

May 13 , 1924.

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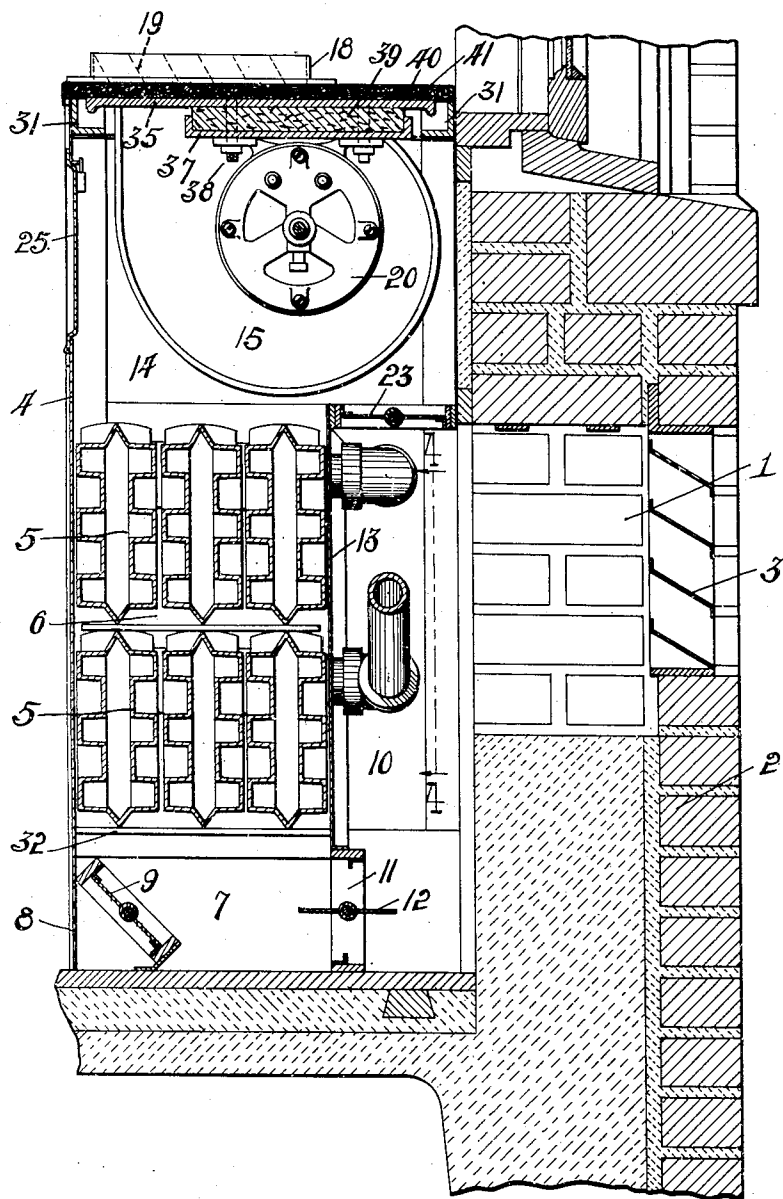
G. E. OTIS

UNIT VENTILATOR

Filed April 8, 1921

4 Sheets-Sheet 1

FIG-1-



INVENTOR

Gerald Earle Otis,
By Owen Alvord Crampton,
Atty.

May 13, 1924.

