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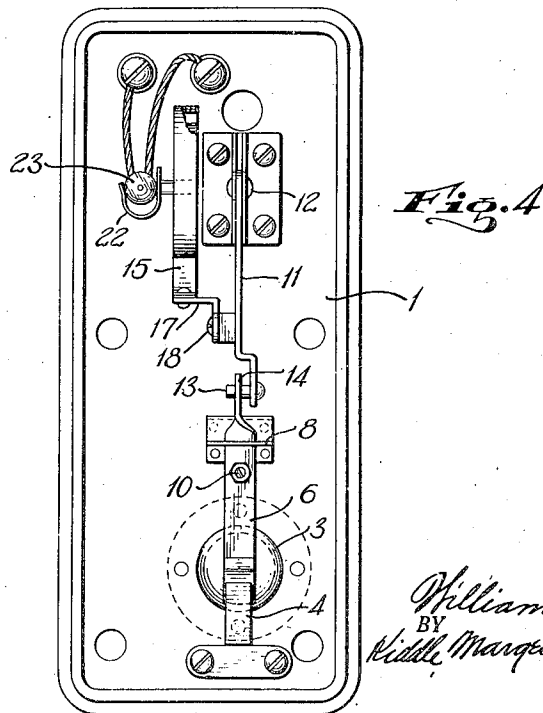
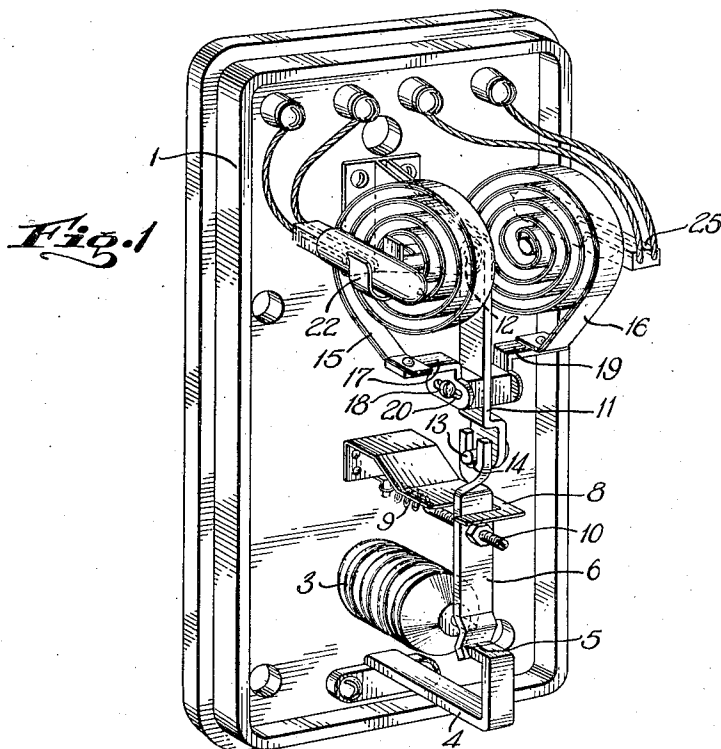
W. A. BULGER

2,059,846

CONTROL MECHANISM FOR AIR CONDITIONING APPARATUS

Filed Nov. 5, 1932

2 Sheets-Sheet 1



INVENTOR.

William A. Bulger,
BY
Kidd, Margeson & Norridge,
ATTORNEYS.

