A. S. SANTOS.

SYSTEM FOR EFFECTING HUMIDITY CONTROL.

APPLICATION FILED JUNE 21, 1917.

1,270,747.

Patented June 25, 1918.

4 SHEETS—SHEET 1.

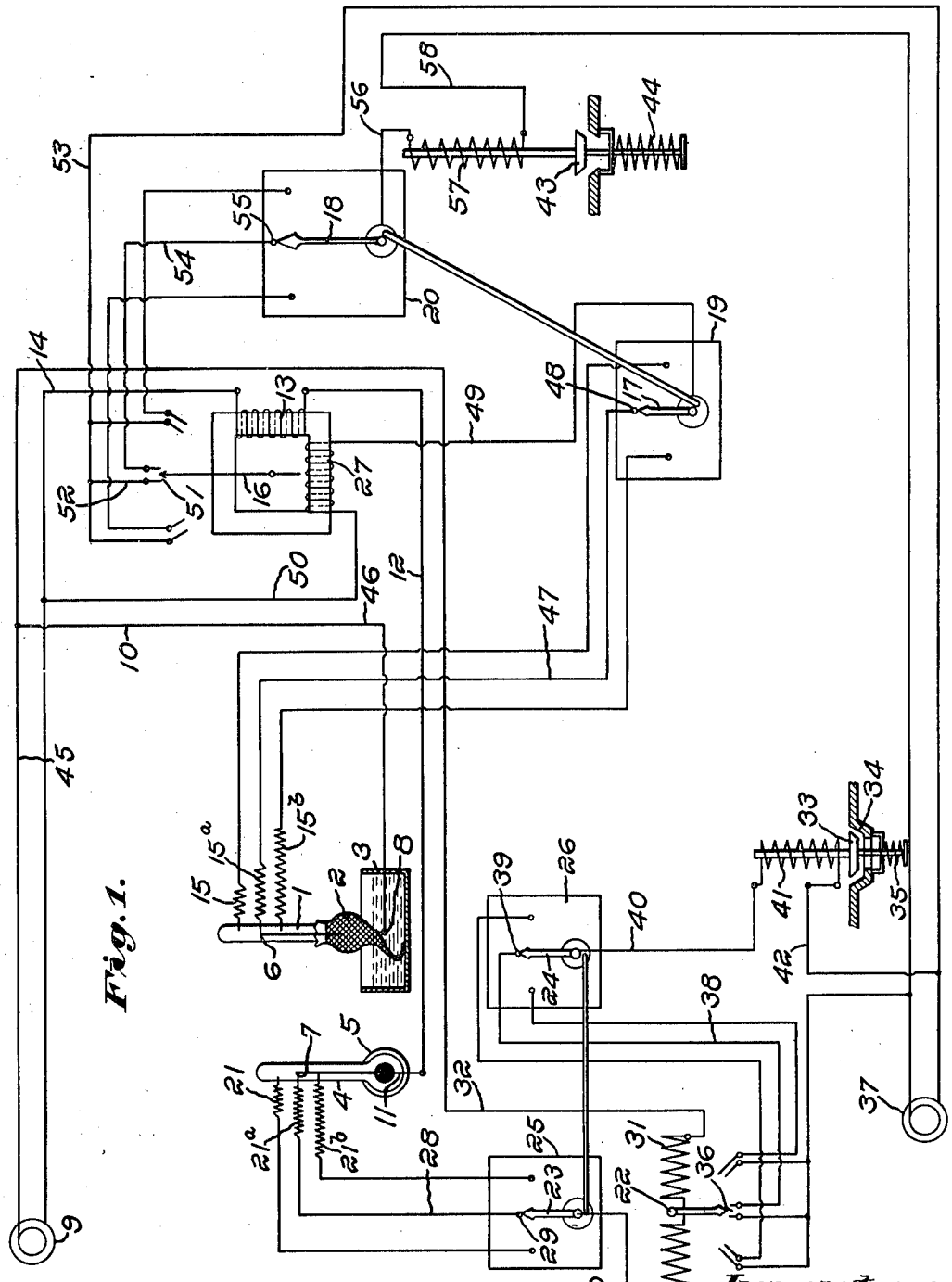


Fig. 1.

Inventor:
Anthony S. Santos,
by Emery, Booth, Janney and Varney
Attys.

