No. 631,555. Patented Aug. 22, 1899.

O. L. BILLINGS.

THERMOSTATIC AND ELECTRICAL VENTILATING DEVICE.

(Application filed Aug. 24, 1898.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1

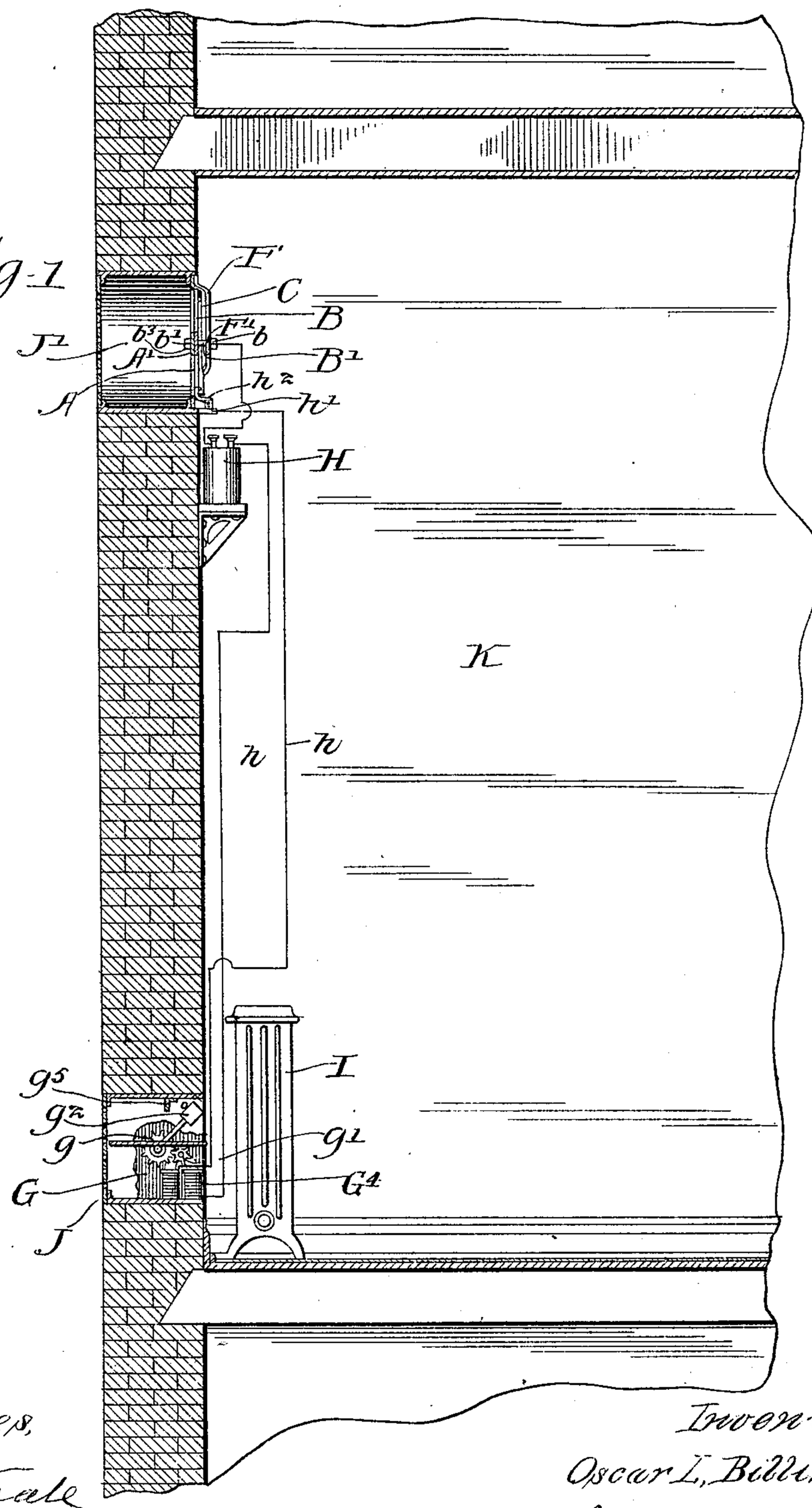

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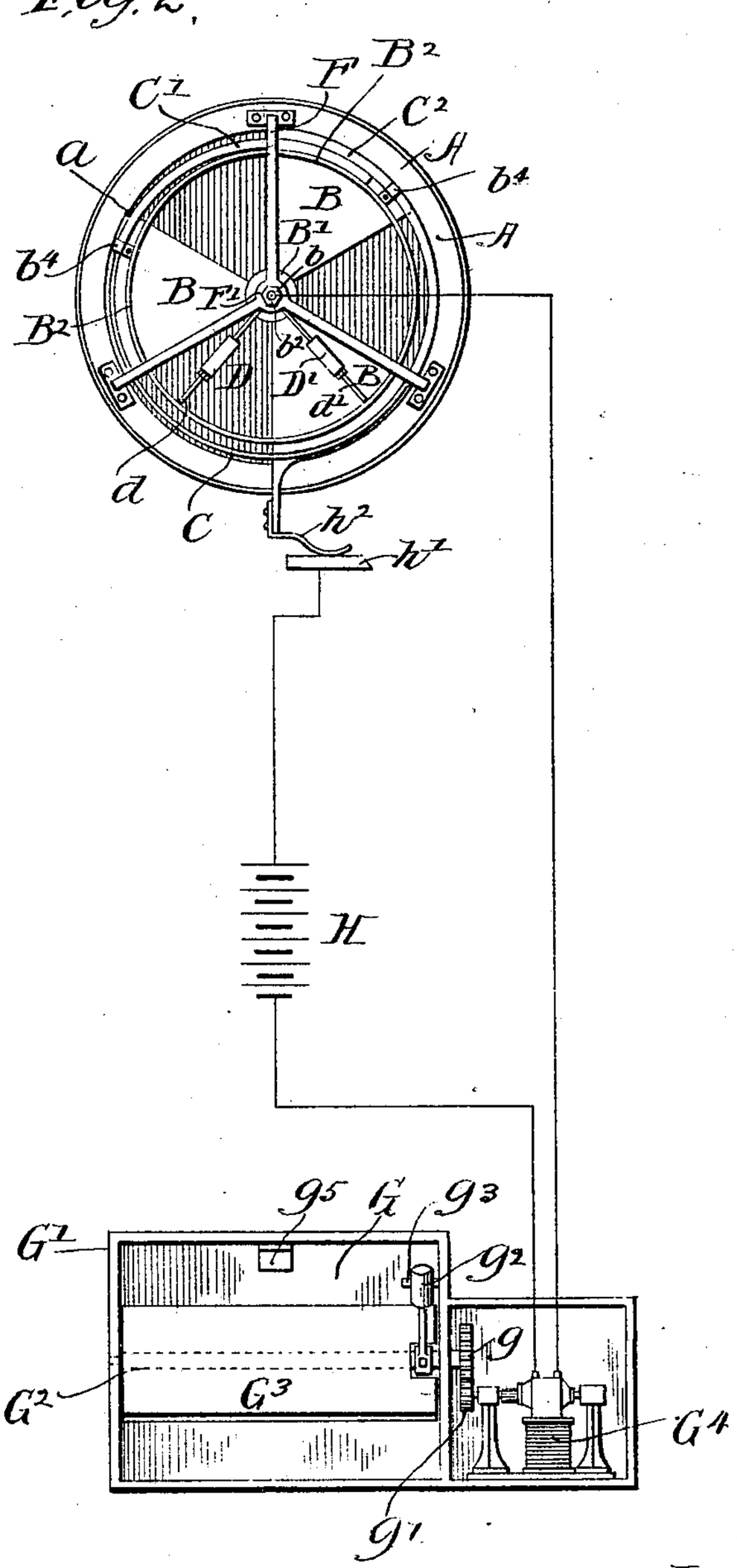
Fig. 2.