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W. A. BULGER

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Fig. 2

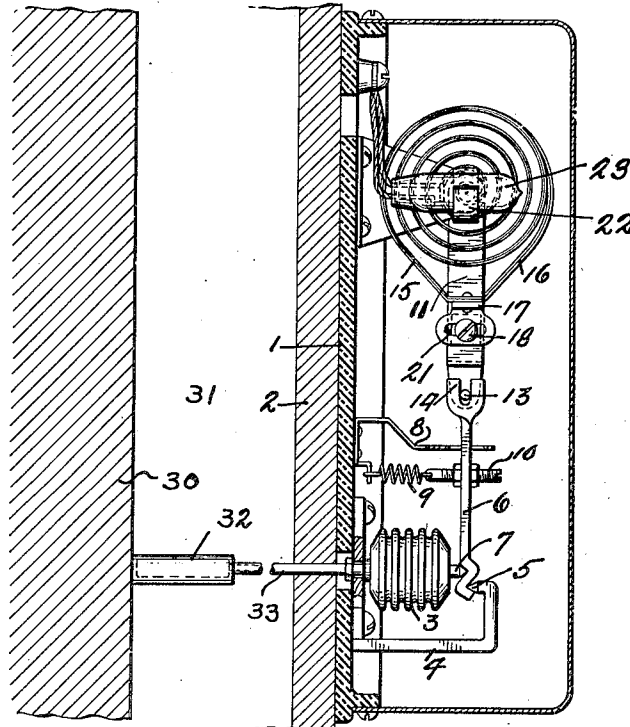
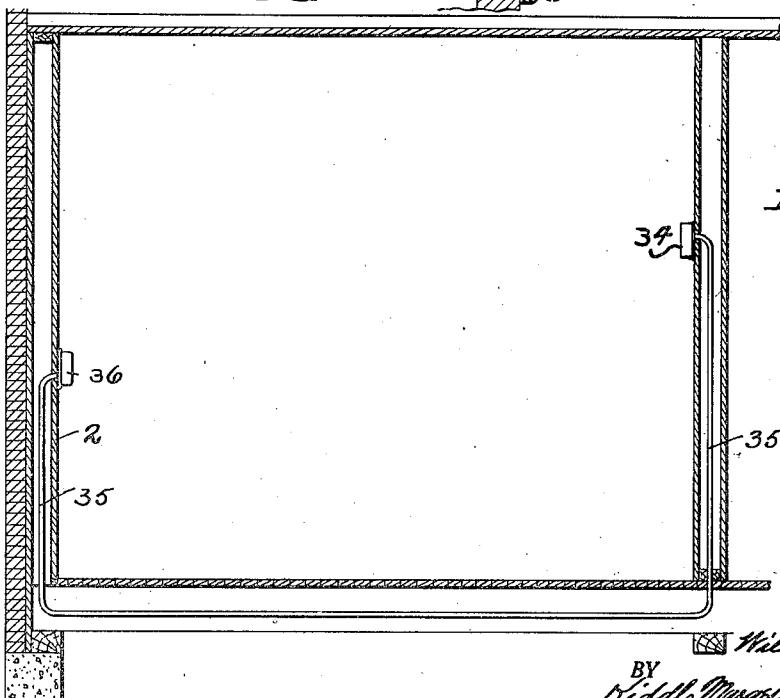


Fig. 3



INVENTOR.



William A. Bulger

BY
Middle, Morgan & Harbridge
ATTORNEYS.

UNITED STATES PATENT OFFICE

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CONTROL MECHANISM FOR AIR
CONDITIONING APPARATUS

William A. Bulger, Chicago, Ill., assignor to Petroleum Heat and Power Company, New York, N. Y., a corporation of Delaware

Application November 5, 1932, Serial No. 641,338

5 Claims. (Cl. 236—44)

This invention relates to an improved means for controlling air conditioning apparatus, and has for one of its objects the provision of a means whereby certain objections met with in air conditioning apparatus as at present constructed are overcome.

The present invention relates more particularly to the provision of improved means for automatically controlling the humidity and/or temperature of the air in a room or other enclosure.

To make the benefits of this invention more apparent let it be noted that in recent years the United States Department of Mines, the American Society of Heating and Ventilating Engineers and various medical authorities and others have conducted exhaustive researches to determine the effect that various air conditions have on human comfort and their findings indicate that the most comfortable air condition for a person at rest in still air would be that corresponding to an "effective temperature" of 64° F. The term "effective temperature" must not be confused with the actual temperature that may exist in a room. On the contrary, "effective temperature" is an arbitrary figure that corresponds to a given dry bulb temperature or actual temperature of the air in the room when the air in the room contains a definite amount of moisture. For example, a temperature of 68° F. and a humidity of 60% are equivalent to an "effective temperature" of 64° F. Likewise a temperature of 72¼° F. and a humidity of 30% are equivalent to an "effective temperature" of 64° F. In other words, when the temperature in a room is lowered the moisture content should be increased to provide the same degree of comfort that one would have at the higher temperature and a lower moisture content.