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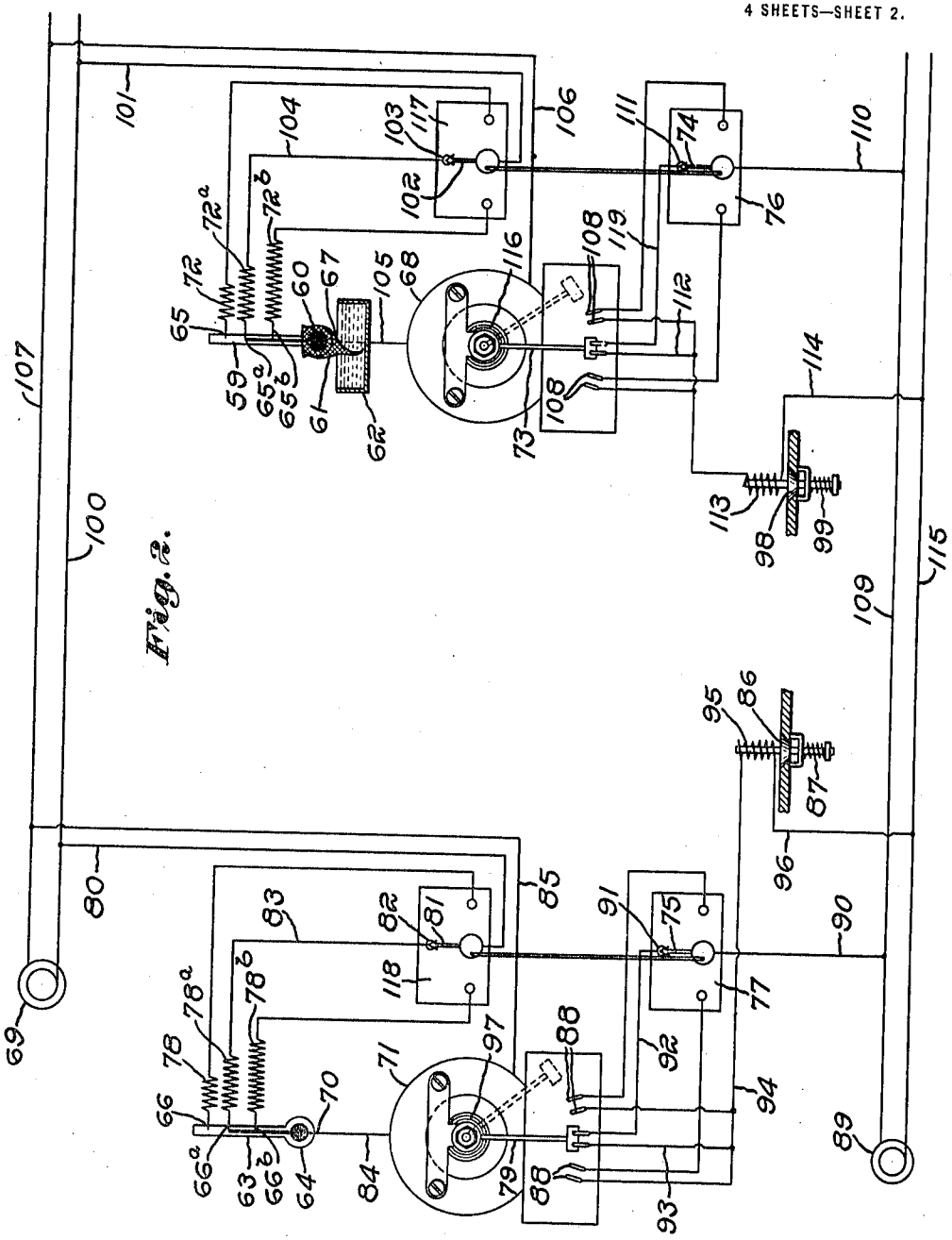


Fig. 2.

Inventor:
Anthony S. Santos.
by Emery, Booth, Janney and Varney
Attys.

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4 SHEETS—SHEET 3.

*Fig. 3.*

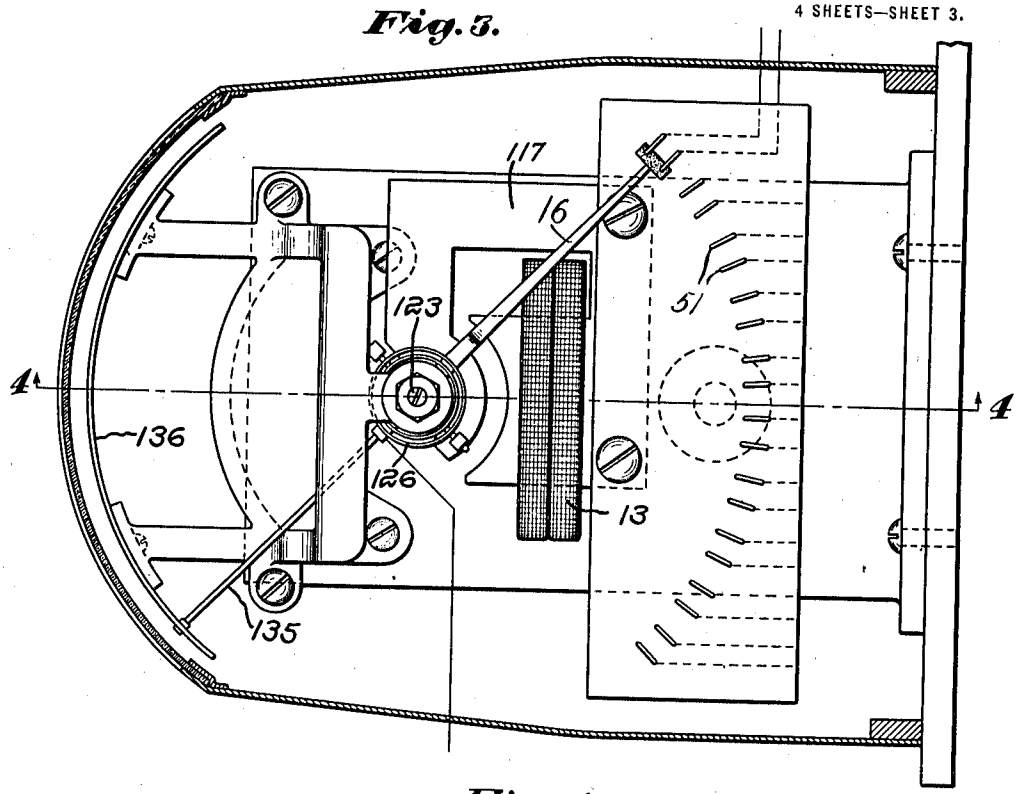
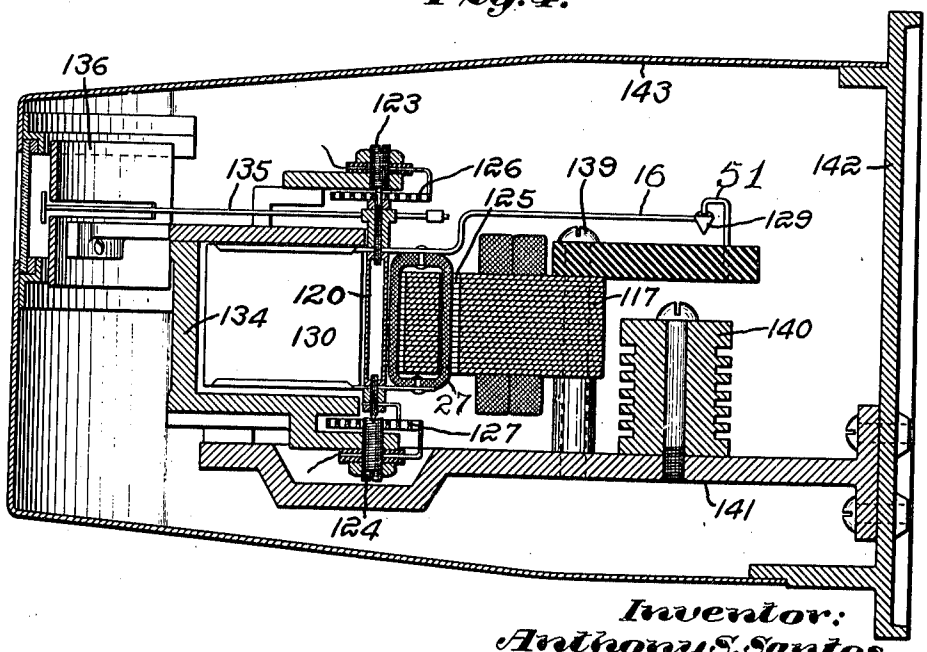