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UNITED STATES PATENT OFFICE.

OSCAR L. BILLINGS, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO SAMUEL W. McMUNN, TRUSTEE, OF CHICAGO, ILLINOIS.

THERMOSTATIC AND ELECTRICAL VENTILATING DEVICE.

SPECIFICATION forming part of Letters Patent No. 631,555, dated August 22, 1899.

Application filed August 24, 1898. Serial No. 689,503. (No model.)

To all whom it may concern:

Be it known that I, OSCAR L. BILLINGS, of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Thermostatic and Electrical Ventilating Devices; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to a thermostatic and electrical ventilating device adapted to be used in the ventilation of any apartment for the purpose of maintaining an even temperature and at the same time a circulation of fresh air.

The invention consists in the matters hereinafter set forth, and more particularly pointed out in the appended claims.

In the drawings, Figure 1 is a front elevation of a device embodying my invention. Fig. 2 is a sectional view of the same.

As shown in the accompanying drawings, the main features of invention consist of a valve combined with means for opening and closing the same automatically, consisting of an apertured valve-diaphragm A, an oscillating circular valve-disk B, a thermostat-coil C, attached to said valve, counterbalance-weights D D′, a valve G, with means to open and close the same, consisting of a box or casing G′, adapted to be set in a wall, a rock-shaft G^2, provided with a geared wheel g, an oscillating valve-disk G^3, attached to the rock-shaft, a counterbalance-weight g^2, attached at right angles to said rock-shaft, a magneto-electric motor G^4, provided with a pinion g', for actuating the rock-shaft G^2, a battery H, electrical conductors h h, forming a circuit connecting the thermostatic valve with the motor G^4, and a device for opening and closing the said circuit.

The diaphragm A consists of a thin circular sheet of metal or other suitable material adapted to be attached vertically to the end of any draft-conduit. It has a plurality of apertures arranged about a common center A′. Said apertures are formed by dividing a circle drawn about the center A′ into an even number of equal sectors and cutting out alternate sectors, thus making the apertures equal to the adjacent solid portion. The diameter of said circle is less than the diameter of the diaphragm. A narrow annular circumferential portion is thus left, which strengthens the said diaphragm and forms a rear surface suitable for attachment to any draft-conduit. One of the solid sections of the said diaphragm is provided with a stop-pin a, so placed as to limit the oscillations of a valve-disk B to an arc equal to the arc of one of the sectors. Attached to the front or outward surface of the said annular or circumferential portion of the diaphragm is a spider F. The said spider consists of a plurality of arms arranged radially about a common hub or center F′. The outer ends of said arms are attached to the said annular circumferential portion of the said diaphragm and curved in such manner as to rise perpendicular to the face thereof for sufficient distance to admit of space for the unobstructed oscillation of the circular valve-disk B, provided with the thermostatic coil C and the weights D D′. When the spider F is attached to the diaphragm A, the center or hub F thereof will be opposite to the center of the said diaphragm. The hub F′ of the spider and the center A′ of the diaphragm form the bearing for the pivot about which the valve-disk B oscillates to open and close the apertures in the diaphragm A.

The valve-disk B consists of a thin circular disk of metal or other suitable material. It is plane on one side, and on the other it is provided with an elongated central hub B′ and is of sufficient diameter to cover the apertures in the diaphragm A. It is provided with apertures corresponding in size and arrangement to the aforesaid apertures in the diaphragm A. The said valve-disk B is provided on its outer face with the annular metallic stay B^2, attached near the circumference of the said valve-disk concentric therewith. With its plane side closely adjacent to the diaphragm A the disk B is pivoted at its center between the spider-hub F′ and the center of the diaphragm A′ upon the pivot-pins b b'. The said pivot-pins are screw-threaded and provided with conical bearing

