 80 for master switch operation. The other terminal 81 of the coil 80 is connected by line 82 to the junction 83 and thence by line 84 to the hall thermostat 85 having a switch member 86 therein adapted to close a circuit by line 87 to junction 88 and thence by line 89 to the other end of the secondary 77 of the transformer arrangement. Thus, when the thermostat 85 has its switch member 86 closing the circuit through the thermostat 85, the coil circuit is closed and the coil 80 is energized. Upon energization, the movable core 90 normally constrained to its upper position shown by the spring means 91, is moved downwardly so that switch member contact 65 then contacts switch contact 64 and as long as this thermostat 85 maintains a closed circuit, the coil 80 is energized and the switch contact carrying member 70 is maintained in the lowered position in opposition to the spring 91. The circuit then is as follows:

Current is supplied through main 60, fuse 61, line 62, motor 45, line 63, contact 64, switch member 65, jumper 66, switch member 67, line 68 and main 69. Thus, the hall thermostat 85 when calling for ventilation secures motor operation independent of the attic thermostat 72.

In multiple with the hall thermostat 85 is a time-o-stat of conventional character and indicated by the numeral 92. One line 93 therefrom connects to junction 83. The other line 94 therefrom connects to junction 88. Thus, the time-o-stat 92 is arranged to close and open the fan motor circuit whenever the mechanism thereof closes the circuit between lines 93 and 94 or opens said circuit, the same being independent of the hall thermostat 85.

The switch structure associated with a switch member 70 includes two other contacts 95 and 96, the same being positioned opposite contacts 75 and 64 so that when contact 65 is in engagement with contact 75, contact 67 is in engagement with contact 95. Similarly, when contact 65 is in engagement with contact 64, contact 67 is in engagement with contact 96. This side of the switch, as it were, is for door motor operation.

This motor is the motor which insures door opening. A line 98 therefrom leads to and connects to the main 60 on the fuse protected side of the line as at 99. A line 100 from said door motor leads to a three-way standard limit control rotatable switch. This switch includes contact 101 and a pair of contacts 102 and 103 conventionally illustrated in Fig. 5. Contact 102 is connected by line 104 to the multiple switch contact 95. Contact 103 is connected by line 105 to the other contact 96 of the multiple switch 70. A line 106 is connected to line 100 as at 107 and to a signal lamp 108, the latter being connected by line 109 to the line 98 at 110. Thus, whenever the motor 97 is energized, the signal 108 is energized, thereby visually indicating the operative condition of the said door motor circuit, it being understood that this control motor is positioned in the attic at a convenient location and is operatively connected to the rod 39, as hereinafter will be described.

It will be noted that whenever the hall thermostat and/or the time-o-stat closes the coil circuit, that line 105 is connected to main 69 for energizing supply to the door motor and whenever the time-o-stat or hall thermostat opens the circuit, the line 104 is conditioned for supplying energy to the door motor 97. The switch arrangement 101, 102 and 103 is of the character specified above and the door motor 97 is capable only of operating during one-fourth revolution of the three-way limit control rotatable switch even though the rotor of the motor operates for more than a single revolution, this being obtainable through a suitable reduction drive, not shown in Fig. 5, and member 112 rotates 180°.

In the lower part of Fig. 5 immediately below the link 39, there is illustrated the door motor 97 and projecting beyond said motor and from a speed reducing arrangement therebeneath is a rotatable shaft 111 which carries an arm 112 and

pivotally connected at one end of said arm as at 113 is a link 114 connected to the rod 39 in turn connected to the single-tree element 38, before mentioned.

It will be understood that the operation of this switch 101—102—103 in conjunction with the hall thermostat and/or time-o-stat is as follows: When either closes the control circuit to the coil 30, the door motor 97 is energized to cause the shaft 111 of the speed reducing mechanism to rotate half a revolution and in so doing the single-tree 38 is moved from the position shown in Fig. 5 to a position downwardly thereof an amount necessary to open the doors 26. When the doors are opened and the arm 112 has rotated 180° or almost to that position, the energy to the motor 97 is cut off by arm 112 and the three-way switch 101, 102 and 103. The time-o-stat, however, or the hall thermostat still maintains a closed coil circuit, but current cannot be supplied through this three-way switch 101—102—103, until the coil 30 is deenergized and the switch contact carrying member 70 is returned by the spring 91 to the position shown in Fig. 5. Then current flows to the door motor by line 104.

