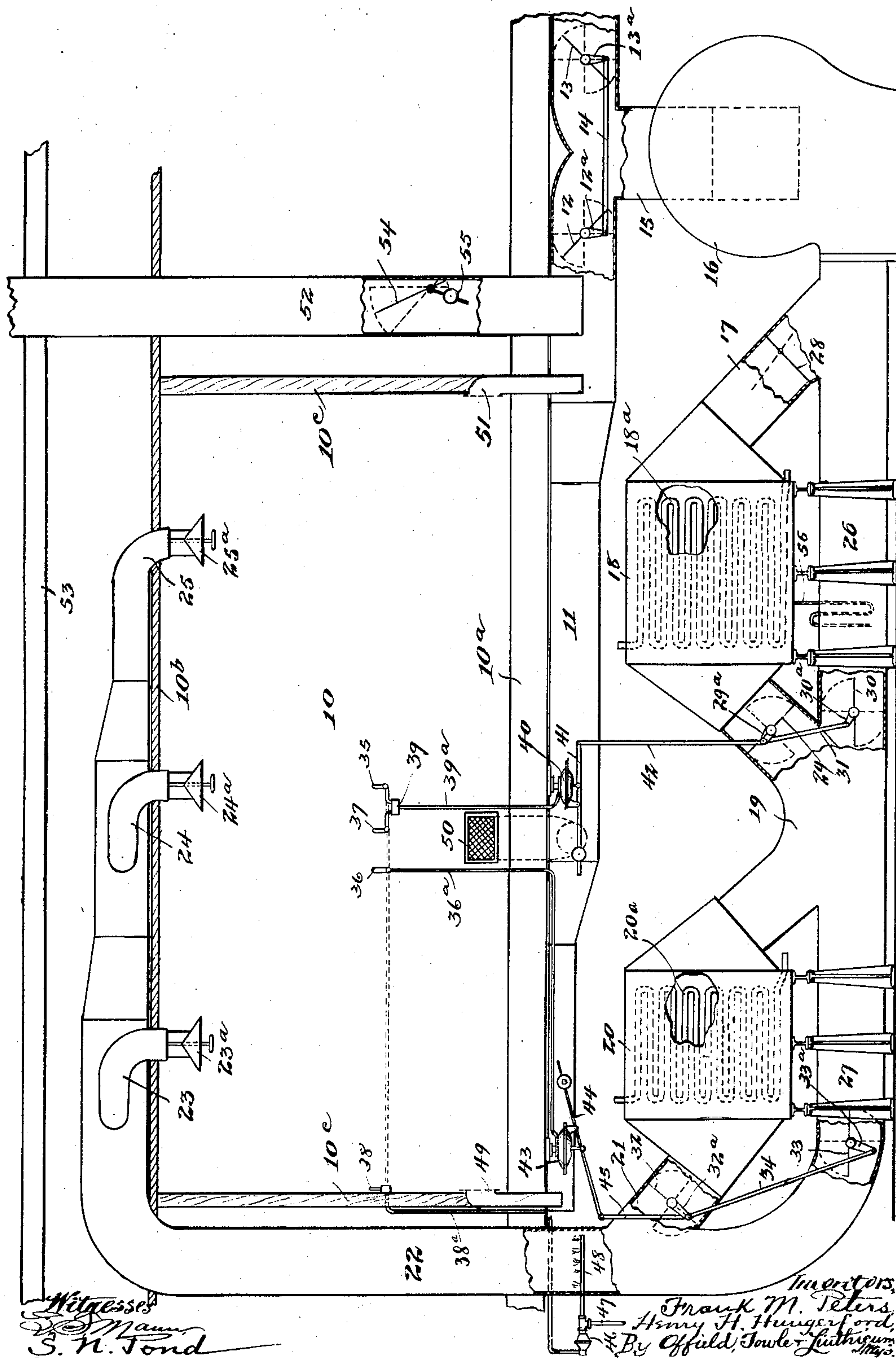


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F. M. PETERS & H. H. HUNGERFORD.  
ATMOSPHERE REGULATING SYSTEM.

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# UNITED STATES PATENT OFFICE.

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## ATMOSPHERE-REGULATING SYSTEM.

No. 843,909.

Specification of Letters Patent.

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*To all whom it may concern:*

Be it known that we, FRANK M. PETERS and HENRY H. HUNGERFORD, citizens of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Atmosphere-Regulating Systems, of which the following is a specification.

Our invention relates to improvements in systems and devices for regulating atmospheric conditions, and more particularly to a system which includes as features thereof means for controlling and regulating the temperature, the humidity, and the ventilation, any or all, of the room or chamber subjected to the influence of the apparatus.

