Jan. 13, 1931. S. M. ANDERSON 1,789,268

FLUID CONDITIONING METHOD AND APPARATUS

Filed Jan. 28, 1930 2 Sheets-Sheet 1

Fig. 1.

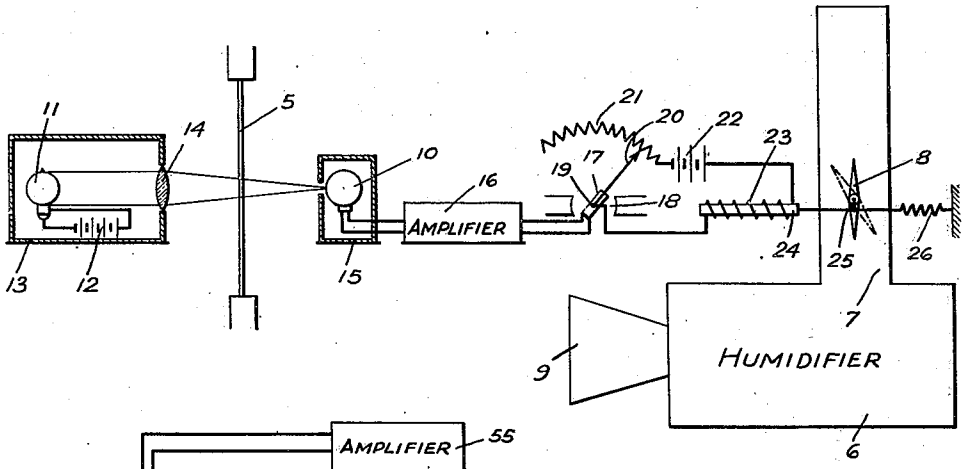


Fig. 2.

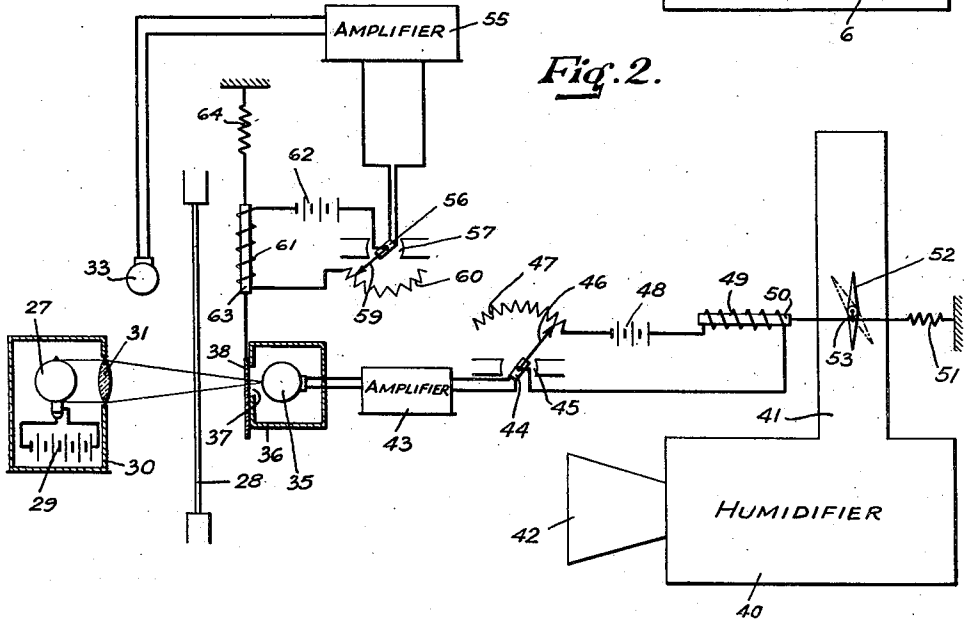
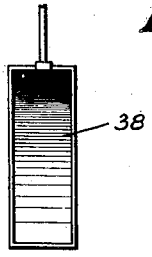


Fig. 3.



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FLUID CONDITIONING METHOD AND APPARATUS

Filed Jan. 28, 1930 2 Sheets-Sheet 2

Fig. 4.