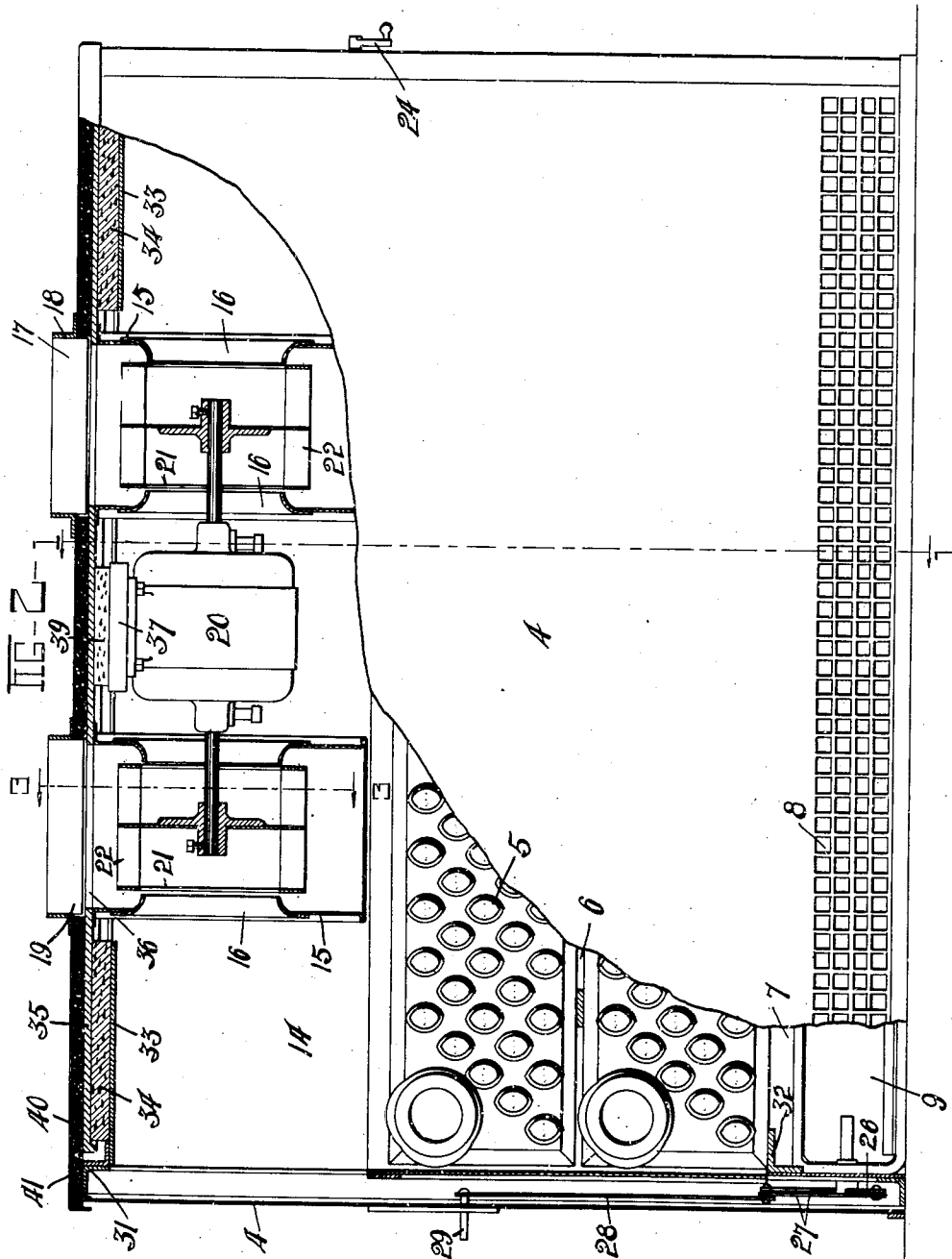
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G. E. OTIS

UNIT VENTILATOR

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4 Sheets-Sheet 2



INVENTOR.

Gerald Earl Otis,

By Edwin Crompton,
Attys.

May 13, 1924.