Experience has shown that in bakeries, breweries, and similar establishments certain processes of manufacture or certain steps therein require a more or less protracted maintenance of atmospheric conditions of substantial uniformity as regards temperature, humidity, and ventilation, or any or all of these conditions, while in school-houses, hospitals, theaters, and the like it is also desirable and advantageous, for a variety of reasons, to maintain substantial uniformity of such atmospheric conditions.

In carrying out our invention we employ means for maintaining a circulation of air through a room or chamber, which means are regulable to maintain a constant flow of fresh air, a flow of fresh air in association with air that has already passed through the apartment, or a continuous circulation and reuse of the same or substantially the same body of air, and in connection therewith we employ thermostatically and humidostatically controlled agencies for maintaining substantially constant a desired character or condition of the air circulated with reference to its temperature and humidity.

Our invention is graphically shown in the accompanying drawing, which represents in diagrammatic form the various agencies employed in carrying out our invention and their relation to each other.

Referring to the drawing, 10 may represent a room or apartment designed to be controlled as to its atmospheric condition.

10<sup>a</sup> may represent the floor, 10<sup>b</sup> the ceiling, and 10<sup>c</sup> the side and end walls, of the apartment 10. Directly beneath the floor 10<sup>a</sup> is an air return and vent duct 11, one end of

which (the right-hand end as herein shown) leads to the external atmosphere, such end of the duct being controlled by a pair of dampers 12 and 13, the spindles of which are connected to operate in unison by arms 12<sup>a</sup> and 13<sup>a</sup>, respectively, and a connecting-rod 14. The air-duct 11 between the damper-valves 12 and 13 is tapped by the intake-duct 15 of a fan or blower, (indicated at 16.) The discharge side of said blower has connected thereto a pipe-section 17, leading into a box or cylinder 18, containing a series of cooling-coils, (indicated at 18<sup>a</sup>), whence a second curved pipe extension 19 leads into a second box or cylinder 20, containing a series of heating-coils, (indicated at 20<sup>a</sup>), whence a short section 21 communicates with an air-conduit pipe 22, leading up behind one end of the apartment and above the ceiling thereof, said pipe terminating in a group of discharge branches 23, 24, and 25, depending through the ceiling, said discharge-pipes preferably being provided with deflectors 23<sup>a</sup>, 24<sup>a</sup>, and 25<sup>a</sup>, respectively, designed to regulate the volume of air discharged into the apartment and likewise to thoroughly disperse and diffuse the same.

Between the pipe-sections 17 and 19 is a by-pass 26 around the air-cooler 18, and between the sections 19 and the junction of the sections 21 and 22 is a second by-pass around the air-heater 20. In the pipe-section 17 is interposed a balanced valve or damper 28, which is normally closed except when the current of air is to be directed through the cooler 18, while the adjacent ends of the section 19 and by-pass 26 are provided with damper-valves 29 and 30, respectively, the spindles of which are connected to operate in unison by arms 29<sup>a</sup> and 30<sup>a</sup> and a connecting-link 31 and so set that when either is wide open the other is closed. Similarly, in the pipe 21 and by-pass 27 are interposed damper-valves 32 and 33, respectively, the spindles of which are connected to operate in unison by arms 32<sup>a</sup> and 33<sup>a</sup> and a connecting-rod 34, said valves also being so set that when one is fully opened the other is closed.

In the apartment 10 are suitably located a pair of thermostats, the exposed parts of which are indicated at 35 and 36, and a pair of humidostats, the exposed parts of which are indicated at 37 and 38. The thermostat



35 and humidostat 37 may operate through a cumulative controller (indicated at 39) and a pressure-pipe 39<sup>a</sup> on a diaphragm-chamber 40, the diaphragm of which latter is connected, through a counterweighted lever 41 and link 42, with the rod 31, connecting the damper-valves 29 and 30. The thermostat 36 is similarly connected, through its pressure-pipe 36<sup>a</sup>, diaphragm-chamber 43, a counterweighted lever 44, and link 45, with the rod 34, connecting the damper-valves 32 and 33. The humidostat 38, through its pressure-pipe 38<sup>a</sup> and valve 46, governs the admission of a steam-jet through a pipe 47 and nozzle 48, which enters the air-conduit at any suitable point between the air-blower and the chamber, said nozzle being herein shown as penetrating the lower end of the section 22 in such a manner as to discharge the steam-vapor directly into the current of air traveling therethrough.

The outlet for the air in the apartment 10 is provided for by one or more flues 49, 50, and 51, opening through the inner surfaces of the side and end walls of the apartment and leading thence through the floor into the return and vent duct 11. A vent-pipe 52 at its lower end taps the duct 11 inwardly of the innermost damper-valve 12, said pipe extending through the ceiling of the apartment and through the superposed roof of the building, (indicated at 53.) At any suitable point in the vent-pipe 52 is placed a balanced damper-valve 54, the counterweight 55 of which is so arranged as to normally maintain the valve closed, but permit it to open more or less, accordingly as the return-passage for the air to the fan is closed or opened. The cooler box or cylinder has tapping its bottom a trapped discharge-pipe 56 for a purpose hereinafter described.