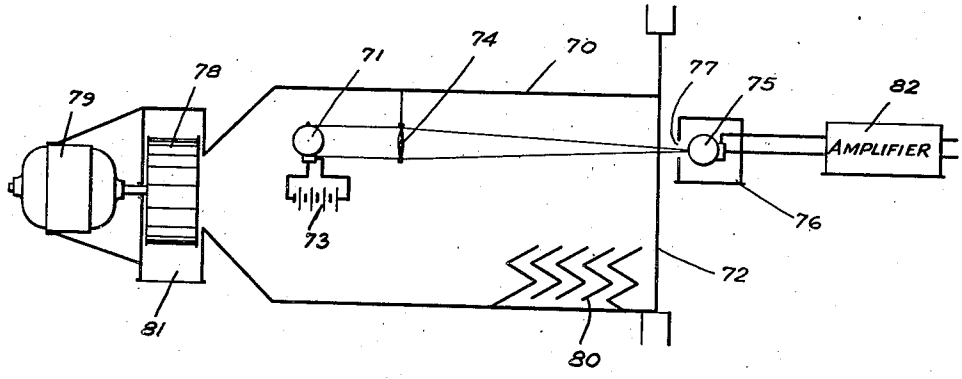
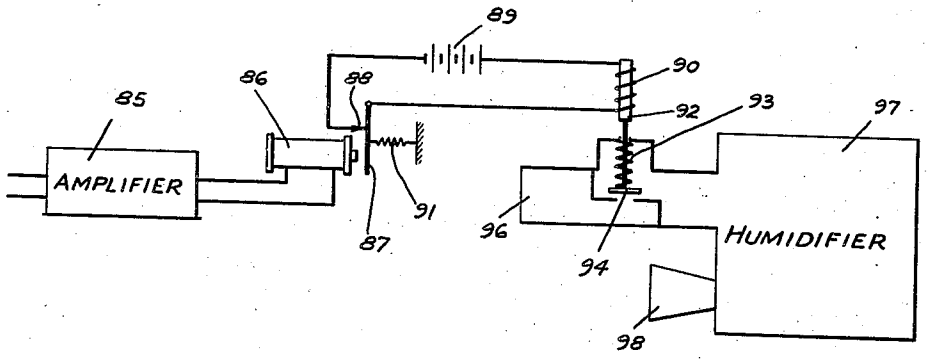


Fig. 5.



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UNITED STATES PATENT OFFICE

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FLUID-CONDITIONING METHOD AND APPARATUS

Application filed January 28, 1930. Serial No. 424,102.

This invention relates to methods and apparatus for controlling the vapor content of fluids and relates more particularly to methods and apparatus for controlling the relative humidity of the air within an enclosure.

It is becoming better and better known that living conditions in heated rooms are greatly improved when the air within the rooms contains a substantial amount of moisture or water vapor which tends to prevent the drying of the nasal and throat passages of the occupants. This moisture also tends to prevent the circulation of dust, which in itself is undesirable and may be injurious. Also, in certain manufacturing processes, among which are the manufacture of paper and the manufacture of cloth, the presence of a certain amount of moisture is necessary in the air in which the processes are employed. The heating systems generally employed for heating buildings effectively reduce the relative amount of moisture in the air so that it has been found desirable to provide humidifying apparatus for introducing additional moisture to compensate for the loss of relative humidity through the heating process.

A relative humidity of from fifty (50%) to fifty-five (55%) per cent is in many cases desirable, but in cold weather and especially in extremely cold weather, such a high degree of moisture in the air of a closed room is attended by a serious disadvantage, in that a low outdoor temperature chills the window panes of the room, causing the moisture in the air of the room to condense thereon, and if this condensation is excessive, the window pane becomes frosted or clouded and the view is obscured. In many cases it may be desirable that the moisture content of the air in a room be as high as possible without producing this condensation of the moisture on the window surface, but due to the wide range of outdoor temperatures during the winter months, and the resulting difference in temperature between the heated air in the room and the outside air, the relative amount of moisture which can be supplied to the room without causing condensation will correspondingly vary within wide limits.

An object of this invention is to control the vapor content of a fluid.

Another object of the invention is to automatically control the supply of moisture to the air within a room by observation of the condensation of moisture from the air on the surface of a window of the room.

In one form of the invention a photo-electric cell which has the property of varying the current in its electrical circuit, proportional to light variations impressed upon it, is subjected to the action of light passing through a window pane, or other similarly located transparent medium of a heated room, and the variation in the light striking the photo-electric cell caused by the condensation of moisture on the surface of the window pane, is caused to actuate control apparatus for controlling the moisture supply. The outer surface of the window or other transparent medium is in contact with and, therefore, responsive to the action of the outdoor temperatures, and the inside surface is in contact with and, therefore, subject to the action of the air within the room.