1,493,497

G. E. OTIS

UNIT VENTILATOR

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FIG-3-

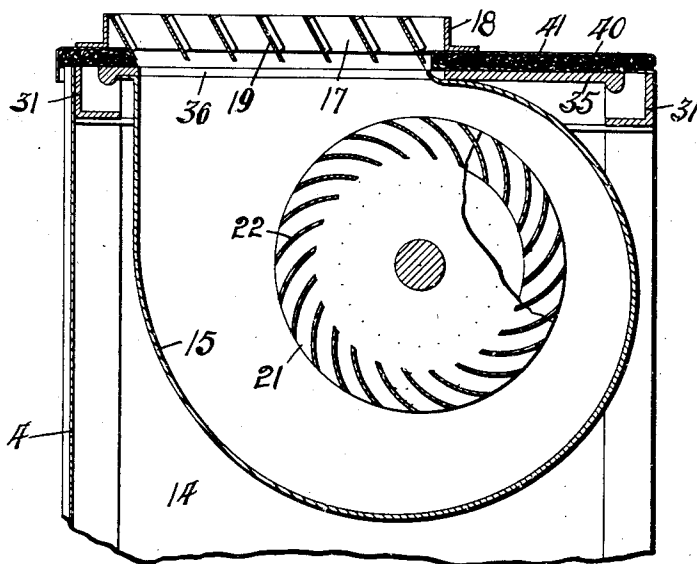


FIG-4-

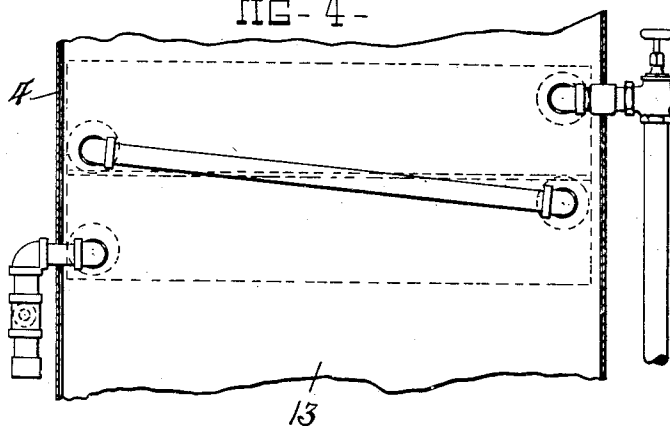
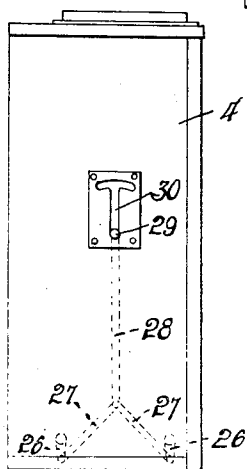


FIG-5-



INVENTOR
Gerald Earle Otis
By Owen Owen & Crampton,
Attys.

May 13 , 1924.

1,493,497

G. E. OTIS

UNIT VENTILATOR

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4 Sheets--Sheet 4

FIG-6-

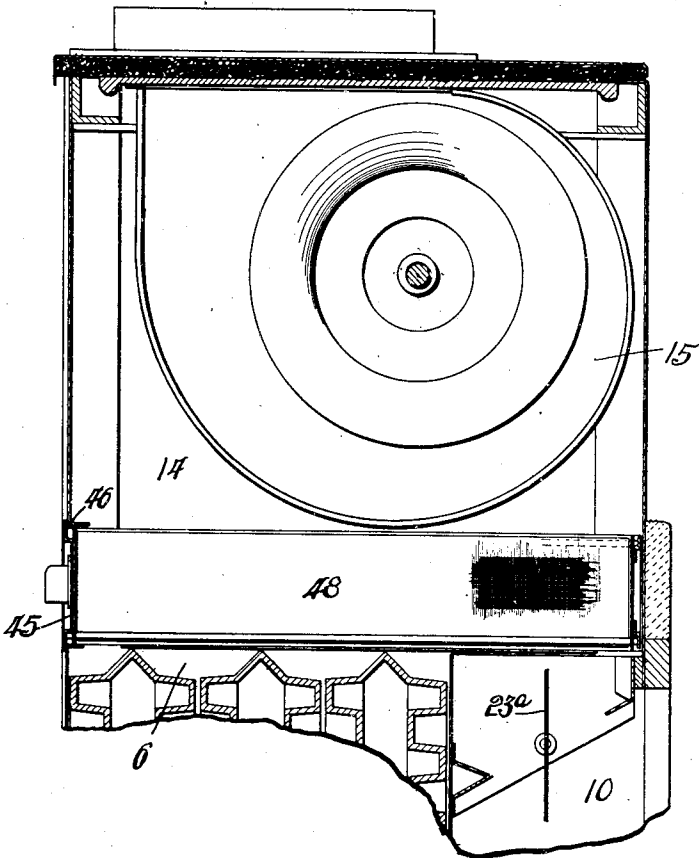
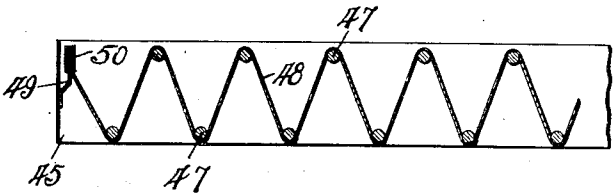