*Fig. 4.*




*Inventor:*
*Anthony S. Santos,*
*by Emery, Booth, Janney and Varney*
*Attys.*

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4 SHEETS—SHEET 4.

*Fig. 7.*

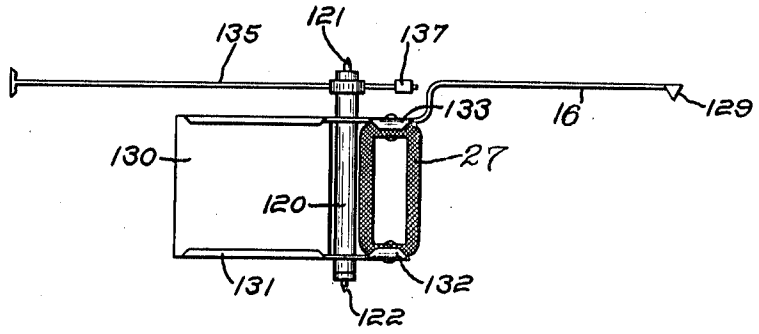



*Fig. 5.*

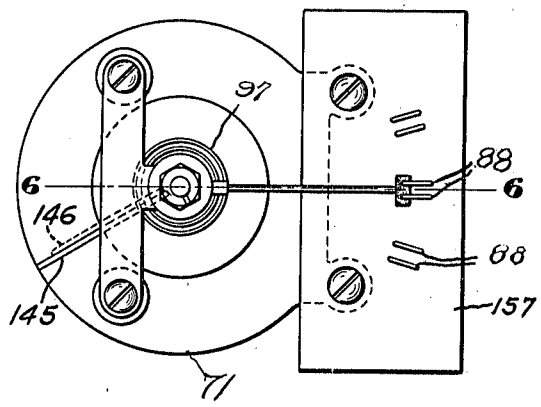



*Fig. 6.*

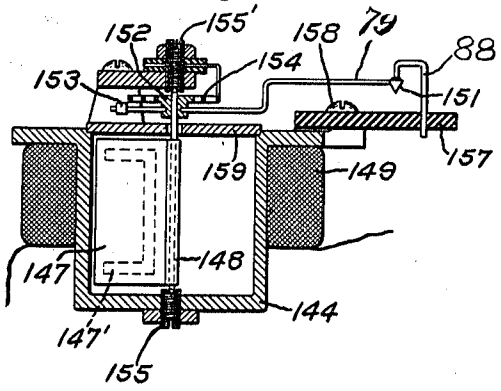
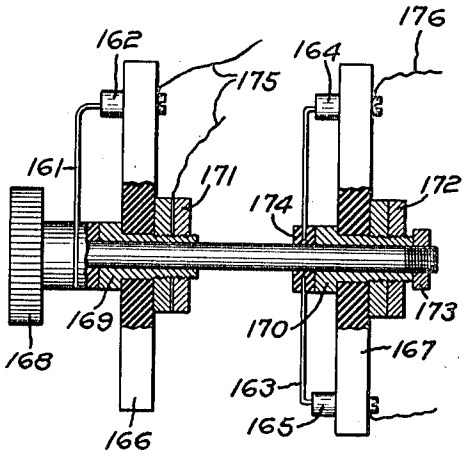



*Fig. 8.*




*Inventor:*
*Anthony S. Santos,*
*by Emery, Booth, Janney and Varney*
*Attys.*

# UNITED STATES PATENT OFFICE.

ANTHONY SILVA SANTOS, OF WEST ROXBURY, MASSACHUSETTS, ASSIGNOR TO SPRAY ENGINEERING COMPANY, OF BOSTON, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

## SYSTEM FOR EFFECTING HUMIDITY CONTROL.

1,270,747. Specification of Letters Patent. Patented June 25, 1918.

Application filed June 21, 1917. Serial No. 176,082.

*To all whom it may concern:*

Be it known that I, ANTHONY SILVA SANTOS, a citizen of the United States, and a resident of West Roxbury, in the county of Suffolk and State of Massachusetts, have invented an Improvement in Systems for Effecting Humidity Control, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to systems for effecting humidity control.

In order that the principle thereof may be readily understood, I have disclosed certain embodiments thereof in the accompanying drawings, wherein—

Figure 1 is a diagrammatic representation of one form of heating and humidifying system embodying my invention;

Fig. 2 represents a somewhat modified system for carrying out my invention;

Fig. 3 is a plan view of a humidity controller that may be used in the practice of my invention, the casing thereof being in section;

Fig. 4 represents a vertical longitudinal section of said humidity controller on the line 4—4 of Fig. 3;

Fig. 5 is a plan view of a temperature controller that may be employed in the practice of my invention;

Fig. 6 is a cross section thereof upon the line 6—6 of Fig. 5;

Fig. 7 is a side elevation of the humidity controller moving element; and

Fig. 8 is a view in side elevation and in section of the selective switching arrangement for obtaining the desired humidity of temperature.