The operation of our improved system of atmosphere regulation is substantially as follows: Assuming that the damper-valves 12 and 13 are so set as to close the valve 12 and open wide the valve 13 and the fan having been set in operation, a current of fresh air from outside is drawn into and forced through the fan. Assuming that this air is at or substantially at the predetermined temperature desired within the apartment 10 to which the thermostats have been set, the latter will so operate as to maintain closed the valves 29 and 32 and maintain open the valves 30 and 33, under which condition of the apparatus the current will flow directly through the by-passes 26 and 27, the section 22, and the discharge-sections 23, 24, and 25 into the chamber 10, the air passing thence through the discharge-flues 49, 50, and 51 into the return and vent duct 11, whence the current rises and passes off through the vent-pipe 52, the force of the current being sufficient to swing the balanced valve 54 open sufficiently to permit its passage. If, however, the air

drawn from outside through the fan exceeds the desired temperature limit of the chamber 10, the thermostat indicated at 35 promptly reverses the dampers 29 30; thus causing the current of air from the blower to pass through the cooler 18, the closing of the damper 30 creating sufficient pressure to open the balanced valve 28 and permit the flow of air past the same. If, on the other hand, the air from outside is cooler than is desired to be maintained in the chamber 10, the thermostat indicated at 36 acts to reverse the valves 32 and 33, thereby causing a current of air emerging from the by-pass 26 to travel through the heater 20. By means of the steam-pipe 47 and jet 48 a supply of aqueous vapor may be furnished to the current of air on its way to the apartment, and if the incoming air proves to be too dry or if its travel through the cooler 18 has extracted too much of the humidity therefrom the current of air can be moistened to the required degree by this means, which is controlled by the humidostat 38 acting, through its valve 46, to admit the supply of steam-vapor. If, on the other hand, the entering air contains an undue percentage of moisture, the humidostat 37 acts on the valves or dampers 29 and 30 to direct the air-current through the cooler 18, by which the moisture in the air is partially or wholly condensed, the deposited moisture being drained off through the pipe 56. Should this operation have the effect of too greatly cooling the air, the thermostat 36 will act at the same time upon the valves 32 and 33 to direct the dried cold current of air through the heater 20.

The thermostat 35 and humidostat 37 control independent valves that admit compressed air through the pipe 39<sup>a</sup> to the diaphragm-chamber 40. If the conditions in the chamber 10 are too hot and too moist, both valves will open, admitting compressed air cumulatively to the diaphragm-chamber, and thereby shifting the dampers to direct the incoming air through the cooler, which is also a condenser and extracts the moisture. If the conditions in chamber 10 are too cold and too dry, neither the thermostat 35 nor the humidostat 37 will act, but these conditions will be regulated by the thermostat 36 and the humidostat 38. If the air in chamber 10 is too hot, but hygroscopically correct, the thermostat 35 alone will act, the humidostat 37 being idle. On the other hand, if the air in the chamber 10 is too moist, but of correct temperature, the humidostat 37 will act and the thermostat 35 will be idle. It will thus be seen that the thermostat 35 and humidostat 37 control only the positive conditions of temperature and humidity, while the negative conditions are controlled by the other pair 36 and 38. In other words, one of the thermostats controls the rising and the other the falling of the temperature rela-



tively to a given point or degree, while, similarly, one of the humidostats controls the increase and the other the decrease of humidity relatively to a given point or percentage of the same. There is no interference in the action of these parts, since the humidostat of either pair will promptly act to correct any change of hygroscopic conditions incidentally created by the action of the thermostat of the other pair, and vice versa.

Under some conditions it is feasible and practicable in order to avoid the necessity of either heating or cooling a stream of air constantly flowing from the outside to maintain a closed circulation of the air in the apartment, and this may readily be done by reversing the valves 12 and 13, to open the former and close the latter. In this case the air-current discharged from the apartment through the return-duct 11 is obviously reconveyed to the inlet-pipe of the blower and forced thence to and through the circulation-pipes and the apartment in a continuous and closed circuit. In this case, there being no pressure on the valve 54 in the vent 52, this valve automatically closes and prevents the induction of external air through said vent. In still other circumstances it may be feasible and desirable to maintain in part a closed circuit, permitting the introduction, however, of a certain proportion of external air. For this purpose the valves 12 and 13 may be set partially open to any desired extent or degree, as shown by the full lines in the drawing, in which case the blower draws in air from both the return and vent duct 11 and from the outer atmosphere, a certain portion of the air discharged from the apartment rising through the vent 52.

