Sept. 27, 1960 R. F. HARGREAVES 2,954,445

DEHUMIDIFYING UNIT CONTROL MEANS AND METHOD OF MAKING THE SAME

Filed Nov. 14, 1958

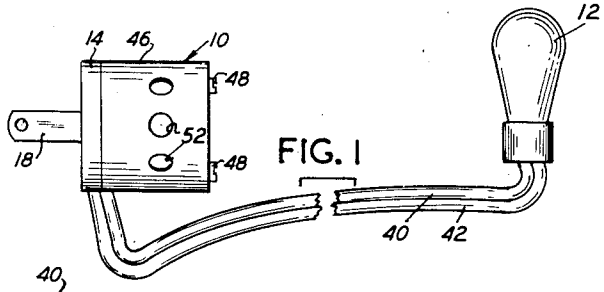


FIG. 1

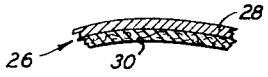


FIG. 6

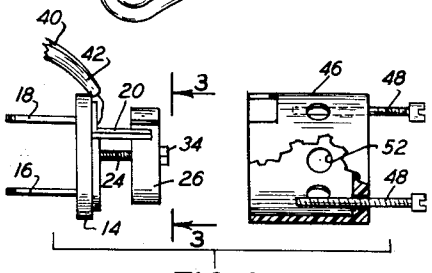


FIG. 2

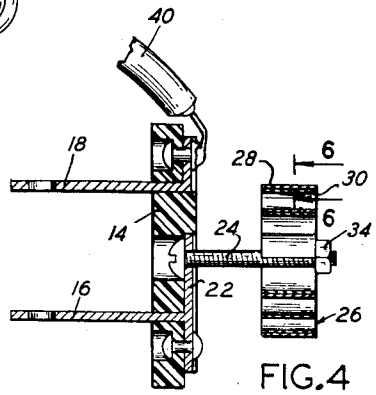


FIG. 4

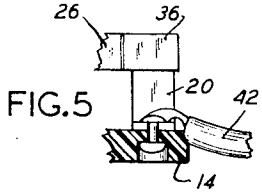


FIG. 5

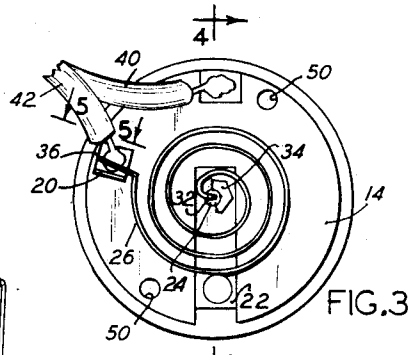


FIG. 3

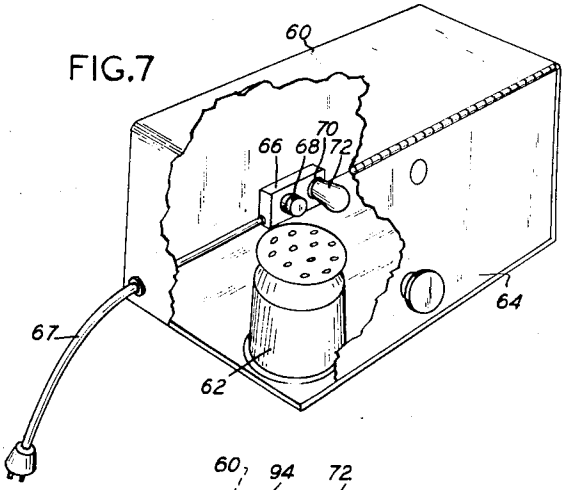


FIG. 7

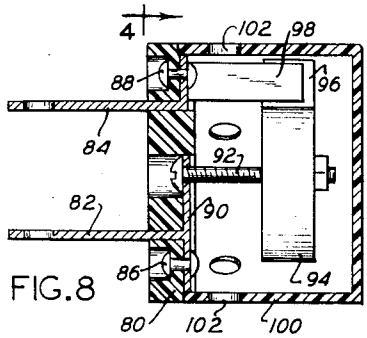


FIG. 8

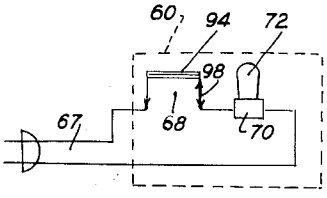


FIG. 9

INVENTOR.
ROBERT F. HARGREAVES
BY
BUCKHORN, CHEATHAM & BLORE
ATTORNEYS

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DEHUMIDIFYING UNIT CONTROL MEANS AND METHOD OF MAKING THE SAME

Robert F. Hargreaves, 120 NW. 9th Ave., Portland 20, Oreg.