In accordance with my invention, I have provided a system for effecting temperature and humidity control, and preferably including an electric circuit and means associated therewith having a high co-efficient of expansion, a series of contacts in said circuit associated with said high co-efficient of expansion, selective means associated with each of said contacts for effecting a change in the strength of the current of the said circuit, and temperature and humidity controllers in circuit with said high co-efficient of expansion means and said contacts, and operated through movement of said high co-efficient of expansion means and the consequent changes in the strength of the said current.

Preferably such system includes wet and dry bulb thermometers with a series of contacts for each thermometer, selective means associated with each of said contacts for effecting a change in the strength of the current of the circuit having said contacts, and temperature and humidity controllers of any suitable type in circuit with the said thermometers, contacts and selective means.

Other means than those herein described may be provided to vary the strength of the current, and other types of means for providing a suitable current may, of course, be employed.

Referring first to that disclosure of my system in Fig. 1, I have therein represented selective resistances operatively associated with two thermometers, namely, a dry bulb thermometer and a wet bulb thermometer. The selective resistances of the dry bulb thermometer are connected with the selective temperature switch and energizing coil of the temperature controller, and source of electric current. The selective resistances of the wet bulb thermometer are connected with the selective humidity switch, moving element of the humidity controller and source of electric current. The selective switches of both the humidity and temperature controllers are in accordance with my system arranged to change at the same time the switch points leading to the solenoid valves and the selective resistances.

Referring more particularly to Fig. 1 of the drawings, the wet bulb thermometer is indicated at 1, it having a bulb covered by some suitable fibrous material such as woven silk extending down into a water receptacle 3. The water rises through the material 2 by capillary action and cools the thermometer bulb according to the evaporative capacity of the air in the locality where the temperature and humidity are to be controlled. The dry bulb thermometer is indicated at 4, and has a bulb 5 exposed to the circulating air. The two thermometers are preferably of common commercial varieties, and are provided with contact wires 6 and 7 respectively entering the tubes at a suitable number of different points and making contact with the rising and falling mercury columns.

The several contacts 6 are placed at de-

termined points on the tube of the wet bulb thermometer and such points are positioned to correspond with the wet bulb thermometer temperature of the selected humidity. I also provide a contact point 8 at the bottom of the wet bulb thermometer in order to effect connections with the source of current 9 through the wire 10. The dry bulb thermometer 4 has its contacts 7 placed at selected points on the tube so as to make contact as described, and said selected points correspond with the selected temperature. I also provide a contact point 11 at the bottom of the bulb 5 of the dry thermometer to make connections through the wire 12 with the fixed coil 13 of the humidity controller and the source of current 9 through the wire 14.

The contact points 6 of the web bulb thermometer 1 are connected in this embodiment of my invention to selective resistances 15, $15^a$, $15^b$ of determined ohmic non-inductive resistances, so as to allow the flow of a determined current to give a certain deflection to the moving element 16 of the humidity controller to correspond with the selective humidity. The said selective resistances 15, $15^a$, $15^b$ are connected to the contact points 6 which correspond with the wet bulb temperatures, which in turn correspond with the selected humidity indicated by the switch levers 17, 18 of the switches 19, 20.

The contact points 7 of the dry bulb thermometer 4 are in the embodiment of my invention connected to selective resistances 21, $21^a$, $21^b$ of determined ohmic non-inductive resistance so as to allow the flow of a determined current to give a certain deflection to the moving element 22 of the temperature controller to correspond with the selected temperature. The said selective resistances 21, $21^a$, $21^b$ correspond with the selected temperatures indicated by the switch levers 23, 24 of the switches 25, 26.

Referring now to the operation of the disclosed embodiment of my invention, let it be supposed that it is desired to obtain a temperature of seventy degrees and a humidity of seventy per cent. The wet bulb temperature corresponding with such humidity is 63.5 degrees, which means that the contact point 6 to correspond with that humidity will be placed on the wet bulb thermometer 1 at 63.5 degrees. Such contact point 6 will then be connected to a selected resistance of a certain ohmic value, which will allow a certain amount of current to flow through the moving coil 27 of the humidity controller. Preliminarily to this, however, it is necessary to place the selected switch blades on the desired point indicated on the switches 25, 19, corresponding with the desired temperature and humidity, namely, seventy degrees and seventy per cent. Current will then flow from the current source 9 through wire 14, then through fixed coil 13 of the humidity controller, through wire 12, contact point 11 up the mercury column of the dry bulb thermometer 4, contact point 7, resistance $21^a$, wire 28, contact point 29, and blade 23 of the switch 25, wire 30, energizing coil 31 of the temperature controller, and wire 32, back to the source of current 9.

I have diagrammatically indicated a valve 33 adapted to seat in a valve casing 34, it being evident that any suitable type of valve may be employed. The said valve 33 is normally held open by the coil spring 35. As soon as the coil 31 is energized, it will give a deflection corresponding with the desired temperature, whereby the pointer or blade 22 will close the contacts 36, allowing current to flow from the source of current 37 through the wire 38, switch point 39 and blade 24 of the switch 26, wire 40, thereby energizing solenoid 41 and returning to the source 37 through the wire 42. As soon as the solenoid 41 is energized, it will close valve 33 against the tension of the spring 35, thereby shutting off the steam or other heat supply. As soon as the mercury column drops, it will open the temperature controlled circuit, deënergizing the coil 31, the pointer 22 will open the contact 36, thereby deënergizing the solenoid 41. The spring 35 will thereupon open the steam or other heat valve 33 letting on the steam heat. The process will be reversed as soon as the mercury column again touches the said contact 7, thereby keeping the temperature at a constant value of seventy degrees.

The wet bulb temperature or humidity is controlled in the following manner in the system shown in Fig. 1. The current supply to operate the humidity controller is preferably taken in parallel. I provide a suitable valve, herein diagrammatically indicated at 43. This valve is normally held open by the spring 44, and the air is thereby humidified until the mercury column of the wet bulb thermometer rises and closes the circuit at the suitable contact point 6. In such case the path of the current is as follows:

From the source of current 9 the current passes through the wires 45, 10, the contact 8, thence up the mercury column of the wet bulb thermometer 1, the contact point 6, the selective resistance $15^a$, the wire 47, the switch point 48, the blade 17 of the switch 19, thence through the wire 49, the moving coil 27 of the humidity controller, through wire 50, back to the source 9, thereby completing the circuit.