From the foregoing it will be seen that our invention provides a system of ventilation which not only maintains a constant and uniform flow of air through an apartment or storage-chamber and a consequent constant change of the air therein, but may also provide for the maintenance of constant and uniform thermal or hygroscopic conditions, or both, within said apartment, irrespective of such conditions prevailing outside. Obviously for the preservation of goods and materials susceptible to deterioration and injury through thermal and hygroscopic changes a system such as our invention provides fills an important place. Similarly, in hospitals, school-houses, theaters, or other inclosed places or apartments where a great number of persons may congregate or where it is essential for the comfort and health of human beings to have perfectly-controlled atmospheric conditions such conditions may be insured by the employment of the apparatus or system herein shown.

It is evident that numerous changes and modifications, particularly in the relative detail arrangement of the air-forcing device,

the air-conduits, the heater, the cooler, the moistener, and other appurtenances of the system, might be employed without departing from the spirit or lessening the advantages of the invention, and hence we do not limit ourselves to the particular construction or relative arrangement of the elements of the system as shown and described, except to the extent indicated in specific claims.

We claim—

1. In an atmosphere-regulating system for rooms, the combination with an air-forcing device and a conduit extending from the discharge side thereof to and through a wall of the room, of an air-heater interposed in said conduit, a by-pass around said heater, an air-cooler also interposed in said conduit, a by-pass around said cooler, and separate thermostatically-operated means serving to control the passage of the air-current through said heater and cooler and their respective by-passes respectively according to the temperature in the room, one of said means operating when the maximum and the other when the minimum desired temperature is attained, substantially as described.

2. In an atmosphere-regulating system for rooms, the combination with an air-forcing device and a conduit extending from the discharge side thereof to and through a wall of the room, of an air-cooler interposed in said conduit, a by-pass around said cooler, an air-heater also interposed in said conduit, a by-pass around said heater, thermostatically-operated means serving to control the passage of the air-current through said heater and cooler and their by-passes according to the temperature in the room, and humidostatically-controlled means also serving to control the passage of the air-current through said cooler, substantially as described.

3. In an atmosphere-regulating system for rooms, the combination with an air-forcing device and a conduit extending from the discharge side thereof to and through a wall of the room, of a moisture-condenser interposed in said conduit, a by-pass around said condenser, and means operated by a humidostat located in the room serving to direct the air-current through said condenser or said by-pass, substantially as described.

4. In an atmosphere-regulating system for rooms, the combination with an air-forcing device and a conduit extending from the discharge side thereof to and through a wall of the room, of a moisture-condenser interposed in said conduit, a by-pass around said condenser, means operated by a humidostat located in the room serving to direct the air-current through said condenser when the humidity of the air in the room exceeds a predetermined point, a vapor-injector interposed in said conduit, and means operated by the humidostat located in the room serving



to admit vapor through said injector when the humidity of the air in the room falls below a predetermined point, substantially as described.

- 5 5. In an atmosphere-regulating system designed to maintain substantially constant temperature and humidity conditions in a room, the combination with an air conduit or circuit in which the room is interposed, of an  
10 air-forcing device in said conduit, air heating and cooling means also interposed in said conduit, valve-controlled by-passes around the same, thermostatically-controlled means for controlling the engagement of the circulating current with said heating and cooling  
15 means, and humidostatically-controlled means for injecting steam or other vapor into the circulating air-current, substantially as described.
- 20 6. In an atmosphere-regulating system designed to maintain substantially constant temperature and humidity conditions in a room, as well as to control the ventilation thereof, the combination with an air conduit  
25 or circuit in which the room is interposed, of an air-forcing device in said conduit, air heating and cooling means also interposed in said circuit, valve-controlled by-passes around the same, thermostatically-controlled means  
30 for controlling the engagement of the circulating current with said heating and cooling means, humidostatically-controlled means

for controlling the engagement of the circulating current with said cooling means, and other humidostatically-controlled means for  
35 extracting moisture from said air-current, air inlet and outlet passages also communicating with said circuit, and means whereby the circuit may be maintained open, closed, or partially opened and closed relatively to  
40 the outer air, substantially as described.

7. In an atmosphere-regulating system for rooms, the combination with an air conduit or circuit in which the room is interposed, of  
45 an air-forcing device in said circuit, the intake member of said air-forcing device having means whereby it may be connected wholly with the circuit or wholly with the external atmosphere, or partially with both,  
50 air heating and cooling means interposed in said circuit, valve-controlled by-passes around the same, separate thermostatically-controlled means for controlling the engagement of the circulating current with said  
55 heating and cooling means respectively, and a vent-pipe tapping said conduit between the room and the air-forcing device, substantially as described.

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