

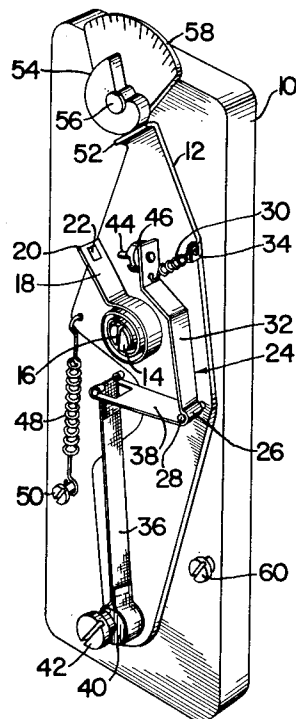
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CONTROL DEVICE

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CONTROL DEVICE

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5 Claims. (Cl. 200—138)

This invention relates to a control for conditioning equipment for an enclosed space, such as a room.

It is well known that the occupant of a room will experience the same degree of personal comfort at various temperature and relative humidity combinations. This comfort may be measured by what is known as the "effective temperature," which is defined as the range of temperature and relative humidity combinations at which a person experiences the same degree of personal comfort. For example, if a person feels comfortable at 70° "effective temperature," he experiences the same degree of comfort in an ambient condition of 70° F. and 100% relative humidity as he does at 75° F. and 50% relative humidity and at 81° F. and 10% relative humidity.

It is an object of this invention to utilize the thermally responsive movement of a temperature responsive means and the humidity responsive movement of a hygroscopic material to control the operating circuit of a room conditioner.

Another object of this invention is to construct an effective temperature control device which may be easily calibrated.

Another object of this invention is to combine a temperature responsive means and a humidity responsive means into a simple, compact, and reliable control device permitting economy in manufacture and facilitating installation and repair.

In a preferred embodiment of this invention, a plate is rotatably mounted on the control support member and a pair of oppositely disposed contacts are provided. One contact is mounted on the plate for rotative movement relative thereto, and the other contact is mounted on the support member. These contacts may be serially connected in the operating circuit for the room conditioning means. Adjusting means are provided for positioning the plate which correspondingly positions the contact mounted thereon relative to the other contact. A humidity responsive means is operatively connected to the contact mounted on the plate for actuating the same relative to the other contact and a temperature responsive means is operatively connected to the contact mounted on the support member for actuating the same relative to the contact mounted on the plate. By this arrangement, the contacts open and close in accordance with the variations in the ambient humidity and the ambient temperature.

The above and other objects and features of the invention will appear more fully from a consideration of the following disclosure taken in connection with the accompanying drawing wherein a perspective view of a preferred embodiment of the invention is illustrated by way of example.

As shown in the drawing, the control device comprises a substantially rectangular support member 10 and a plate 12 mounted on support member 10 by means of a shaft 14 which is threadedly mounted in support member 10 and has plate 12 positioned thereon. Plate 12 is loosely supported on shaft 14 for rotation relative to both shaft 14 and support member 10. Shaft 14 is tightly

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secured in support member 10 and is not rotatable when plate 12 is rotated. Shaft 14 has a groove 16 in the outer end thereof adapted to receive a screwdriver or other means to cause shaft rotation.

A bimetallic strip 18 wound in the form of a spiral is secured at one end to shaft 14. The outer end 20 of bimetallic strip 18 has an electrical contact 22 formed thereon. Bimetallic strip 18 is constructed to rotate clockwise about shaft 14 in response to a decrease in the ambient temperature and counterclockwise about shaft 14 in response to an increase in the ambient temperature.

An angular lever 24 is mounted on plate 12 to rotate about the apex 26 thereof by means of a pivot pin 28 which is secured to plate 12 and has a portion of lever 24 adjacent to apex 26 formed thereabout. A spring 30 is connected in tension between one leg 32 of lever 24 and a hook 34 formed on plate 12. By this construction, spring 30 biases lever 24 in a clockwise direction about pivot pin 28.