According to a feature of the invention, as long as the humidity of the air in the room is below the condensation point, the photo-electric cell will be subjected to a maximum amount of light through the window, but as soon as condensation begins to take place upon the inner surface of the window, the intensity of light directed upon the photo-electric cell begins to decrease. This decrease in light so actuates through the photo-electric cell, control circuits to automatically control the amount of moisture added to the air from the humidifier or other source. When the condensation has disappeared from the surface of the window, the light striking the photo-electric cell increases and actuates control circuits to increase the amount of moisture supplied to the air.

According to another feature of the invention, variations in the amount or intensity of the light striking the photo-electric cell caused by changes in the intensity of the light without the window or other conditions other than the formation of the

condensed moisture on the surface of the window, are automatically compensated for.

The invention will now be described with reference to the drawing of which:

Figure 1 is a schematic view illustrating one form of the system according to this invention for controlling the moisture content of the air within a room;

Fig. 2 is a schematic view of a system for controlling the moisture content of the air within a room, together with a system for compensating for variable light effects;

Fig. 3 is a view of a light shutter particularly adapted for use in controlling the amount of light in the system of Fig. 2;

Fig. 4 is a schematic view of a system for supplying light to the control photo-electric cell of a humidity control system, and

Fig. 5 is a schematic view of a valve mechanism for humidity control.

Referring now to Fig. 1, the window pane 5 has its left side (facing the drawing) exposed to the outside air and its right side exposed to the air within a heated room or other enclosure. The humidifier 6 serves to supply the moisture through the nozzle 9 into the room. Within the room the photo-electric cell 10 is exposed to light coming from the outside through the window 5 and is placed in line with the portion of the window on which condensation first appears. Placed without the room is the source of constant illumination, the lamp 11, the filament of which is heated by the battery 12. The light from the lamp 11 focused by the closure 13, the lens 14 serving to focus the light from the lamp 13 on to the photo-sensitive cathode of the photo-electric cell 10. The light from the lamp 11 focused by the lens 14 passes through the window pane 5. The distance between the lens 14 and the photo-sensitive cathode of the photo-electric cell 10 is such that the light rays from the lamp 11 are focused to a small spot on the cathode of the photo-electric cell 10. The photo-electric cell 10 is placed within the enclosure 15 in such a way that its cathode is exposed only to light entering from the direction of the window pane 5. The potential variations set up within the photo-electric cell 10 by light variations playing on its photo-cathode, are amplified through the amplifier 16, which also serves to supply polarizing potentials for the electrodes of the cell 10. The amplified currents from the amplifier 16 are fed into the moving coil 17 of the galvanometer 18. The galvanometer coil 17 is pivoted at 19 and has attached to it the resistance arm 20. The outer end of the arm 20 contacts with the resistance 21 throughout the range of movement of the coil 17. The resistance 21 is connected in circuit with the battery 22, the solenoid 23, and the resistance arm 20, the amount of the resistance 21 which is connected in the circuit at any given time depending upon the degree of angularity of the coil 17, which in turn depends upon the amplitude of the photo-electric currents amplified through and delivered by the amplifier 16. The plunger 24 is adapted to slide in and out of the solenoid 23 to a degree proportional to the amount of current flowing through the solenoid winding. One end of the solenoid plunger 24 is connected to the crank arm 25 of the valve 8; the crank arm 24 of the valve 8 being also connected to the spring 26.

In operation, since the light from the lamp 11 is concentrated and appears as a very bright spot on the photo cathode of the photo-electric cell 10, the amount of light entering through the window pane 5 from outside, except in the concentrated beam of light from the lens 14, is so small in proportion to the intense light from the concentrated beam that any changes in the light entering through the window pane 5 outside the concentrated beam, have a very small effect on the photo-electric cell, and the sensitivity of the photo-electric cell may be so adjusted by regulation of its polarizing potentials that a small change in illumination will not cause a noticeable change in the current flowing through the amplifier 16. Light which ordinarily enters through the window pane would vary according to the degree of cloudiness, etc., but such changes in light do not effect to any appreciable extent the operation of the system disclosed.