As soon as the coil 27 is energized, it will give a deflection which will correspond with the amount of the current flowing through said coil, and the coils 31 of the temperature controller and the coil 13 of the humidity controller. In this manner, the pointer 16

attached to the movable coil 27 of the humidity control will close the contacts 51, allowing current to pass from the source 37 through the wires 53, 52, 54, thence through the switch point 55, and blade 18 of the switch 20, thence through wire 56, solenoid 57, and wire 58 back to the source of current 37. As soon as solenoid 57 is energized, it will close the valve 43 against the tension of spring 44, thereby shutting off the humidification. As soon as the mercury column drops, it will open the humidity controlling circuit, deënergizing the movable coil 27, the pointer 16 will open contact 51, thereby deënergizing the solenoid 57. The tension of the valve spring 44 will then open the humidification valve, thereby increasing the humidity. The process will be reversed as soon as the mercury column touches the contact 6, thereby keeping the humidity at the constant value of seventy per cent.

Fig. 2 represents another form of my invention for effecting the temperature and humidity control, but wherein also I employ selective resistances to which my invention is not, however, limited. In such form of my invention, the numeral 59 indicates a wet bulb thermometer having a bulb 60 which is covered by woven material, such as silk 61 extending down into a receptacle 62 containing water, the water rising up through the woven material by capillary action and cooling the thermometer bulb 60 according to the evaporative powers of the air in the locality where the temperature and humidity are to be controlled. The dry bulb thermometer is indicated at 63, and has its bulb 64 exposed to the circulating air. The said two thermometers may be of common commercial variety and are respectively provided with contact wires 65, $65^a$, $65^b$, and 66, $66^a$, $66^b$ entering the tubes and making contact with the rising and falling mercury column within. The said contact points are placed at determined points on the tubes. In the case of the wet bulb thermometer 59, the contact points 65, $65^a$, $65^b$ are placed to correspond with the wet bulb thermometer temperature of the selected humidity. There is also a contact point 67 at the bottom of the bulb 60 to make connections with the fixed coil of the humidity controller 68 and the source of current 69. The dry bulb thermometer 63 has its contact points 66, $66^a$, $66^b$ placed at selected points on the tube and making contact with the rising and falling column of mercury within. These contacts are also placed at selected points to correspond with the selected temperature, there being a contact point 70 at the bottom of the bulb 64 to make connection with the fixed coil of the temperature controller 71 and the source of current 69.

The contact points 65, $65^a$, $65^b$ of the wet bulb thermometer 59 are connected to selective resistances 72, $72^a$, $72^b$ of a determined ohmic non-inductive resistance so as to allow the flow of determined current to give a certain deflection to the moving element 73 of the humidity controller 68 to correspond with the selected humidity. The said selective resistances 72, $72^a$, $72^b$ are connected to the contact points 65, $65^a$, $65^b$ which correspond with the wet bulb temperature of the selected humidity indicated by switch levers 74 and 102 of switches 76 and 117, respectively.

The contact points 66, $66^a$, $66^b$ of the dry bulb thermometer 63 are connected to selective resistances 78, $78^a$, $78^b$ of determined ohmic inductive resistances, so as to allow the flow of a determined current to give a certain deflection to the moving element 79 of the temperature controller 71 to correspond with a selected temperature. The said selective resistances 78, $78^a$, $78^b$ are connected to the contact points 66, $66^a$, $66^b$ which correspond with the dry bulb temperature and which in turn corresponds with the selected temperature indicated by the switch levers 75, 81 of the switches 77, 118.

The operation of this form of my invention is as follows: Let it be assumed that it is desired to obtain a temperature of seventy degrees Fahrenheit and a humidity of seventy per cent. The wet bulb temperature corresponding to this humidity is 63.5° F., which means that the contact point to correspond with that humidity will be placed on the wet bulb thermometer 59 at 63.5° F. Such contact point will then be connected to a selective resistance of a certain ohmic value which will allow a certain amount of current to flow through the fixed coil of the humidity controller 68.

The first step in the operation is to place the selective switch blades on the desired points shown on switches 76, 77 or those which correspond with the desired temperature and humidity, namely, 70° F. and 70%.

Current will then flow from the source 69 through wire 80, selective resistance switch blade 81, switch point 82, wire 83, selective resistance $78^a$, the mercury column of thermometer 63, the contact point 70 on the bulb 64, the wire 84 connecting the fixed coil of the temperature controller 71 and the wire 85 back to the source 69.

I have provided the steam valve 86, which is always open by the tension of a suitable spring 87. As soon, however, as the coil of the temperature controller 71 is energized, it will magnetize the moving element of pointer 79 which will give a deflection corresponding to the desired temperature. Thus the pointer 79 will close the proper pair of contacts 88, allowing the current from the source 89 to flow through the wire 90, switch blade 75 of the switch 77, the switch point 91, the wire 92, the mercury contact

points 88, the wires 93, 94, the solenoid coil 95 of the valve 86, and the wire 96, back to the source of current 89.

As soon as the solenoid coil 95 is energized, it will close the steam valve 86 against the tension of the spring 87, thereby shutting off the steam supply. As soon as the mercury column drops, it will open the temperature controller circuit at the contact point 66ª, deënergizing the fixed coil of the temperature controller 71 and the pointer 79 which will be returned to the dotted line position by the hair spring 97, thereby opening contacts 88 and deënergizing the solenoid 95. The tension of the spring 87 thereupon will open the steam valve 86, thereby admitting steam heat. The process will be reversed as soon as the mercury column rises to a higher contact point, thereby keeping the temperature at a constant value of 70° F. In this manner, the dry bulb temperature controls the valve 86, and in a similar manner the wet bulb temperature or humidity controls a suitable valve.

The supply current to operate both the temperature and humidity controllers is taken across the source or in parallel.