When the hall thermostat 35 opens the coil circuit or the time-o-stat opens the coil circuit, the coil 30 is deenergized and switch member 70 returns to the position shown by the full lines in Fig. 5. Then and then only is the line 104 supplied with energy, and then and then only is the motor supplied the energy, and it is operated to then return the arm 112 to the position as shown in Fig. 5, permitting the doors to close.

Adjacent the time-o-stat and hall thermostat, which may conventionally be placed adjacent each other for convenience in wiring, there may be mounted the door motor signal 108 and fan motor signal 120. This signal 120 is connected by line 121 to the line 62 and is connected by line 122 to the line 63 as shown. Thus, signal 108 always indicates when the door motor is energized and signal 120 adjacent thereto always indicates when the fan motor 45 is energized.

It will be apparent, therefore, that the attic thermostat 72 can operate and energize the fan motor 45 independently of the hall thermostat and/or time-o-stat and that the hall thermostat and/or time-o-stat can operate independently of the attic thermostat but when so operated either of these multiple hall controls in turn controls the door motor and secures energization of the fan motor as well.

While herein there is disclosed a particular form of fan means, it is to be understood that other forms of air moving means such as a blower or blowers, or a suction fan, or fans, can be employed as required by each particular installation. The term "fan means" as used in the claims is intended to include the specific form disclosed herein as well as any one of the aforesaid equivalents.

It is to be further noted that "operating" signals 108 and 120, and the connecting wiring thereto, may be eliminated if this means of signalling is not desired, and in lieu thereof may be substituted one "non-operative" signal, wired in conjunction with a simple three-way switch, both signal and switch being "cut into" line 63 so as to signal when on one position of the switch and to not signal when on the second position of the switch, yet conduct the current required for all operative conditions.

While the invention has been illustrated and described in great detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character.

The several modifications described herein as well as others which will readily suggest themselves to persons skilled in this art, all are considered to be within the broad scope of the invention, reference being had to the appended claims.

The invention claimed is:

1. In a multifloor building structure having a ventilated upper story, and a lower floor communicating therewith, the combination of door means controlling the communication, compartment fully enclosed within the upper story and having openings adjacent opposite ends, said openings being laterally offset relative to each other and diagonally positioned in the compartment and lying in substantially parallel planes and oppositely directed, one opening registering with the communication and controlled by said door means, the other opening communicating at all times with the interior of the upper story, fan means in the compartment immediately adjacent the compartment said other opening, means for operating the door means for selective ventilation of the upper story or the lower floor and upper story, and means for operating said fan whenever any ventilation is required said compartment having a third opening juxtapositioned to the door means and arranged for closure by the same for upper and lower floor ventilation and arranged for compartment communication with the upper story when said door means closes the first mentioned offset opening for upper story ventilation only.

2. A structure as defined by claim 1, characterized by the addition of a thermally responsive control in the upper story for the fan means for upper story ventilation only.

3. A structure as defined by claim 1, characterized by the addition of a thermally responsive control in the lower story for the fan means for lower story ventilation through the upper story.

4. A structure as defined by claim 1, characterized by the addition of dual, thermally responsive, control means for said fan means, one thermally responsive control means being in the upper story and responsive to thermal conditions therein, and another thermally responsive control means being in the lower story and responsive to thermal conditions therein, said door operating means being responsive to one of said thermally responsive control means.

5. A structure as defined by claim 1, characterized by a time operable control for simultaneously operating the fan means and the door controlling means.

6. A structure as defined by claim 1, characterized by the addition of a time operable control for simultaneously controlling the fan means and the door operating means, thermally responsive means in the upper story, and thermally responsive means in the lower story, one of said thermally responsive means controlling said fan means independent of the door operating means and the other thermally responsive means simultaneously controlling the fan means and the door controlling means.