So long as the nozzle 9 delivers the correct amount of moisture into the room, no condensation will be formed upon the inner surface of the window pane. Therefore, the lamp 13 gives a light of constant intensity on the photo cathode of the photo-electric cell 10. But as soon as any moisture condenses on the surface of the window pane 5 near the photo-electric cell, this condensation cuts off a portion of the light from the lamp 13 and causes a decrease in the amount and intensity of the light playing upon the photo cathode of the photo-electric cell 10. This decrease in light causes a decrease in the current flowing through the cell 10, this change in current being amplified by the amplifier 16 and fed into the moving coil 17 of the galvanometer 18, where it causes the galvanometer coil 17 to rotate to the left (facing the drawing) so as to increase the amount of the resistance 21 connected in circuit with the battery 22, the solenoid 23, and the resistance arm 20. This decrease in current through the solenoid 23 weakens the electro-magnetic field of the solenoid so that the spring 16 is enabled to withdraw the plunger 24 from the solenoid 23 and rotate the valve 8 through the crank shaft 25 towards its closed position, as indicated by the dotted lines. This closing of the valve 8 shuts off a portion of the water delivered to the humidifier 6, through the pipe

7. The greater the amount of condensation on the inner surface of the window pane 5, the greater the decrease in current through the photo-electric cell 10, the amplifier 16, the galvanometer coil 17, so that the galvanometer coil 16 moves further to the left and through movement of the resistance arm 20 places more of the resistance 21 in the circuit connecting the resistance 21, battery 22, solenoid 23 and resistance arm 20. The less the current flowing through the solenoid 23, the more the spring 26 will be able to withdraw the plunger 24 and more completely close the valve 8.

As soon as the condensed moisture disappears from the inner surface of the window pane 5, the lamp 11 is enabled to throw more light upon the photo cathode of the photo-electric cell 10, this causing an increase in current through the photo cell 10, the amplifier 16, and the galvanometer coil 17, this increase in current causing the coil 17 to rotate to the right (facing the drawing) and through movement of the resistance arm 20 to decrease the amount of resistance 21 connected in the circuit connecting resistance 21, battery 22, solenoid 23, and resistance arm 20. This decrease in resistance in the circuit causes a greater current flow through the winding of solenoid 23, thus causing the electro-magnetic force developed to pull the plunger 24 into the solenoid 23 against the action of the spring 26 so as to move the valve 8 towards its open position. This movement of the valve 8 permits more moisture to enter the room. It is thus seen that this arrangement provides an automatic control of the amount of moisture admitted to the heated room, the system closing or opening the valve admitting moisture to the air as condensation appears or disappears from the inner surface of the window pane.

The system and apparatus illustrated in Figs. 2 and 3 of the drawing show a modification of the arrangement shown by Fig. 1, the modification consisting in means for compensating for changes in the amount of light, other than that from the light source made a part of the system, which enters the room through the window pane. Under ordinary conditions, the additional apparatus shown in Figs. 2 and 3 would not be necessary, but it is conceivable that conditions might be such in some localities that the additional features might possibly be required so that they are herein disclosed and made as a part of this invention.

The light source 27 is mounted outside the room in line with the window pane 28 which separates the room, the heated air of which is to be moistened, from the outside atmosphere. The photo-electric cell 35 is mounted in its enclosure 36 within the room in line with the light passing from the lamp 27 through the window pane 28. The lamp 27 is heated by the battery 29 and is contained within the enclosure 30. The lens 31 which is mounted within the enclosure 30 serves to concentrate the light from the lamp 27 upon the cathode of the photo-electric cell 35. As has previously been explained in the discussion of Fig. 1 of the drawing, if the moisture supplied to the room by the humidifier 40 through the pipe 41 and out of the nozzle 42 is sufficient to form condensation on the inner surface of the window pane 28, this condensation cuts off a portion of the light from the lamp 27 which is focused on the photo-electric cell 35. This change in light striking the cathode of the photo-electric cell causes a current change in its circuit, this current change being amplified by the amplifier 43 from which it is passed into the coil 44 of the galvanometer 45 where it causes the movement of the resistance arm 46 over the resistance 47, the degree of movement depending upon the change in light striking the photo-electric cell. Increased illumination striking the photo-electric cell causes increased displacement of the galvanometer coil 44 which, through movement of the resistance arm 46 decreases the amount of the resistance 47 in the circuit connecting the resistance 47, the battery 48, the solenoid 49 and the switch arm 46. This decrease in the resistance in the circuit causes an increased current flow through the solenoid 49, this increase of current causing a stronger electro-magnetic field which, in turn, causes the plunger 50 of the solenoid to be drawn further into the solenoid against the resistance of the spring 51. This movement of the plunger 50 causes the valve 52 to the crank arm 53 of which the plunger 50 is connected, to move towards its open position, thus letting more moisture from the humidifier 40 through the nozzle 42 into the room. Decreased illumination of the photo-electric cell 35 causes, through the amplifier 43, a decreased current through the galvanometer coil 44, the movement of the galvanometer coil 44 towards its zero position caused thereby moves the resistance arm 46 along the resistance 47 to include more of the resistance 47 in the circuit including the resistance 47, the battery 48, solenoid arm 49 and switch arm 46. This increase of resistance causes a weaker current and a resulting weaker field in the solenoid, this weaker field allowing the plunger 50 to be withdrawn by the spring 51 and to move the valve 52 towards its closed position through movement of the crank arm 53. The decrease in illumination reaching the photo-electric cell 35 is caused, of course, as has previously been described, by the condensation forming on the inner surface of the window pane 28. The increase in illumination striking the photo-electric cell 35 is caused by the disappearance of the condensation from the window pane.