The operation of the humidity controller shown in this form of my invention is as follows: I provide a suitable valve 98 which is held open by the tension of a suitable coil spring 99, thereby effecting humidification of the air until the humidity has become high enough to cause the mercury column in the wet bulb thermometer 59 to rise and close the circuit at one of the contact points 65, 65ª, 65ᵇ.

The first step in the operation is to place the humidity selective switch blade 74 upon the desired point, say 70%. The path to the electric current from the source of current 69 is through the wires 100, 101, the selective switch blade 102, the switch point 103, the wire 104, selective resistance 72ª, contact point 65ª, the mercury column, the contact point 67, the wire 105, connecting the coil of the humidity controller 68, the wire 106, and the wire 107 back to the source of current 69. As soon as the coil of the controller is energized, it will deflect the moving element carrying pointer 73 with mercury contact at the end thereof, it will close suitable pairs of contacts 108, allowing current from the source 89 to flow through the wires 109, 110, switch blade 74 of the switch 76, contact point 111, wires 119, 112, solenoid coil 113, and wires 114, 115 back to the source of current 89.

As soon as the solenoid coil 113 is energized, it will close the valve 98 against the tension of coil spring 99, thereby closing the source of humidification.

When the mercury column drops again, it will open the humidity controlling circuit at point 65ª, deënergizing the controller coil. The pointer 73 will then return to the position shown in Fig. 2 in dotted lines, through the action of hair spring 116, thereby opening the valve circuit at the contact points 108, thus deënergizing the solenoid coil 113. The tension of the spring 99 will then open the valve 98, thereby effecting an increase in the humidity. The process will be reversed as soon as the mercury column rises and touches contact point 65ª, closing the circuits and keeping the humidity at a constant value of 70% or any other desired value.

In Figs. 3, 4 and 7, I have represented in plan and in cross section a humidity controller which may, if desired, be employed by me in the practice of my invention, but to the use of which my invention is not limited. In said figures, I have at 117 indicated a core built up of iron laminations punched and machined to the desired shape and have wound on a leg thereof the fixed coil 13, which I herein term the dry bulb thermometer coil and which may correspond to the fixed coil 13 of Fig. 1. This coil is connected in series with the energizing coil of the temperature controller in Fig. 1, and the selective resistance pertaining thereto. I have indicated a movable coil at 27, and corresponding to the movable coil 27 of Fig. 1, it being suspended on a shaft 120 having pivots 121, 122 supported in suitable bearings 123, 124. The said coil 27 is free to move in a slot 125 punched out in the core 117, against the tension of two hair springs 126, 127. The said coil 27 is shown in detail in Fig. 7. The said coil and the coacting parts in Fig. 7 correspond to and constitute the moving element 16 of Fig. 1. At 16, I have indicated a pointer corresponding to the moving element 16 of Fig. 1, and preferably made of aluminum and carrying at its outer extremity a V shaped cup 129 carrying a drop of mercury. The inner extremity of the pointer 16 is bent so as to hold a light vane of aluminum 130, the opposite edge of such vane being held in place by a preferably aluminum strip 131. The opposite end of the strip 131 is suitably bent or formed as indicated at 132 to hold in position the movable coil 27. The upper end of said coil 27 is herein shown as held in place by a suitable formation 133 upon the pointer arm 16. The said coil 27, the vane 130, the pointer 16 and the strip 131 are secured to the shaft 120 in any suitable manner and preferably as shown in Fig. 4.

The vane 130 is inclosed in a suitable casting 134 and acts as a damper to the moving coil 27 when the latter moves in the core 117 under the influence of the electric field caused by the current flowing through the fixed coil 13 and the movable coil 27. The latter coil I herein term the wet bulb ther-

mometer coil, and it is connected to the wet bulb thermometer of Fig. 1 through the selective resistances described in connection with said figure.

Upon the shaft 120 is mounted a second pointer 135 to indicate the position of the moving element on a suitable scale 136 shown most clearly in Fig. 3. The said pointer may also be used to indicate the position of the V shaped cup 129 or the humidity of the surrounding air. The moving element 27 is balanced by means of suitable counterweights, one of which is indicated at 137 in Fig. 7.

The hair springs 126, 127 serve to move the V shaped cup 129 away from the contacts 51 corresponding to the contacts 51 in Fig. 1 and indicated most clearly in Fig. 3 when the coil 27 is deënergized, thereby opening the circuit of said contacts 51. The said contacts are secured to any suitable member, such as a bakelite board secured to the iron core 117 by screws 139. The contacts 138 are fastened to their respective points on the switch 20 in Fig. 1 and the solenoid 57 of the valve 43. At 140, I have indicated a convenient form upon which to wind current limiting resistances in series with the movable coil 27. The controller is provided with a suitable base 141, back 142 and cover 143.

The operation of the humidity controller is as follows: The deflection of the moving element of Figs. 3, 4 and 7 is proportional to the resistance inserted in the wet bulb and dry bulb thermometers; that is, the resistance coils attached to the thermometer tubes are selected to give a certain deflection corresponding to a desired humidity. Let it be supposed that the resistances 15, $15^a$ or $15^b$ and 21, $21^a$, or $21^b$ of Fig. 1 be in the circuit. The said resistances 21, $21^a$, $21^b$ will allow only a certain amount of current to flow to the fixed coil 13, thereby magnetizing the core 117 to a certain degree. Each resistance 15, $15^a$ or $15^b$ will also allow the flow of a certain current through the movable coil 27, thereby effecting movement thereof to a point corresponding to certain humidities. If the resistance $15^a$ has been placed at the point 63.5° F. on the wet bulb thermometer and the resistance $21^a$ has been placed at the point 70° of the dry bulb thermometer, the current flowing through these resistances will give a deflection to the moving element of the humidity controller which will correspond to a contact point 51, thus effecting the humidity of 70%. As soon as the V-shaped cup 129 bridges a pair of contacts 51, current flows through the mercury in the cup, thereby energizing solenoid 57 in Fig. 1, thus closing the valve 43. It is evident that any slight change of temperature in the room will effect either the dry or wet bulb thermometers, thereby changing the position of pointer 16 carrying the V shaped cup 129. As the mercury column of the thermometers rises and falls, it will cut the resistances out or include them into the circuit, thereby changing the position of the cup 129. If the resistances are calibrated, it is evident that any control of humidity can be obtained. The springs 126, 127 control the position of the moving element 27 as the current is varied in the fixed and movable coils 13, 27.