Means are provided for restricting the biased movement of lever 24 to thereby position the same. Such means comprises a strip 36 of hygroscopic material, such as a nylon ribbon, connected at its one end to the other leg 38 of lever 24 and at its other end to an eccentric portion 40 of a screw 42 threadedly mounted in plate 12. Hygroscopic strip 36 increases in length in response to an increase in the ambient relative humidity and decreases in length in response to the decrease in ambient relative humidity.

An electrical contact 44 is threadedly mounted in the outermost end of leg 32 which is constructed and arranged so that contact 44 is in opposed relation with contact 22. A small magnet 46 is also mounted on the outermost end of leg 32 to close contacts 22 and 44 with a snap action when they have moved close enough to each other.

Means are provided for positioning plate 12 in various effective temperature setting positions. To this end, a spring 48 is connected in tension between plate 12 and a terminal screw 50 threaded into support member 10 whereby plate 12 is biased in a counterclockwise direction about shaft 14. Plate 12 has a flange 52 which is biased into engagement with a cam 54 by the action of spring 48 whereby cam 54 restricts the counterclockwise movement of plate 12 to position the same. Cam 54 is fastened onto a shaft 56 which is rotatably mounted in support member 10. By this construction, the clockwise rotation of cam 54, by means of shaft 56, causes a corresponding counterclockwise rotation of plate 12 about shaft 14 against the bias of spring 48.

An effective temperature selecting plate 58 is also mounted on shaft 56. In the installed condition of the control device, effective temperature selecting plate 58 is easily accessible through the control device cover whereby shaft 56 and cam 54 may be rotated by actuation of effective temperature selecting plate 58. Appropriate effective temperature numerals may be marked on effective temperature selecting plate 58 and these numerals may be aligned with an index mark on the control device cover to provide the desired effective temperature setting. It will be apparent that by positioning plate 12, contact 44 is also positioned relative to contact 22.

Contacts 22 and 44 are adapted for series connection in the control circuit of the room conditioner. To this end, contact 44 is electrically connected to terminal screw 50 through lever 24, pin 28, and an electrical connection (not shown) on the rear of support member 10. Contact 22 is connected to another terminal screw 60, which is threadedly mounted in support member 10 by means of bimetallic strip 18, shaft 14, and an electrical connection (not shown) on the rear of support member 10.

Terminal screws 50 and 60 may be serially connected in the room conditioner control circuit. In order to prevent any possibility of a short circuit, support member 10 and plate 12 may be constructed of an electrical insulating material.

The calibrating means for the control device comprises rotatable shaft 14 and eccentric screw 42. By rotating shaft 14 to cause rotative movement of bimetallic strip 18, the position of contact 22 with respect to contact 44 may be readily adjusted. By rotating eccentric screw 42 to cause a longitudinal movement of hygroscopic strip 36 by means of eccentric portion 40 and a corresponding rotative movement of lever 24 about pivot 28, the position of contact 44 with respect to contact 22 may be adjusted.

Operation

When the control device is positioned in the room to be conditioned and terminals 50 and 60 are serially connected in the conditioner control circuit, the effective temperature selecting plate 58 is rotated to the desired effective temperature as indicated by the index mark on the cover and the numerals on effective temperature selecting plate 58. This rotative movement of effective temperature selecting plate 58 causes rotation of plate 12 about shaft 14 by the action of shaft 56 and cam 54. Rotation of plate 12 changes the relative position of contact 44 with respect to contact 22 and, under normal conditions, places the control device in the open position as shown in the drawing.

As the ambient temperature drops, bimetallic strip 18 moves clockwise about shaft 14 thereby moving contact 22 toward contact 44 until contact 22 is close to contact 44 whereby magnet 46 causes a snap action contact closing movement. When contacts 22 and 44 are closed, there is a closed circuit between terminals 50 and 60 whereby the room conditioner control circuit is affected in the desired manner. For example, the closing of the circuit between terminals 50 and 60 may be utilized to turn a heating means "on" or to turn a cooling means "off" in a manner well known in the art. If the ambient temperature should subsequently rise a sufficient amount, a reverse action occurs wherein bimetallic strip 18 moves contact 22 out of engagement with contact 44 thereby breaking the circuit between terminals 50 and 60.