ends adapted to enter corresponding bearing-recesses at the two ends of the hub B′ of the valve-disk. The spider-hub F′ and the center of the diaphragm A′ are each provided with screw-threaded apertures extending perpendicularly therethrough and adapted to receive the pivot-pins b b', respectively. The said pivot-pins are provided also with the jam-nuts b^3 b^3, respectively, which securely hold the said pins in such adjustment as to suitably bear the said valve-disk and permit it to oscillate freely upon the said pins. The extent of the said oscillations is limited to an arc equal to the arc of one of the solid sectors, or, in other words, sufficient movement to open and close the valve, formed by the diaphragm and valve-disk, by a stop-pin a, located near the edge of one of the sectors of the diaphragm and in such position as to alternately engage opposite sides of one of the apertures in the said valve-disk B. It is of course understood that the bearing herein described is not material to this invention, and any bearing which will permit free oscillation of the said valve-disk to open and close the valve will suffice.

The thermostatic coil C′ C C² is preferably a spiral tube, of metal or any suitable material, having a middle portion C of greatly-reduced diameter and two enlarged end portions C′ C². The said coil is attached by means of metallic clasps b^4 b^4 to the front or outward face of the said valve-disk at the circumference thereof and in such a manner that the enlarged ends are at the upper side of the said valve-disk B when the same is in operative position. The said enlarged end C² overlaps the enlarged end C′. In the enlarged end C² is placed mercury or other liquid of great specific gravity. A very light and volatile fluid, such as ether, is placed in the other end of the tube C′. The end C′ of the tube is then hermetically sealed to prevent the escape of the said volatile fluid and to cause movement of the mercury in the tube through the vaporization of the said volatile fluid and consequent pressure exerted thereby in the said closed end C′ because of variations in temperature, as hereinafter more fully explained. The end C² is preferably not hermetically sealed, but may be closed in any manner to permit free ingress and egress of air.

Attached to the hub B′ of the valve-disk B are the angular guide-rods d d', extending radially from the said hub and parallel to the valve-disk B and provided with counterbalance-weights D D′. The said rods are shown as attached to the said hub on its lower side at right angles to each other and so located that when the valve is closed by the rotation of the valve-disk B a vertical line let fall parallel to the said valve-disk from the central axis of the hub will form equal angles with the rods d d'. Adjustably attached to the said rods d d', respectively, are the said counterbalance-weights D D′. These are preferably cylindrical and provided with a central longitudinal angular aperture adapted to receive the said rods d d', respectively. Said rods fit closely in the said aperture and permit the weights to be moved thereon for the purpose of adjusting the apparatus to various degrees of temperature.

The operation of the apparatus herein described is as follows: The apparatus is designed to attach vertically or in any position except horizontally to a draft-conduit. The thermostatic coil or tube C′ C C², as hereinbefore stated, contains in its hermetically-sealed end, or left end as herein shown, a small quantity of any volatile fluid, as ether, and in the right end as herein shown, the end not hermetically sealed, mercury or other liquid of great specific gravity. The quantity of mercury used and the adjustment of the said coil upon the disk B should be such that at temperatures below that at which the fluid in the other end of the tube begins to volatilize the mercury will flow through the small middle portion of the tube C until it stands at a higher level in the end C′ than in the end C². This will cause the said valve-disk B to be out of equilibrium, and it will rotate toward the left until in stable equilibrium or until the stop-pin a in the diaphragm engages the edge of the advancing section of the disk B. The valve is now closed. It is obvious that atmospheric pressure will facilitate the flow of the mercury toward the closed arm, inasmuch as it will aid in compressing any vapor of the fluid not as yet condensed and according to a well-known principle facilitate condensation and retard vaporization in proportion to the increase of pressure. Hence the mercurial side of the tube is not hermetically sealed. It is clear, however, that if the end C² be hermetically sealed and the portion of the tube C² above the mercury be a vacuum the quantity of fluid and the shape of the tube may be so proportioned that the instrument will operate effectively. When the temperature rises to a point where vaporization of the fluid begins, the vapor thereof increasing the pressure in the end C′ of the said tube will cause the mercury to flow toward the mercurial end of the tube, rising higher therein than in the other end of the tube until the disk shall be again out of equilibrium and rotate back to the right until in stable equilibrium or until the stop-pin a shall engage the opposite side of the aperture in the said disk. The valve will now be open.