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7 Claims. (Cl. 200—61.06)

The present invention relates to control means for a dehumidifying unit, such as an air conditioner, salt oven or other type of unit, and to a method of making a portion of the control means.

An ever present problem in humid climates is in providing a storage area of controlled humidity for salt shakers and the like so as to keep such products dry. It is an object of the present invention to provide a new and novel control unit for a dehumidifying unit for storing salt and other materials so as to prevent their absorption of moisture from the ambient atmosphere and subsequent caking.

A further object of the invention is to provide control means for a dehumidifying unit that may be easily and quickly adjusted to vary the sensitivity of the control means.

Still another object of the invention is to provide a control means that is simple in construction and which may be inexpensively manufactured.

A still further object of the invention is to provide a new and improved method of manufacturing elements for the control means.

Other objects and advantages of the invention will become more apparent hereinafter.

In accordance with an illustrated embodiment of the invention, the humidity controller of the invention comprises an insulating mounting member on which are mounted a pair of plug-in connectors for insertion in a conventional convenience outlet. Supported on the mounting member is a humidity responsive element consisting of a two-ply strip arranged in coil form, one of the plies of the strip being formed of a resilient, electrically conductive metal and the other ply being formed of moisture absorbent paper. One end of the coil is fixedly secured to the mounting member and the other end is free to move relative to a contact which the coil is adapted to engage whenever the relative humidity rises above a certain point. Means are provided for connecting a heating device to the plug-in connectors in series with the coil through the contact whereby the heating device will be turned on or off as the coil "makes" or "breaks" with the contact, the heating device being adapted to be mounted in a confined space containing the articles to be stored so that the temperature of such space may be raised, if necessary, to lower the relative humidity therein below a desired level.

For a more complete description of the invention, reference is made to the following specification taken in conjunction with the accompanying drawings wherein:

Fig. 1 is an elevation of a controller made in accordance with the invention showing the same connected to a heating element of a lamp type;

Fig. 2 is an exploded view of the controller made in accordance with the invention;

Fig. 3 is an enlarged view of the controller taken in the direction of the arrows 3—3 of Fig. 2;

Fig. 4 is a sectional view taken along line 4—4 of Fig. 3;

Fig. 5 is a fragmentary view showing an arrangement of a contact forming part of the controller;

Fig. 6 is an enlarged sectional view through the humidity responsive element taken along line 6—6 of Fig. 4;

Fig. 7 is a perspective view partly broken away of a dehumidifying unit and controller made in accordance with a modification of the invention;

Fig. 8 is a sectional view through the modified control unit utilized in the embodiment of Fig. 7; and

Fig. 9 is a schematic view of the electrical circuit in the embodiment of Fig. 7.

Referring now to the drawings, the embodiment of the invention illustrated in Figs. 1 to 6, inclusive, comprises a dehumidifying controller **10** adapted to control a heating element, such as a lamp **12**, positioned at a remote location from the controller. Thus, for example, the dehumidifying controller **10** can be connected into any convenience outlet of a home while the heating lamp **12** could be positioned within a remote, confined enclosure in which the relative humidity is to be controlled. With particular reference now to Figs. 2 to 6, inclusive, the controller **10** comprises a circular base or mounting member **14** formed of suitable electrical insulating material and upon which is mounted a pair of plug-in connectors **16**, **18** in a standard arrangement so that the connectors can be inserted into a standard convenience outlet (not shown) of a residence lighting circuit. Means to provide a circuit between the connectors and the heating lamp **12** includes a first contact **20** fixed in any suitable manner to the base member **14** near the periphery thereof and projecting upwardly therefrom. As best shown in Fig. 4, the connector **16** is provided with an extension portion **22** which extends over the center of the mounting member **14**. Threadedly engaged in the extension **22** and extending upwardly from the mounting member **14** is a screw **24** upon which is mounted a humidity responsive element **26** comprising a spirally coiled strip of two-ply material, the outer ply **28** of the strip of coil being formed of thin, flexible, electrically conductive metal and the inner ply of the strip being formed of a moisture absorbent paper **30**. I prepare such coils by exposing a sheet of moisture absorbent paper to a saturated atmosphere for a sufficient period of time to permit the sheet to absorb a quantity of water, whereupon it will expand. The paper sheet in its wet condition is then adhered to a sheet of thin, flexible, electrically conductive metal, such as a Phosphor bronze, by means of a suitable adhesive. I have found that almost any of the commercially available phenol-formaldehyde base adhesives are suitable and others will be known to those skilled in the art. After securing the humidified paper to the metal sheet, the combined sheets are severed into strips of the width desired for the coils. As the paper layer dries it will shrink, causing the strips to curl with the paper ply on the inner side of the curve. As a final step, the strips are formed into spiral coils with the paper ply on the inner side of the strip. I find that almost any moisture absorbent paper can be used for the paper ply though, of course, expansion characteristics of papers will differ, and by selection of the paper used, a certain degree of control over the response of the coil to changes in humidity may be obtained. The inner end of the coil **26** is wedged in a slot **32** (see Fig. 3) formed in the end of the screw **24** which serves as an anchoring means for the coil end.