Of course, other light than that from the lamp 27 will pass through the window pane 28 to strike the cathode of the photo-electric cell 35. While it is believed that ordinarily the constants of the photo-electric cell circuits may be adjusted so that changes in illumination from sources other than that of the lamp 27 will not effect to any great extent the operation of the control apparatus illustrated, there is provided automatic control means for compensating for any variations in illumination from sources other than the lamp 27. The photo-electric cell 33 is placed outside the room on the side of the window pane 28 which is exposed to the outside atmosphere and is exposed to the outdoor light. Variations in the illumination of the photo-electric cell 33, such as those caused by weather conditions or change in time, set up current variations in the photo-electric cell 33 which are amplified through the amplifier 55. The amplified current variations are fed into the moving coil 56 of the galvanometer 57 and cause the galvanometer coil 56 to rotate and move the resistance arm 59 along the resistance 60 and so vary the amount of the resistance 60 in the electrical circuit, which includes the resistance 60, the solenoid 61, the battery 62 and the resistance arm 59. Increased currents through the coil 56 which are caused by increased illumination striking the photo-electric cell 33 cause an increased current through the solenoid 61 which, in turn, causes an increased electro-magnetic field in the solenoid and causes the plunger 63 to be further withdrawn into the solenoid 61 against the resistance of the spring 64. The plunger 63 of the solenoid 61 has attached thereto the light shutter 38 which is shown in detail by Fig. 3 and which is shaded gradually from dark to light so as to admit a variable amount of light through its surface along its length. The increased current through the solenoid 61 caused by the increase in illumination of the photo-electric cell causes withdrawal of the plunger into the solenoid and the movement of the shutter 38 before the opening 37 of the enclosure 39 which houses the photo-electric cell 35. As the current through the solenoid caused by increased illumination of the photo cell 33 increases, the plunger 63 of the solenoid is caused to place darker and darker portions of the light shutter 38 before the opening 37 of the enclosure 39. As the illumination of the photo cell 33 is decreased, the currents through the galvanometer coils 56 are decreased, thus causing the galvanometer coil to rotate towards its zero position and to include more of the resistance 60 in the circuit including the resistance 61, the battery 62 and the resistance arm 59. This increased resistance causes a decreased current flow through the solenoid 61, this causing a weakened magnetic field and permitting the spring 64 to withdraw the plunger 63 from the solenoid so as to move therewith the light shutter 38 so that its lighter portion is before the opening 37 of the enclosure 39, which houses the photo-electric cell 35. The light shutter 38 is so shaded gradually from dark at one end to light at the other end, that when the dark portion is between the photo-electric cell 35 and the light source 27 but a relatively small amount of light from the lamp 27 can strike the photo-cathode of the photo-electric cell 35. As the shutter 38 is moved so that its lighter portion is between the photo-electric cell 35 and the lamp 27, more light from the lamp 27 can strike the photo cathode of the photo-electric cell 35. As more light from the outdoors strikes the photo-electric cell 33 through its control apparatus, the shutter 38 is moved before the photo-electric cell 35 so that less light can strike the photo-electric cell 35, thus compensating for the increased illumination through the window pane 28. As the illumination of the photo-electric cell 33 decreases through its control apparatus, the light shutter 38 is moved before the photo-electric cell 35 so that more light can strike the photo-electric cell. The light shutter 38 is so shaded and the constants of the electrical circuits are so chosen that regardless of changes in illumination entering the window pane 28, a constant light from outside the window pane 28 strikes the photo-electric cell 35. Thus, changes in the amount of light entering the room from without the window pane 28 are automatically compensated for so that the only changes in light striking the photo-electric cell 35 are those caused by condensation forming on the inner surface of the window pane 28.