The counterbalance-weights, as hereinbefore stated, are designed to regulate the valve to various temperatures. This is done by moving the weights along the rods to such points as will retard or accelerate the oscillation of the disk, as the case may require, dependent on the temperature at which it is desired the valve will operate. It is evident that with the weight D′ moved close to the hub and there secured and with the weight D secured on the outer end of the arm or rod

d the pressure will be increased upon the volatile fluid and its vapor in the closed end of the tube and the oscillation of the valve-disk to the right and the consequent opening of the valve will require a higher temperature in accordance with the law heretofore mentioned. By reason of the same law the valve may be made to operate at a lower temperature by securing the weight D near the hub B′ and attaching the weight D′ at the outer extremity of the rod d'. The said weights so adjusted tend to rotate the valve to the right, thus to a certain extent counteracting and reducing the pressure on the volatile fluid. Hence the valve will open at a lower temperature. Between the two extreme positions of the weights and consequent extremes of temperature at which the apparatus is designed to be operative there is a wide range of temperatures for which the instrument may be set by intermediate adjustment of the said weights. This may be done by hand, or an additional regulating and adjusting device may be used. The said valve G consists of a rectangular casing or box of metal or any suitable material adapted to be set into a wall or the outlet of any draft-conduit. A rock-shaft G^2, transverse to the said draft-conduit, passes longitudinally and horizontally through the middle of the said box or casing and is journaled in the ends thereof. A rectangular valve-disk G^3, having a form and area equal to the form and area of the opening in the said casing G′, is pivoted upon the said rock-shaft and oscillates with the said rock-shaft to open and close the valve in the manner of a "butterfly-valve." The said rock-shaft is provided with a counterbalance-weight g^2, attached radially to the said rock-shaft in such manner as to close the said valve by gravity. A stop g^3 is inserted in the end of said casing in such manner that when the said valve is wide open the said stop engages the said weight g^2 and prevents the further rotation thereof. A similar stop g^5, against which the valve-disk shuts, is placed in the top of said casing. The inner end of the rock-shaft is provided with a gear-wheel g, which meshes with a pinion g' on the shaft of a magneto-electric motor of any desired kind conveniently placed for actuating the said valve. As herein shown, the valve-casing is provided at one end with a linear extension designed to set into the wall and contain the said motor; but it is evident that the electromotor need not be placed in such recess to obtain the desired result. It is, however, much more compact and convenient when so located, inasmuch as the motor then takes up no space in the room and is less liable to injury and consequent disarrangement. It is also evident that any oscillating valve may be used instead of that of rectangular form herein shown. The said motor G^4 is electrically connected with the thermostatic valve heretofore described, the connection being conveniently made as follows: A battery H of any desired kind is conveniently located and one of the poles thereof electrically connected with the said motor. The other pole of the said motor is electrically connected with the said thermostatic valve, preferably by having electrical connection with the pivot-pin b. One of the sectors of the valve-disk B is provided with a metallic extension h^2, so attached that when the said disk oscillates to open the said valve the said extension h^2 will come in contact with a metallic strip h' in electrical connection with the other pole of the said battery, and thus complete the circuit through the motor G^4 by means of the said oscillation of the valve-disk B. The circuit will be broken when the said disk B rotates back to close the valve.