FIG-7-



INVENTOR

Gerald Earl Otis,

By *Quinn, Quinn & Crampton,*
Attys.

UNITED STATES PATENT OFFICE.

GERALD EARLE OTIS, OF MOLINE, ILLINOIS.

UNIT VENTILATOR.

Application filed April 8, 1921. Serial No. 459,642.

To all whom it may concern:

Be it known that I, GERALD EARLE OTIS, a citizen of the United States, and a resident of Moline, county of Rock Island and State of Illinois, have made an Invention Appertaining to Unit Ventilators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the characters of reference marked thereon, which form a part of this specification.

This invention relates to portable units for mechanically supplying temperature conditioned air for ventilating rooms in buildings, and located in the rooms to be ventilated or in spaces immediately adjoining the same. The device illustrated and described is one in which the normal function is to warm the fresh air for ventilation, with steam or hot water radiators, but it is to be understood that the same or similar radiators may be used for cooling, or any other appropriate type of cooling or heating element substituted.

The object of my invention is the provision of a new and useful apparatus of the character described, the operation of which is practically noiseless, efficient and satisfactory, thereby particularly adapting it for use in churches, schools, hospitals and the like and the application of which to modern buildings is facilitated. Further objects and advantages of the invention will be apparent from the following detailed description thereof.

While the invention in its broader aspect is capable of embodiment in numerous forms, a preferred embodiment thereof is illustrated in the accompanying drawings, in which,—

Fig. 1 is a vertical section of an apparatus embodying the invention taken substantially on the line 1—1 in Fig. 2 and including the associated portion of the wall and floor of a room in which located. Fig. 2 is a front elevation of the apparatus with a part broken away. Fig. 3 is an enlarged section on the line 3—3 in Fig. 2 with a part broken away. Fig. 4 is a reduced fragmentary section on the line 4—4 in Fig. 1. Fig. 5 is a reduced end elevation of the apparatus. Fig. 6 is a fragmentary vertical section of a slightly different form of the apparatus, and

Fig. 7 is a section of the air filtering means in Fig. 6.

Referring to the drawings, 1 designates a fresh air intake opening through an exterior building wall 2, or in a wall bounding a fresh air shaft. The opening 1 is preferably provided with a grate or screen 3.

A cabinet or casing 4 of sheet metal or other suitable construction is disposed within the room with which the intake opening 1 communicates at the inner end of the opening 1 so that all air which enters the room therefrom is required to pass through the cabinet. The cabinet 4 encloses a temperature conditioning means 5, which in the present instance is in the form of a radiator and adapted to have either a heated or cooling fluid of vapor, steam or liquid form pass therethrough from any suitable source of supply, as well understood in the art. The elements 5 are disposed in a temperature conditioning compartment or passageway 6, which is open at its bottom to a loading compartment in the base of the ventilator casing, and this compartment is adapted to have communication with the interior of the room through a grated opening 8 controlled by a damper 9, and to have communication at its rear with a fresh air compartment or flue 10 through an opening 11 controlled by a damper 12. The fresh air compartment or flue 10 extends up at the rear of the conditioning compartment 6, being separated therefrom by a partition 13, and extends to the top of the intake opening 1 in full communication therewith.