Referring now to Fig. 4 of the drawing, there is disclosed a light-proof enclosure 70 in which the light source 71 is supported. The enclosure 70 is placed against the lower portion of the outside of the window pane 72 that no light from without the enclosure 70 can enter the window pane 72 through the surface of the window pane covered by the enclosure. The light source 71 is energized by the battery 73 and the light from the light source is concentrated by means of the lens 74 on the photo-electric cell 75, which is supported in the room, the air of which is to be humidified. The photo-electric cell 75 is supported within its light-proof enclosure 76, the light from the lens 74 passing through the aperture 77 of the enclosure 76. The aperture 77 is so arranged with respect to the window pane 72 and the enclosure 70, that no direct light from without the window pane 72 can strike the photo-electric cell 75. The photo-electric cell is preferably placed near that portion of the window pane 72 on which condensation first appears. The light variations set up in the photo-

electric cell 75 due to the condensation of moisture on the window pane 72, are amplified by the amplifier 82 to operate control mechanism similar to that described in connection with Figs. 1 and 2, or to that which will later be described in connection with Fig. 5.

In order that the atmospheric conditions on that portion of the window pane 72 enclosed by the light-proof enclosure 70 may be the same as if that portion of the window pane was not enclosed, the outside air is drawn by the fan 78 through the light-proof shutters 80 and is circulated along the surface of the window pane and is discharged through the opening 81. The fan 78 is driven by the motor 79.

With this arrangement the light from outside the window of the room is prevented from reaching the light-sensitive cathode of the photo-electric cell 75, so that any changes in light due to weather conditions, or change in time, do not effect operation of the system, the only light changes effecting the photo-electric cell 75 being those caused as has been previously explained in connection with Figs. 1 and 2 by condensation of moisture upon the surface of the window pane 72.

The control systems described in connection with Figs. 1 and 2 operate to close valves in the water pipes supplying conditioning water to the humidifiers, the degree of valve closure being proportional to the amount of moisture condensed on the window panes. It may be preferable that instead of regulating the flow of water to a humidifier and the corresponding amount of water admitted into the room as moisture condenses on the window pane, that the system operate on the appearance of moisture on the window pane to completely shut off the water supply to the humidifier until the condensation disappears, at which time the water control valve operates to allow full water flow to the humidifier. Fig. 5 illustrates this method of control. There the current from the amplifier 85 energizes the winding of the relay 86, the armature 87 of the relay which is adapted to be attracted to the core of the relay against the tension of the spring 91 strikes the contact 88 when the relay is energized, thus closing the electrical circuit including the battery 89, the winding of the solenoid 90, the armature 87, and the contact 88. Normally the humidifier 97 will be discharging moistened air into the room, the valve 94 being open to admit water through the water pipe 96 to the humidifier 97. When moisture appears on the window pane under observation, the decrease in light reaching the photo-electric cell of the control apparatus causes a decrease in current to flow to and from the amplifier 85. This decrease in current through the winding of the relay 86, due to the weakened magnetic flux of the relay core, permits the spring 91 to draw the armature 87 from against the contact 88, thus opening the electrical circuit including the battery 89 and the winding of the solenoid 90. With no current flowing through the winding of the solenoid 90, the spring 93 closes the valve 94 and withdraws the plunger 92 from the solenoid 90. As soon as the condensation disappears from the window pane, the increase in light reaching the control photo-electric cell causes that increase in current flow through the amplifier and the winding of the relay 86, thus causing the armature 87 to be attracted by the relay core and to close the electrical circuit including the battery 89 and the winding of the solenoid 90, so that the magnetic flux set up in the core of the solenoid 90 attracts the plunger 92 against the compression of the spring 93 and opens the valve 94, admitting water through the water pipe 96 into the humidifier 97, so that moistened air will again be discharged into the room through the nozzle 98.