In Figs. 5 and 6, I have represented in plan and in cross section respectively a form of temperature controller that may be used in the practice of my invention. In said figures, I have represented at 144 a suitable casting having a radial slot extending from the center to the edge to avoid eddy currents from being induced in the casting. Said casting also holds a suitably shaped piece of seasoned wood 145 of suitable construction carrying at its center a suitable iron punching 146. I have represented a preferably aluminum vane at 147, it having a suitable iron punching 147′, indicated in dotted lines in Fig. 6. The said vane is mounted on the preferably steel shaft 148. At 149 I have indicated a suitable coil wound or mounted upon the casting 144. A pointer 150 carrying a V shaped cup 151 containing mercury is secured to a suitable hub 152 upon the shaft 148. A counterweight 153 is provided upon the pointer 150 to balance the movement of the moving element which in this form of my invention is suspended upon bearings 155, 155′. I provide a spring 97 corresponding to the spring 97 in Fig. 2 to control the movement of the moving element when the current through the coil 149 is varied.

The pairs of contact points 88 corresponding to the contacts 88 shown in Fig. 2 are fastened on a bakelite or other suitable board 157 fastened to the casting 144 by screws 158. The purpose of the contact points 156 is to close the valve circuit for steam heating. The said contact points 156 are connected to the switch 26 of Fig. 1 in the corresponding switch in Fig. 2 and to the solenoid 41 of valve 33 of Fig. 1 and corresponding solenoid of Fig. 2.

The casting 144 may be provided with a brass closing disk 159 having a radial slot to avoid eddy currents.

The operation of this form of apparatus is as follows: When current flows through the coil 149, it magnetizes the iron punching 146 with the same polarity as the punching 147′ upon the vane 147. The vane 147 being mounted to turn, will be repulsed and will therefore change the position of the cup 151.

Said vane also acts as a damping vane since in its movement it compresses the air against the rectangular piece of wood 145, thereby making steadier the movement of

the moving element. The coil 149 is connected to the dry hub theremometer 4 of Fig. 1 through the resistances 21, 21a, 21b, and the fixed coils of the humidity controller and the corresponding dry bulb (Fig. 2). It is obvious that any change of temperature will change the resistances on such dry bulb thermometer, and thereby change the deflection of the moving element of the temperature controller.

The contact points 156 are connected to various points of the switch 25 of Fig. 1, and the corresponding switch of Fig. 2 that correspond to the various temperatures. If it be required to obtain a temperature of 70° F., the rise or fall of the thermometer will disconnect or connect the suitable resistance 15 of Fig. 1, and will energize the coil 149 of Fig. 6, which will in turn magnetize the iron punchings 146, 147'. The resulting repulsion will bring the pointer 150 carrying the cup 151 to the contact 88 which will correspond to the switch point 29 of the switch 25 in Fig. 1, or the corresponding contact 88 in Fig. 2. When the contact 88 is bridged by the cup 151, it will close the circuit containing the solenoid 41 of Fig. 1, energizing said solenoid and effecting the closing of the valve 33 of said figure, or the corresponding valve in Fig. 2.

It is evident that any slight change of temperature in the room will change the position of the V shaped cup 151. If the resistances are calibrated, it is obvious that any control of temperature may be readily secured.

In Fig. 8, I have represented a form of selective switch which may be employed for obtaining any degree of temperature and humidity. Two of such switches are required to operate my system of humidity control, one for the temperature control and the other for the humidity control. The blade 161 and the point 162 shown in said Fig. 8 effect the control of the temperature controlled, while the blade 163 and the points 164, 165 control the temperature valves. In the case of the humidity controller switch, the blade 161 controls the humidity controller while the blade 163 and the points 164, 165 control the humidity valves. The selective switch shown in Fig. 9 corresponds to the selective switches 25, 26 shown in Fig. 1.

It is necessary that the blades 161, 163 always occupy the same relative position; that is, that they be always parallel to each other. Let it be supposed that it is desired to obtain a temperature of 70° F. and a humidity of 70%. The point 162 would in such case indicate 70° F. on the temperature control switch, and the points 164, 165 would represent the corresponding connection to the steam valve of the system shown in Figs. 1 and 2. In the case of the humidity control switch, the point 162 would indicate 70%, while the points 164, 165 would indicate the corresponding connection of the humidifying valves of Figs. 1 and 2.

In the construction shown in said Fig. 8, the plates 166, 167 are preferably of bakelite, the blades 161, 163 are preferably of phosphor bronze, and the handle 168 is of hard rubber. The bushings 169, 170 are of brass and the nuts 171, 172, 173 are preferably of brass. Preferably the insulating nut 174 is of bakelite. The wires 175 are connected to the controller circuit, and the wires 176 are connected to the valve circuit. While preferably I use the instruments shown in Figs. 3 to 8 inclusive, I am not limited thereto in the practice of my invention, as with the systems of Figs. 1 and 2, I may use any suitable instruments, controllers of switches or other parts.

It will be evident from the foregoing description that by the use of the system disclosed, I may effectively and accurately control both the temperature and the humidity of the room wherein the structures are located. My system is intended for use in various relations which it is unnecessary to specify.

Having thus described one illustrative embodiment of my invention, I desire it to be understood that although specific terms are employed, they are used in a generic and descriptive sense and not for purposes of limitation, the scope of the invention being set forth in the following claims.

Claims:

1. A system for effecting temperature and humidity control comprising wet and dry bulb thermometers, and a series of contacts for each thermometer, a selective resistance for each contact, a selective temperature switch for each series of resistances of the dry bulb thermometer, a humidity switch for each set of resistances of the wet bulb thermometer, and valves operatively associated with said switches and said contacts, thermometers and resistances.