The conditioning compartment 6 opens at its top into a collecting chamber 14 in the top portion of the ventilator casing and this compartment has one or more fan housings 15 therein, each of which has side openings 16 to the compartment and an exit opening 17 through the top of the housing to the interior of the room in which the ventilator is disposed. The discharge openings 17 are formed by frames 18 and each has deflecting vanes 19 disposed therein for governing the angle of discharge of the air from the ventilator.

An electric motor 20 is suspended within the ventilator casing from the top thereof between the fan housings 15, and has its shaft projecting in opposite directions therefrom and into the respective fan housings and carrying a fan 21 therein. Each fan has air inlet openings at its sides in register

with the openings 16 of the fan housing and is provided at its peripheral portion with blades 22, which are pitched or curved inward and rearward with respect to the direction of rotation, as shown, so as to enable the fan to be run at high speed with a resultant minimum of noise due to the impact of the air with the blades. It is found in practice that with the blades arranged in this manner the fan may be run at very high speeds with very little resultant noise.

In order that fresh air may be admitted direct to the collecting chamber 14 without passing through the conditioning chamber 6, the fresh air flue 10 opens at its top to the chamber 14, such opening being controlled by a damper 23, the shaft of which extends without one end of the casing 4 and is provided with a control handle 24. The casing 4 is provided in the front thereof with a door 25 which may be opened to permit access to the motor 20.

The dampers 9 and 12 have a unitary control adapted to open one when the other is closed, and vice versa. This control consists in providing each damper shaft with a crank-arm 26 and connecting each arm by a link 27 to a vertically extending rod 28 having a handle 29 at its upper end projecting laterally therefrom through a T-slot 30 in the associated end of the casing. With the present arrangement, when the handle 29 is at the lower end of the slot 30 the damper 9 is closed and the damper 12 is open, and when the handle is at the upper end of the slot, in which position it may be held by entering either arm of the slot, the damper 9 is open and the damper 12 closed.

The casing 4 is provided with a rigid supporting frame 31 of structural steel or other suitable material, the essential purpose of which is to act as a combined support for the temperature conditioning elements and the fans and motor. This frame rests on the building floor or other suitable solid foundation. Brackets 32 are provided at the sides of the frame 31 for supporting the temperature conditioning elements 5 so that the conditioning means acts as a ballasting means for the frame.

It is found that one of the most desirable qualities in a ventilating apparatus of this class is noiseless operation, which should be approached as closely as possible, since one of the largest fields for unit ventilators is in schools, hospitals and the like, where noise is objectionable. I have observed that noise in ventilators of this class originates from two sources, first, through vibration of the motor and running parts, and secondly, through the rush of air through the fans and restricted air passages.

One of the advantages afforded by my invention lies in the use of a rigid support-

ing frame 31 for carrying the fans and motor and which rests on a substantial foundation and is ballasted by the weight of the temperature conditioning elements, and which is insulated from the frame and cabinet as well as from the motor by suitable sound deadening materials. In order to minimize the sound arising from the vibration and running of the motor, the top of the frame is provided at the ends thereof with shelf plates 33, each having a pad 34 of cork, felt or other sound deadening material mounted thereon and supporting the respective end of a top plate 35 from which the motor and fan housings are suspended. The top plate 35 has openings 36 therein in register with the fan housing outlet openings. The motor 20 is attached to a sub-base plate 37 and is suspended therewith from the top plate 35 by bolts 38. A sound deadening pad 39 of cork, felt or other suitable material is disposed between the top plate 35 and sub-plate 37. Noise and vibration from the moving parts is further eliminated by providing an insulating pad of felt or other suitable material 40 between the cover member 41 and cabinet and the frame 31 and top plate 35.