K indicates a room it is desired to heat and ventilate; J and J′, two draft-conduits, J′ being located at a higher point than the conduit J, and I a heating-coil or other source of heat adjacent to the opening of the conduit J. The thermostatic valve is shown as applied to the inner end of the conduit J′, the valve facing into the room K. The valve G is shown as applied to the conduit J. In operation when the air within the room K reaches the temperature to which the thermostatic valve is adjusted the said valve will open by the oscillation of the disk B, as hereinbefore explained. The said movement of the disk completes the electrical circuit by bringing the two metallic conductors h' h^2 in contact, and the current passing through the motor G^4 sets the same in motion. The said motor now begins to open the valve, and if contact is continued will open said valve until the weight g^2 comes in contact with the stop g^3, when the valve will be wide open. The said engagement of the weight g^2 and stop g^3 acts as a brake for the said motor and prevents further rotation therein; but so long as the current continues the said motor acting against the geared wheels will hold the valve open. From the moment the valve G begins to open the cold air will begin to flow into the room therethrough and will be warmed by the source of heat I, placed opposite thereto. The air thus warmed expands and rises to the upper part of the room and flows out through the thermostatic valve. The said valve is set to a given temperature, and the moment the temperature of the outflowing air is lower than that for which the said valve is set the said thermostatic valve closes, thus breaking the electrical circuit by rotating the contact-piece h^2 from its engagement with h'. This deënergizes the motor G^4, and the weight g^2 on the valve-disk G^3 causes the said valve to close, the motor-armature turning freely backward when no longer restrained by or under the influence of the field-magnets of the motor. The weight will be again raised when the temperature within the room reaches the right point. Obviously the valve G need not be connected with a cold-air conduit, inasmuch as the source of heat and the pure-air

conduit may be beneath the floor of the room, as in the case of a hot-air furnace or an electrical or other heater, admitting pure hot air to the room K through registers in the floor or lower part of the side wall. In this construction the valve G may be used as such hot-air registers instead of the ordinary form of register and will operate in a manner similar to that heretofore described, except that the valves will be so connected that the opening of the thermostatic valve will close the valve G and the closing of the thermostatic valve will operate to open the said valve G. This may be accomplished by changing the location of the metallic strip h' to such position that the extension h^2 will come in contact therewith when the valve is closed. Obviously the weight g^2 is not essential, as one side of the valve may be made heavier or a spring may be applied to perform the function of the said weight.

I claim as my invention—

1. A ventilating apparatus comprising an air-inlet opening at the lower part of an apartment, a valve therein, a weight or its equivalent holding said valve normally closed an exit-aperture at the upper part of said apartment, a valve controlling the same, a thermostat connected with and operating with said valve and an electric actuating device for the valve of the inlet-opening, said electric actuating device being controlled by the movement of the said valve of the exit-opening.

2. A ventilating apparatus comprising an inlet-opening at the lower part of the apartment, a valve in said inlet-opening, a weight applied to hold said valve normally closed an electric motor acting on the valve to open the same against the action of the weight, an air-exit aperture at the upper part of the apartment, a valve controlling said exit-aperture, a thermostat connected with and operating said valve and an electric contact device operated by said valve and in circuit with the electric motor.

3. A ventilating apparatus comprising an air-inlet opening at the lower part of an apartment, a valve therein, a weight or its equivalent holding said valve normally closed, an electric motor operating to open said valve, an air-exit opening at the upper part of said apartment, a valve for controlling said opening provided with a rotative valve-disk, a thermostat for operating said valve which is attached to and moves with the valve-disk and an electric contact device operated by the movement of said valve-disk and in circuit with the said electric motor.

4. A ventilating apparatus comprising an air-inlet opening at the lower part of an apartment, a butterfly-valve therein, a weight or its equivalent applied to hold said valve normally closed, an electric motor applied to actuate said valve to open the same against the action of said weight, an air-exit opening at the upper part of said apartment, a valve for controlling the same having a rotative valve-disk, a thermostat for turning said disk attached to and moving with the same, an electric contact device actuated by the movement of said disk and in electric connection with the said motor, and means for heating the air admitted through said air-inlet opening.

In testimony that I claim the foregoing as my invention I affix my signature, in presence of witnesses, this 2d day of August, A. D. 1898.

OSCAR L. BILLINGS.

Witnesses:

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