The amplifier 85 shown by Fig. 5 may be the amplifier 16 of Fig. 1, the amplifier 43 of Fig. 2, or the amplifier 82 of Fig. 4, since the control systems to the right of the amplifiers in all figures of the drawing may be interchanged as desired. In like manner, the amplifier 82 of Fig. 4 may actuate the control apparatus shown to the right of amplifier 16 of Fig. 1, amplifier 43 of Fig. 2, and amplifier 85 of Fig. 5.

It is realized that the release of electrons from the photo-electric cathode by photo-electric action is believed to be accomplished by ultra violet light. It should be understood, therefore, that the light sources 11 of Fig. 1, 27 of Fig. 2, and 71 of Fig. 3, may be of the mercury vapor, carbon arc, or other suitable types for supplying light rays effective for photo-electric action. The envelopes of the light sources may be of quartz or other suitable material to pass that portion of the spectrum of light rays effective for photo-electric action. Likewise, the focusing lenses and the window panes or other transparent mediums used with this invention are to be constructed of such material that light rays effective for photo-electric action may pass through.

While for the purpose of explanation a window of the room has been described as the medium upon which condensation occurs, it is to be understood that any suitable surface may be used in co-operation with a light source and other necessary equipment to operate the control mechanism through variation of light due to condensation on the surface, and the focusing lens itself may be used as this surface.

Also while the control mechanism has been described as adjusting a valve in the conditioning water pipe, it is obvious that this con-

trol mechanism may serve to operate any control mechanism whatsoever associated with the equipment.

In describing the inventions herein disclosed they have been explained for the purpose of illustration as applied to the moisture content of a room or enclosure to prevent the clouding over or frosting of window panes under varying conditions of atmosphere. I wish it to be understood, however, that this is but one application of my invention and is for illustrative purposes only. My invention has many other applications and can be used under any conditions where it is desirable or practicable to regulate the amount or proportion of a gas or vapor which is subject to condensation upon a surface exposed to changes in temperature and I wish it distinctly understood that both apparatus and method are to be limited only as hereinafter pointed out in the claims.

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

1. The method of controlling the vapor content of a fluid within an enclosure containing a transparent medium exposed on one side to a different temperature from that within the enclosure, which comprises actuating vapor control means by the variations in light through said medium caused by condensation of said vapor thereon.

2. The method of controlling the vapor content of a fluid within an enclosure containing a transparent medium exposed on one side to a different temperature from that within the enclosure, which comprises passing a light beam through said medium, and actuating vapor control mechanism by the change in intensity of said light beam caused by any condensation of said vapor upon said medium.

3. The method of controlling the vapor content of a fluid within an enclosure containing a transparent medium exposed on one side to a different temperature from that within the enclosure, which comprises changing light variations through said medium caused by condensation of said vapor thereon into electrical variations, and actuating vapor control mechanism by said electrical variations.

4. The method of controlling the addition of moisture to the air within a room containing a transparent medium exposed on one side to a different temperature from that within the room, which comprises changing light variations through said medium caused by condensation of moisture thereon into electrical variations, and actuating the moisture adding mechanism by said electrical variations.

5. Apparatus for controlling the amount of vapor in a fluid contained within an enclosure, comprising a vapor source, a medium separating said enclosure from a fluid having a different temperature from that within said enclosure, and means actuated by the condensation of any of said vapor on said medium for controlling the amount of vapor from said source.

6. Apparatus for controlling the amount of vapor in a fluid contained within an enclosure, comprising a vapor source, a transparent medium separating said enclosure from a fluid having a different temperature from that within said enclosure, and means actuated by light variations through said medium caused by condensation of said vapor thereon for controlling the amount of vapor from said source.

7. Apparatus for controlling the amount of vapor in a fluid contained within an enclosure, comprising a vapor source, a transparent medium separating said enclosure from a fluid having a different temperature from that within said enclosure, means for changing light variations through said medium caused by condensation of said vapor thereon into electrical variations, and means for controlling the amount of vapor from said source by said electrical variations.

8. Apparatus for controlling the humidity of air within a room, comprising means for introducing moisture into said air, a transparent medium in said room exposed on one side of the atmosphere, and means actuated by the condensation of moisture on said medium for controlling the addition of said moisture.

9. Apparatus for controlling the humidity of air within a room, comprising means for introducing moisture into said air, a transparent medium in said room exposed on one side to the atmosphere, and means actuated by variations of light through said medium due to condensation of moisture thereon for controlling said first mentioned means.