The noise customarily resulting from the rush of air through the fans and restricted air passages is avoided or minimized by providing air passages of sufficient capacity to permit a free and unrestricted passage of the air therethrough, and also by providing the fans with blades which are pitched or curved backward relative to the direction of rotation.

I have also found that the arrangement of the fans whereby the air is drawn instead of blown through the temperature conditioning compartment is quite an improvement over apparatus of this character heretofore used, since it increases the efficiency of the heating or cooling element and reduces the load on the fans. Where fans discharge through heating or cooling elements, the air current does not spread uniformly, particularly where the distance between them is short, but causes higher velocities in the sections opposite the fan outlet than in other sections. This results in lowered efficiency in the temperature conditioning element and in eddy currents in the air that waste the fan power. Moreover, the arrangement of the fans on the discharge sides of the temperature conditioning element insures better protection for the motor against moisture and severe weather conditions than is the case when located on the other side, and permits the use of open frames on electric motors which insures higher efficiency and easier access.

It is evident in the use of my apparatus that fresh air enters the compartment or flue 10 of the cabinet through the inlet opening

1 and may then pass directly into the collecting chamber 14 and be discharged therefrom into the room by the operation of the fans, or if desired the damper 23 may be entirely closed, the damper 12 opened and the damper 9 closed, so that the fresh air is caused to enter the loading compartment 7 and thence pass upward through the conditioning compartment 6, where it is either heated or cooled by the action thereon of the conditioning elements 5 and then passes into the collecting chamber 14 from which it is discharged into the room. If it is desired to reuse the air in the room, the damper 9 may be opened the desired extent for such purpose and the damper 12 either entirely or partially closed, as it may be desired to use alone the air in the room or to mix therewith fresh air from the flue 10. It is evident that a nice regulation of the air discharged into the room from the compartment 14 may be obtained to suit conditions, as either fresh air or room air or both may be directed through the conditioning compartment into the collecting compartment 14, or the damper 23 may be opened to any desired extent to admit fresh air direct to the compartment 14 without first passing through the conditioning compartment.

It is found in practice that the arrangement whereby the tempering damper 23 is placed on the suction side of the fan is a material improvement over apparatus of this character in which the tempering damper is disposed on the exhaust side of the fan since it insures a more uniform mixture of the conditioned and unconditioned air when the tempering damper is opened. Experience has shown that a uniform temperature in the air discharged from the ventilators of the class described is important since "streaky" discharge currents are liable to cause unpleasant draughts in the room ventilated. While it is ordinarily extremely difficult to get hot and cold currents of air to thoroughly mix, the arrangement which I have provided is found to effect such mixture in a thorough and efficient manner.

In Figs. 6 and 7 I have illustrated a slightly changed construction of the apparatus, the collecting compartment being deepened to provide a space between the fan housings and the upper ends of the fresh air compartment 10 and temperature conditioning compartment 6 for receiving a dust collecting means. This means comprises a drawer 45 preferably constructed in rectangular form of sheet metal and being inserted into the cabinet through an opening 46 in its front side. The drawer is open at top and bottom to permit the circulation of air therethrough and is provided lengthwise thereof or from front to rear, in

the present instance, with a series of upper and lower sets of spaced rods 47, with the rods of one set alternating with respect to the rods of the other set, or in other words, with the rods of the upper set disposed centrally over the spaces between the rods of the lower set. A strip of cheese cloth 48 or other suitable air filtering medium of a width corresponding to the length of the rods is arranged in zig-zag form within the drawer, being passed successively under a rod of the lower set and then over a rod of the upper set, and so on throughout the width of the drawer, and fixed at its ends to the drawer sides. A simple means for securing the ends of the strip to the drawer sides is to provide each side of the drawer with an upstanding flange 49 over which the end portion of the strip may be drawn and then pressing a U-shaped clamping strip 50 down over the ends of the flange and the portion of the strip standing thereover. This provides a very effective dust collecting medium for the air, and, being disposed between the source of air inlet supply and the motor, eliminates to a large extent the objections incident to dust being drawn into the motor, and enables the motor frame to be open instead of closed, which adds to its efficiency. By arranging the cloth or dust collecting medium in zig-zag form causes a much greater surface of the same to be presented to the air than would otherwise be the case. The drawer is capable of being easily and quickly removed from the cabinet for the purpose of cleaning or replacing the filtering cloth. In this form of the invention the position of the tempering damper, which is designated 23^a, is lowered somewhat from that of the form first described to provide room for it to be opened below the filtering medium.