In the winter time the temperature and moisture content of the air may be extremely low and if this air is heated it will not contain sufficient moisture for a healthful condition.

Commercial air conditioning apparatus of the present day has incorporated in its structure means for adding moisture to the air, and the usual practice is to set these units so that they will automatically maintain a temperature of 70° F. and a relative humidity of 45%. While this insures a comfortable condition, if this humidity of 45% be maintained in a home throughout the winter excessive and even injurious condensation on the walls and windows will often result.

Prior to the present invention it has not been possible automatically properly to regulate the thermostatic and hygroscopic elements of the conditioning apparatus so as to prevent this excessive condensation. By reference to a psychrometric chart it will be seen that in an atmosphere having a dry bulb temperature of 70° F. and a relative humidity of 45%, the dew point temperature will be 47½° F. This means that with the air in a room at a dry bulb temperature of 70° F. and at a relative humidity of 45% which is a satisfactory condition so far as comfort is concerned, any article or any surface in that room at a temperature below 47½° F. will become moistened with condensation from the water vapor in the air.

I have noticed also that in a great many homes today the inside surfaces of the outside or exterior walls are usually at a much lower temperature than 47½° F. especially when the outdoor temperature is near the zero mark which will cause excessive condensation on these surfaces, so consequently in addition to an automatic regulation of the temperature and moisture content conditions of the air I propose to control these conditions in relation to the temperature at the inside surface of the exterior walls of the enclosure in which my apparatus is installed. For example, if the temperature at the inside surface of the exterior wall of a room be sufficiently low that condensation will take place when the dry bulb temperature of the air in the room is 70° F. and the humidity is 45% my control will operate automatically so that the air conditioning apparatus will provide a higher room temperature and a lower relative humidity. Now if the condition of this air were changed to a dry bulb temperature of 72¼° F. and 30% humidity the "effective temperature" would still be 64° F., a comfortable condition as above stated, but under these conditions the dew point would be lowered to 39° F., or 8½° lower than the dew point for a dry bulb temperature of 70° F. and a 45% humidity condition. Inasmuch as it is generally desirable in the winter time to operate at a dry bulb temperature of 70° F. and 45% humidity my control will be so calibrated that this condition will be maintained except at such times that the wall temperatures drop below the dew point temperature 47½° F. for this condition.

As briefly outlined above my invention provides for automatic regulation of the temperature and moisture content of the air in a room in accordance with temperature conditions at

the inner surface of the outer wall of the room; in addition to the foregoing I have also provided in a modification of my invention a humidifier which is automatically controlled and capable of changing the moisture content of the air when the wall temperatures become too low.

In the drawings accompanying this application:

Fig. 1 is a view in perspective of an embodiment of my invention;

Fig. 2 is a sectional elevational view of a modification of Fig. 1;

Fig. 3 is a further modification; and

Fig. 4 is an elevational view showing an installation of my apparatus employing an automatically controlled humidostat only.

Referring to Figs. 1 and 2 of the drawings in detail, 1 designates a covered box adapted to be secured in any suitable manner to the inner surface of the outer wall 2 of the room in which the condition of the air is to be controlled. Secured to the inside of the back of the box or case 1 is a metal casing 3 containing a volatile fluid either gas or liquid, such as butane, for instance, which is very susceptible to temperature changes. Secured to the rear wall of the box 1, below the casing 3, is a bracket 4 which provides a fulcrum 5 for a vertically extending lever 6 always engaged by a pin 7 mounted on the inner or forward end of the casing 3.