7. In a ventilating system of the character described, a compartment having the adjacent opposite ends laterally offset and diagonally positioned oppositely directed openings, the planes thereof being substantially parallel, fan means adjacent one opening and in the compartment, door means controlling the other and diagonally

opposite opening, door operating means of cyclically operable character and including a unidirectional motor, switch means for the motor, and branch circuits for the motor, said switch means controlling said branch circuits, the branch circuits being selectively energized for door means opening and closing, and automatically conditionable upon the door means attaining one of the open or closed positions for opening one branch circuit and closing the other branch circuit thereby conditioning the latter for subsequent operation for subsequent door means movement to the other position vice versa.

8. In a ventilating system of the character described, a compartment having the adjacent opposite ends laterally offset and diagonally positioned oppositely directed openings, the planes thereof being substantially parallel, fan means adjacent one opening and in the compartment, door means controlling the other and diagonally opposite opening, the door means being a pair of doors positionable within the compartment and movable from the door controlled opening away from each other into position adjacent opposite walls of the compartment for opening the door controlled opening.

9. In a ventilating system of the character described, a compartment having the adjacent opposite ends laterally offset and diagonally positioned oppositely directed openings, the planes thereof being substantially parallel, fan means adjacent one opening and in the compartment, door means controlling the other and diagonally opposite opening, the door means being a pair of doors positionable within the compartment and movable from the door controlled opening away from each other into position adjacent opposite walls of the compartment for opening the door controlled opening, and resilient means carried by the compartment engageable by the doors when in fully open position and normally constraining the doors toward the door closing position.

10. In a ventilating system of the character described, a compartment having openings adjacent opposite ends, said openings being laterally offset relative to each other and diagonally positioned in the compartment and lying in substantially parallel planes and oppositely directed, fan means adjacent one opening and in the compartment, and multiple door means controlling the other and diagonally opposite opening, each door means closing half of said last mentioned opening said compartment having an opening adjacent each of said door means and the door means controlled opening and controlled by the adjacent door means, there being as many individual door means as there are third mentioned openings.

11. A system as defined by claim 10, characterized by said door means being normally constrained toward the said other and diagonally opposite opening closing position, and by the addition of door control means arranged to open and hold open each of said door means with reference to said other and diagonally opposite opening and for simultaneous door closing of the third mentioned openings.

12. In a multifloor building structure having an upper story having an opening exposed to the atmosphere for atmospheric communication, and a lower floor having an opening to the upper story for communication therewith, and door means controlling said opening, the combination of a compartment entirely within the upper story and having an intake opening at one end registering with the lower floor opening and an outlet opening at the other end and discharging upwardly into the upper story and communicating at all times with the interior of the upper story for compartment outlet purposes and upper story circulation purposes, fan means in the compartment immediately adjacent the outlet opening thereof, an electric motor for the fan means, said compartment having, remote from the fan means, a second intake opening immediately adjacent the registering openings and juxtapositioned to said door means, means for operating said door means for selective association with the registering openings and the second intake opening, upper floor ventilation occurring through the second intake opening, the compartment, and the outlet opening thereof when the fan means is operated and the door means closes the registering openings, the resulting upper floor circulation effecting upper floor ventilation by reason of the upper story atmospheric communicating opening, lower floor ventilation occurring when the fan means is operated and the door means substantially closes the second intake opening and opens the registering openings, dual, thermally responsive, circuit means for said motor, each of the dual means being arranged to secure fan operation, one thermally responsive means having a portion located in the upper story and responsive to thermal conditions therein, the other thermally responsive means having a portion located in the lower story and responsive to the thermal conditions therein, said door operating means being electrically operable and responsive to one of said thermally responsive control circuit means for proper association of the door means for selective ventilation determinable by selective association of said door means, the other of the dual, thermally responsive circuit means controlling said fan means motor independently of the door operating means circuit control means.

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