I wish it understood that my invention is not limited to any specific construction, arrangement or form of the parts as it is capable of numerous modifications and changes in both the construction and arrangements of the parts, without departing from the spirit of the claims.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is,—

1. In a ventilator, a cabinet, a vertical fresh air flue at the rear wall of the cabinet, a horizontal loading compartment at the bottom of the cabinet having one end communicating with the lower end of the flue and its opposite end opening through the front wall of the cabinet, dampers at the said respective ends of the loading compartment, means to effect simultaneous operation of said dampers, a collecting compartment at the upper end of the cabinet communicating with the upper end of the flue and opening into the room at its

top, a damper at said upper end of the flue, a conditioning compartment between the flue and cabinet front and between the collecting and loading compartments and communicating at its respective ends with the collecting and loading compartments, conditioning means in the conditioning compartment, and current creating means in the collecting compartment.

2. In a ventilator, a cabinet having a collecting compartment at its top opening into the room, at the top of the cabinet, a fresh air flue at the back of the cabinet communicating at its top with the collecting compartment, a loading compartment at the cabinet base communicating with the flue and with the room, a conditioning compartment between the collecting and loading compartments and communicating with each, current creating means in the collecting compartment, and means whereby to enable fresh air to be drawn from the flue directly into the collecting compartment or to be drawn from the flue through the loading and conditioning compartments and thence into the collecting compartment or drawn from the room into the loading compartment and then through the conditioning compartment into the collecting compartment.

3. In a ventilator, a cabinet having a collecting compartment at its upper part opening into the room, a fresh air flue communicating with the compartment, a loading compartment communicating with the flue and the room, a conditioning compartment between the collecting and loading compartments and communicating with each, current creating means in the collecting compartment, a damper between the flue and collecting compartment and dampers controlling communication of the loading compartment with the room and with the flue.

4. In a ventilator, a cabinet having a collecting compartment at its upper part opening into the room, a loading compartment at the lower part of the cabinet, a conditioning

compartment between and communicating with the collecting and loading compartments, a fresh air flue communicating at its upper end with the collecting compartment and at its lower end with the loading compartment, current creating means in the collecting compartment, and an inlet for the fresh air flue adjacent its top.

5. In a ventilator, a cabinet, a collecting compartment in the cabinet opening into the room, a loading compartment beneath the collecting compartment, a conditioning compartment between the collecting and loading compartments and communicating with each, a fresh air flue communicating with the loading and collecting compartments, current creating means in the collecting compartment, and means whereby air may be directly drawn from the flue into the collecting compartment or may be drawn downwardly through the flue thence through the loading compartment and finally upwardly through the conditioning compartment into the collecting compartment.

6. In a ventilator, a cabinet, a collecting compartment in the cabinet opening into the room, a loading compartment beneath the collecting compartment, a conditioning compartment between the collecting and loading compartments and communicating with each, a fresh air flue communicating with the loading and collecting compartments, an inlet for the fresh air flue disposed below the collecting compartment, means to control the communication between the fresh air flue and the collecting compartment, current creating means in the collecting compartment, said loading compartment communicating at its ends with the room and fresh air flue, and a damper control for each end of the loading compartment.

In testimony whereof I have hereunto signed my name to this specification.

GERALD EARLE OTIS.