For any position of plate 12, as determined by effective temperature selecting plates 58, the position of contact 44 with respect to contact 22 is determined by the relative humidity sensed by hygroscopic strip 36. As the ambient relative humidity increases, the length of hygroscopic strip 36 increases permitting clockwise rotation of lever 24 about pivot 28 under the bias of spring 30 thereby increasing the space between contacts 22 and 44. Hence, a further ambient temperature drop is necessary before contact 22 will move into engagement with contact 44. On the other hand, as the relative humidity decreases, hygroscopic strip 36 decreases in length to cause counterclockwise rotation of lever 24. This counterclockwise movement of lever 24 decreases the space between contacts 22 and 44 whereby contact 22 moves into engagement with contact 44 at a higher temperature.

The control device will cycle in the above manner to open and close the control circuit for the room conditioner. It will be apparent that the control device will perform this function in accordance with both the ambient temperature and the ambient relative humidity in the room or space to be controlled to thus provide an effective temperature control. Also, the effective temperature control device may be readily substituted for common room thermostats since the device, in essence, adjusts the dry bulb temperature operating point of the

thermostatic portion of the control to provide a constant degree of personal comfort.

It is to be understood that although only one embodiment of this invention has been shown and described for purposes of illustration, the invention can be variously embodied and changes may be made in the construction and arrangement of parts without departing from the scope of the invention as defined by the appended claims.

I claim:

1. In a control device for an electric circuit means, the combination comprising a support member, a plate rotatably mounted on said support member, first and second contact members, means mounting said first contact member on said plate for movement therewith and for rotatable movement relative thereto, means including a thermally responsive bimetallic strip mounting said second contact member on said support member for movement therewith, said first and second contacts being mounted in opposed relation for moving into and out of engagement, a strip of hygroscopic material mounted on said plate and connected to said first contact mounting means for actuating said first contact relative to said second contact in accordance with the ambient humidity, said bimetallic strip being movable in response to ambient temperature variations to actuate said second contact relative to said first contact in accordance with the ambient temperature, and means for rotatably positioning said plate whereby said first contact is positioned relative to said second contact.

2. A device as claimed in claim 1 wherein said means for rotatably positioning said plate comprises a spring means connected to said plate for biasing the same toward rotation in one direction, and a cam member rotatably mounted on said support member and engaging said plate to restrict the biased movement thereof and to cause rotation thereof upon rotation of said cam member.

3. A device as claimed in claim 1 wherein said first contact member mounting means comprises a lever rotatably mounted at a fulcrum portion and having said first contact member mounted thereon, and a spring means connected to one leg of said lever for biasing the same in one direction, said hygroscopic strip being connected at one end to the other leg of said lever to restrict the biased movement thereof of said lever whereby movement of said hygroscopic strip causes a corresponding movement of said lever.

4. A device as claimed in claim 3 including a calibrating means comprising an eccentric screw rotatably mounted on said plate, the other end of said hygroscopic strip being connected to said eccentric screw whereby rotation of said screw causes movement of said hygroscopic strip and a corresponding movement of said lever to thereby adjust said first contact, and a shaft included in said second contact mounting means and rotatably mounted on said support member, one end of said bimetallic strip being connected to said shaft whereby rotation of said shaft causes movement of said bimetallic strip and corresponding movement of said second contact.

5. A device as claimed in claim 4 wherein said means for rotatably positioning said plate comprises a spring means connected to said plate for biasing the same toward rotation in one direction, and a cam member rotatably mounted on said support member and engaging said plate to restrict the biased movement thereof and to cause rotation thereof upon rotation of said cam member.

References Cited in the file of this patent

UNITED STATES PATENTS

1,807,306	Coleman	May 22, 1931
2,322,339	Beals	June 22, 1943