The lever 6 passes through a bracket 8 secured to the rear wall of the box 1 and is always held in contact with the pin 7 of the casing 3 by a spring 9 one end of which is secured to the wall of box 1 and the other to an adjustable screw 10 which is carried by the lever 6. The pin 7 of casing 3 is offset with respect to the fulcrum 5 so that upon expansion of the casing 3 the upper end of the lever 6 will be swung outwardly about the fulcrum 5, while upon contraction of the casing the lever will be pulled in the opposite direction by the spring 9.

Aligned with the lever 6 is a vertically extending lever 11 pivoted at its upper end as shown at 12. The lower end of this lever 11 carries a pin 13 which is received by a fork 14 in the upper end of the lever 6 so that as the latter is pivoted on its fulcrum 5 a pivotal movement will be imparted to the lever 11.

15 and 16 designate a hygroscopic element or humidostat and a thermostatic element or thermostat, respectively. These elements are of standard construction and wound oppositely in spiral formation. The outer end of the humidostat 15 is rigidly attached to a bracket, for example, 17 which in turn is rigidly but adjustably attached to the lever 11 by a screw 18. The outer end of the thermostat is similarly attached through bracket 19 to the lever 11. The brackets 17 and 19 are slotted as shown at 20 to permit of the proper setting of the apparatus.

Secured to the inner end of the humidostat element 15 is a mount 22 for a mercury switch 23, the inner end of the thermostatic element 16 carrying a mercury switch 25. The mercury switch 25 controls the circuit of any suitable type of automatic heating system such as an oil burning apparatus while the mercury switch 23 controls the circuit of any suitable type of a humidifying apparatus such, for example, as shown in my Patent No. 1,952,362, dated March 27, 1934.

It will be appreciated that the spiral of the thermostat 16 tightens, on a rise in temperature, so as to tip the mercury switch 25 in a direction to carry the mercury therein away from the contacts of the switch.

It is to be understood also that on an increase in the moisture content of the air in contact with the hygroscopic element or humidostat 15 the spiral of this element tightens up to tip the mercury switch 23 in a direction to move the mercury away from the electrodes of the switch.

The thermostat 16 and humidostat 15 will be set originally so that with the temperature at the surface of the wall 2 at or above $47\frac{1}{2}^{\circ}$ F. the dry bulb temperature in the room in which my apparatus is installed will be maintained by the thermostat 16 at 70° F. and the humidity of the air of the room 45%. This insures a comfortable condition in the room. If, however, the temperature at the inner surface of the exterior wall of the room drops below $47\frac{1}{2}^{\circ}$ F. which would cause condensation on that wall of the room then the fluid in the tank 3 will contract, to permit the upper end of the controlling lever 6 to move inwardly under the action of the spring 9, thereby changing the setting of the two tubes 23 and 25 so that the temperature of the room will be maintained at a higher dry bulb temperature, for example $72\frac{1}{4}^{\circ}$ F. and lower humidity, say 30% humidity, for example; in other words, an "effective temperature" of 64° F., the same as when the dry bulb temperature is at 70° F. and the humidity 45%, the conditions first assumed.

It will be appreciated, therefore, that my improved apparatus is so constructed and arranged as to maintain the temperature and moisture content of the air in the room such that at all times condensation of the moisture in the air on the coldest wall of the room, that is, the inner surface of the exterior wall of the room is effectually prevented, and yet a comfortable condition is maintained.

In Fig. 2 of the drawings an air space is provided between the wall 2 of the room and the outer wall 30 of the building, and in this air space 31 I provide a tank 32, filled with a volatile fluid, for instance butane, this tank through the medium of a tube 33 being maintained in communication with the butane in the tank or casing 3. In this arrangement, therefore, the temperature in the air space 31 between the walls 2 and 30 controls the operation of the apparatus, as will be understood.