2. A system for effecting temperature and humidity control comprising wet and dry bulb thermometers, and a series of contacts for each thermometer, a selective resistance for each contact, and temperature and humidity controllers in circuit with said thermometers, contacts and resistances.

3. A system for effecting temperature and humidity control comprising wet and dry bulb thermometers and a series of contacts for each thermometer, a selective resistance for each contact, a humidity controller, and a temperature controller in circuit with said respective series of resistances, and a valve governed by each of said controllers.

4. A system for effecting temperature and humidity control comprising wet and dry bulb thermometers and a series of contacts

for each thermometer, a selective resistance for each contact, an electrically operated humidity controller in circuit with the series of resistances of said wet bulb thermometer, an electrically controlled temperature controller in circuit with the series of resistances of said dry bulb thermometer, and a valve governed by each of said controllers.

5. A system for effecting temperature and humidity control comprising wet and dry bulb thermometers and a series of contacts for each thermometer, a selective resistance for each contact, a humidity controller and a temperature controller respectively in circuit with said series of selective resistances, a selective switch operatively associated with each of said controllers to be set at the desired temperature and humidity, and valves respectively governed by said controllers.

6. A system for effecting temperature and humidity control comprising wet and dry bulb thermometers and a series of contacts for each thermometer, a selective resistance for each contact, a humidity controller and a temperature controller in circuit with said thermometers, each of said controllers having a member adapted to be moved to a degree corresponding to the electrical current passing therethrough, and a valve governed by each of said controllers.

7. A system for effecting temperature and humidity control comprising wet and dry bulb thermometers and a series of contacts for each thermometer, a selective resistance for each contact, a humidity controller and a temperature controller in circuit with said wet and dry bulb thermometers, solenoids in circuit with said controllers, and temperature and humidity governing valves operatively associated with said solenoids.

8. A system for effecting temperature and humidity control comprising wet and dry bulb thermometers and a series of contacts for each thermometer, a selective resistance for each contact, a humidity controller and a temperature controller in circuit with said thermometer respectively and each having a movable element adapted to be deflected by the electrical current, and valves respectively governed by said controllers.

9. A system for effecting temperature and humidity control comprising wet and dry bulb thermometers and a series of contacts for each thermometer, a selective resistance for each contact, a humidity controller and a temperature controller respectively in circuit with said thermometers and each having a movable element adapted to be deflected by the electrical current, solenoids respectively in circuit with said controllers, and humidity and temperature valves respectively operable by said solenoids.

10. A system for effecting temperature and humidity control comprising wet and dry bulb thermometers and a series of contacts for each thermometer, a selective resistance for each contact, a humidity controller and a temperature controller respectively in circuit with said thermometers and each having a movable element adapted to be deflected by the electrical current, solenoids respectively in circuit with said controllers, and humidity and temperature valves respectively operable by said solenoids.

11. A system for effecting temperature and humidity control comprising wet and dry bulb thermometers and a series of contacts for each thermometer, a selective resistance for each contact, a humidity controller, and a temperature controller respectively in circuit with said thermometers and provided with a switch, manually positionable selective switches operatively associated with said controllers, a coil 31 operatively associated with the temperature controller, a switch adapted to be moved by said coil when energized, a steam valve adapted to be operated through said temperature controller coil and switch, and a humidity controlling valve adapted to be operated by the humidity controller.

12. A system for effecting temperature and humidity control comprising wet and dry bulb thermometers and a series of contacts for each thermometer, a selective resistance for each contact, a humidity controller and a temperature controller in circuit respectively with said wet and dry bulb thermometers and each having a switch, a manually positionable switch for the humidity controller, a manually positionable switch for said temperature controller, coils adapted to be energized respectively by said controller, switches governed by said coils, and circuits adapted to be closed by said switches, and valves adapted to be operated upon the closing of said circuits.

13. A system for effecting temperature and humidity control comprising wet and dry bulb thermometers and a series of contacts for each thermometer, a selective resistance for each contact, a humidity controller, and a temperature controller respectively in circuit with said thermometers, and valves respectively governed by said controllers, said humidity controller having a core, a movable coil, a movable member governed in its movement by said coil, and contacts adapted to be closed by said movable member.

14. A system for effecting temperature and humidity control comprising wet and dry bulb thermometers and a series of contacts for each thermometer, a selective resistance for each contact, a humidity controller and a temperature controller respectively in circuit with said thermometers and valves respectively governed by said controllers, said humidity controller having

a core, a movable coil, a pointer movable with said coil, and sets of contacts adapted respectively to be closed by said pointer.

15. A system for effecting temperature and humidity control comprising wet and dry bulb thermometers and a series of contacts for each thermometer, a selective resistance for each contact, a humidity controller and a temperature controller respectively in circuit with said thermometers, and valves respectively governed by said controllers, said humidity controller having a fixed laminated core, a movable coil, a pointer movable with said coil, and sets of contacts adapted to be closed by said pointer.

16. A system for effecting temperature and humidity control comprising wet and dry bulb thermometers and a series of contacts for each thermometer, a selective resistance for each contact, a humidity controller and a temperature controller respectively in circuit with said thermometers and valves respectively governed by said controllers, said temperature controller having a coil, a coöperating movable member, a pointer coöperating with the movable member, and sets of contacts adapted to be closed by said pointer.

17. A system for effecting temperature and humidity control comprising an electric circuit, means associated therewith having a high co-efficient of expansion, a series of contacts in said circuit associated with said high co-efficient of expansion means, selective means associated with each of said contacts for effecting a change in the strength of the current of the said circuit, and temperature and humidity controllers in circuit with said high co-efficient of expansion means and said contacts, and operated through movement of said high co-efficient of expansion means and the consequent changes in the strength of the said current.

18. A system for effecting temperature and humidity control comprising wet and dry bulb thermometers, an electric circuit having a series of contacts for each thermometer, selective means associated with each of said contacts for effecting a change in the strength of the current of the circuit having said contacts, and temperature and humidity controllers in circuit with said thermometers, contacts and selective means.

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

ANTHONY SILVA SANTOS.