10. Apparatus for controlling the humidity of air within a room, comprising means for introducing moisture into said air, a transparent medium in said room exposed on one side to the atmosphere, means for changing light variations through said medium due to condensation of moisture thereon into electrical variations, and means for controlling said moisture introducing means by said electrical variations.

11. Apparatus for controlling the humidity of air within a room, comprising means for introducing moisture into said air, a transparent medium in said room exposed on one side to the atmosphere, a light source without said room, light responsive means within said room, and means controlled by said light responsive means through variations in light from said source due to condensation of moisture upon said medium for controlling said moisture introducing means.

12. Apparatus for controlling the humid-

ity of air within a room, comprising means for introducing moisture into said air, a transparent medium in said room exposed on one side to the atmosphere, a light source without said room, a photo-electric cell within said room, and means controlled through said photo-electric cell by variations in light from said source due to condensation of moisture upon said medium for controlling said moisture introducing means.

13. Apparatus for controlling the humidity of air within a room, comprising means for introducing moisture into said air, a transparent medium in said room exposed on one side to the atmosphere, light-sensitive means within said room responsive to light through said medium, means controlled by said light-sensitive means through variations in light through said medium due to condensation of moisture thereon for controlling said moisture introducing means, and means for regulating the amount of light through said medium.

14. Apparatus for controlling the humidity of air within a room, comprising means for introducing moisture into said air, a transparent medium in said room exposed on one side to the atmosphere, a photo-electric cell within said room responsive to light through said medium, means controlled through said photo-electric cell by variations in light through said medium due to condensation of moisture thereon for controlling said moisture introducing means, and means for regulating the amount of light through said medium.

15. Apparatus for controlling the humidity of air within a room, comprising means for introducing moisture into said air, a transparent medium in said room exposed on one side to the atmosphere, light-sensitive means within said room responsive to light through said medium, means controlled by said light-sensitive means through variations in light through said medium due to condensation of moisture thereon for controlling said moisture introducing means, and a light-sensitive means without said room for regulating the amount of light through said medium.

16. Apparatus for controlling the humidity of air within a room, comprising means for introducing moisture into said air, a transparent medium in said room exposed on one side to the atmosphere, a photo-electric cell within said room responsive to light through said medium, means controlled through said photo-electric cell by variations in light through said medium due to condensation of moisture thereon for controlling said moisture introducing means, and a photo-electric cell without said room for regulating the amount of light through said medium.

17. Apparatus for controlling the humidity of air within a room, comprising means for introducing moisture into said air, a transparent medium in said room exposed on one side to the atmosphere, a photo-electric cell within said room responsive to light variations through said medium, means controlled through said photo-electric cell by light variations through said medium caused by condensation of moisture thereon, a photo-electric cell without said room, and means controlled by said second photo-electric cell for regulating the light through said medium.

18. The method of controlling the vapor content of the fluid within an enclosure containing a medium, having one side exposed to a temperature different from that within the enclosure, which comprises exposing said medium to a light beam of substantially constant intensity, and actuating the vapor control mechanism by the change in intensity of light leaving said medium caused by any condensation of said vapor upon said medium.

19. The method of controlling the vapor content of a fluid within an enclosure, containing a medium having one side exposed to a temperature different from that within the enclosure, which comprises exposing said medium to a light beam of substantially constant intensity, changing light variations from said medium caused by any condensation of vapor thereon into electrical variations, and actuating vapor control mechanism by said electrical variations.

20. Apparatus for controlling the amount of vapor of a fluid contained within an enclosure, comprising a vapor source, a medium contained within said enclosure, having one side exposed to a different temperature from that within said enclosure, means for directing a light beam of substantially constant intensity upon the surface of said medium, and means actuated by light variations from said medium caused by any condensation of said vapor thereon for controlling the amount of vapor added by said source.

21. Apparatus for controlling the amount of moisture added to the air within an enclosure, comprising a moisture supplying source, a medium contained within said enclosure and having a portion exposed to a temperature different from that within said enclosure, means for directing a light beam of substantially constant intensity upon the surface of said medium, means for changing the light variations leaving said medium caused by any condensation of moisture thereon into electrical variations, and means actuated by said electrical variations for controlling the amount of moisture added by said source to the air within said enclosure.

In testimony whereof I affix my signature, in the presence of two witnesses.

SAMUEL M. ANDERSON.