In some installations it may not be desirable or practicable to install all of my apparatus at one side of the room, so in Fig. 3 I have shown an installation in which 34 designates the apparatus of Fig. 1, for instance, on the interior wall of a room. To this apparatus is connected a tube 35 which extends between the walls of the room beneath the floor and up between the outer wall of the room and the outer wall of the building to a container 36 of butane, for instance, or other volatile fluid, mounted on the inner surface of the outer wall 2. The container 36 and the container (the same as container 3) forming part of the apparatus designated 34 will be in communication with each other so that the temperature at the inner surface of the outer wall 2 will control the setting of the instruments in the device 34.

As mentioned above in the general description of this invention, Fig. 4 illustrates an apparatus

in which I merely employ a humidostat 15 instead of a humidostat and thermostat, as in the case of Figs. 1, 2, and 3. The construction of the apparatus of Fig. 4 is identical with that of Figs. 1 and 2 with the exception of the omission of the thermostat 16 and its connected parts so that no detailed description of Fig. 4 is necessary except to say that the moisture content of the air in the room in which this apparatus is located will be automatically controlled by the humidostat 15 in conjunction with the tank 3, which under changes in temperature is adapted to change the setting of the humidostat, as will be understood.

It is to be understood that changes may be made in the details of construction above described within the purview of my invention.

What I claim is:—

1. Control mechanism for air conditioning apparatus comprising in combination a humidostat and a thermostat for controlling the moisture content and temperature of the air in a room, and means controlled by temperature conditions adjacent the exterior wall of said room for automatically altering the setting of said humidostat and thermostat to maintain such relation between the dry bulb temperature of the air in the room and the percentage of moisture contained in the air that condensing of moisture out of the air upon the inner surface of said exterior wall is prevented.

2. Control mechanism for air conditioning apparatus comprising in combination a humidostat and a thermostat for controlling the moisture content and temperature of the air in a room, said elements being mounted remote from the interior surface of the exterior wall of the room, and temperature controlled means mounted adjacent the inner surface of the exterior wall of the room for regulating the setting of said humidostat and thermostat to maintain such relation between the dry bulb temperature and moisture content of the air in the room that condensation of the moisture out of the air upon the inner surface of the exterior wall of the room is prevented.

3. Control mechanism for air conditioning apparatus comprising in combination a humidostat responsive to humidity conditions of the air within an enclosure, a thermostat responsive to temperature conditions within said enclosure,

said humidostat and thermostat being mounted within said enclosure, an expansible tank within said enclosure adjacent the inner side of the outer wall thereof, a volatile fluid in said tank, the volume of said fluid varying, due to the heat conduction of said wall, with variations in temperature at the outer side of said wall, and a positive mechanical connection between said tank and said humidostat and thermostat so that as said fluid varies in volume and the said tank expands and contracts the setting of said thermostat and humidostat will be positively and simultaneously varied with variations in temperature of the air at the outer side of the said outer wall.

4. Control mechanism for air conditioning apparatus comprising in combination a humidostat responsive to the humidity conditions of the air within an enclosure, a thermostat responsive to temperature conditions within said enclosure, said humidostat and thermostat being mounted within said enclosure, a single lever connected to said humidostat and thermostat, an expansible tank within said enclosure adjacent the inner side of the outer wall thereof and operatively connected to said lever, a fluid in said tank, the volume of said fluid varying, due to the heat conduction of said wall, with variations in temperature at the outer side of said wall, said tank expanding and contracting with variations in the volume of said fluid to change the setting of the thermostat and humidostat simultaneously with variations in temperature of the air at the outer side of the said outer wall.

5. Control mechanism for air conditioning apparatus comprising in combination a thermostat and a humidostat mounted within an enclosure, said thermostat being responsive to temperature conditions within said enclosure, said humidostat being responsive to the humidity conditions of the air within said enclosure and temperature controlled means inside of said enclosure responsive to variations in temperature of the air at the outer side of said outer wall of the enclosure and mechanically connected to the thermostat and humidostat for positively automatically and simultaneously varying the setting of said thermostat and humidostat with said variations in the temperature of the air at the outer side of the outer wall of said enclosure.

WILLIAM A. BULGER.