A nut 34 may be provided to wedge the end of the coil within the slot 32. The coil is arranged with its outer end 36 positioned closely adjacent the contact 20. As will be evident, an increase in the humidity of the ambient atmosphere surrounding the coil 26 will result in an increase in the absorption by the paper layer 30, with the resulting tendency of the coil to straighten and to move the coil end 36 towards the contact 20. Decrease in the relative humidity of the ambient atmosphere surrounding the coil 26 will, on the other hand, result in evaporation of moisture from the layer 30 with the result that the layer 30 will shrink and cause the coil to tighten, moving the coil end 36 away from the contact 20. The position of the coil end or second contact 36 relative to the first contact 20 under any given conditions can be adjusted by simply rotating the screw 24 which will, of course, rotate the entire coil 26.

The coil 26 is connected in series with the heating lamp 12 by means of a pair of electrical leads 40, 42, the lead 40 being connected to the connector 18 and the lead 42 being connected to the contact 20. Thus, it will be seen, a circuit is made including the connector 18 and lead 40 to the lamp 12 and back through the lead 42 to the contact 20. When the coil end 36 is in contact with the contact 20, the circuit is then complete through the coil 26 and screw 24 to the connector 16. A cover 46 may be provided to protect the coil 26 and other elements mounted in the base 14, suitable means, such as screws 48, threadedly engaging openings 50 in the mounting member 14 being provided to secure the cover to the mounting member. The cover 46 is provided with openings 52 to permit the circulation of air therethrough so that the atmosphere within the cover will be substantially the same as that surrounding the controller.

As has been indicated previously, the controller 10 can be plugged into any suitable convenience outlet and the heating lamp 12 or other heating device can be positioned in an enclosed area remote from the controller 10. Thus, when the humidity in the atmosphere ambient to the controller increases to a particular point depending upon the adjustment of the controller, the heating lamp 12 will be activated causing the temperature of the air within the confined space to be heated, thus lowering the relative humidity thereof. On the other hand, if the relative humidity of the atmosphere ambient to the controller 10 should drop below a particular point, the controller will respond by opening the circuit to the lamp 12.

The modification of the invention illustrated in Figs. 7, 8 and 9 is shown in connection with a cabinet 60 in which it is desired to raise the temperature thus to lower the relative humidity to permit storage of salt shakers as indicated at 62 and other foods and articles which might be harmed by excessive humidity present in the room atmosphere. The cabinet 60 may be provided with a door 64 or other suitable means of access. Mounted within the cabinet 60 is a conduit box 66 to which power may be supplied by an extension cord 67 or by other suitable means. The conduit box 66 is provided with a conventional plug-type outlet 68 in which a modified controller to be described may be mounted and it is also provided with a suitable outlet 70, such as a lamp base, for receiving a heating element, such as a heating lamp 72. The outlets 68, 70 are connected in series with the extension cord 67 as indicated in Fig. 9. Referring now to Fig. 8, the controller of the presently described embodiment comprises a circular base or mounting member 80 formed of suitable insulating material upon which is mounted a pair of plug-in connectors 82, 84 secured to the base by means of rivets 86, 88, respectively. The connector 82 is provided with an extension 90 which extends over the center of the mounting member 80 and through which is threadedly received a screw 92 to which is secured a coiled humidity responsive element 94 constructed substantially identical to the element 26 described previously. The coil 94 is suitably secured to the screw 92 so that the coil may be bodily rotated by rotating the screw 92. The coil 94 is provided with an outer end portion 96 which is positioned to engage a contact 98 connected directly to the connector 84 when the relative humidity is above a predetermined level. To protect the coil 94, a cover 100 provided with suitable ventilating openings 102 may be mounted on the mounting member 80.

Fig. 9 shows schematically the circuitry of the presently described embodiment, the cabinet 60 being represented by dotted lines bearing the same reference character. As indicated, the humidity responsive element 94 is connected to close the circuit between the contacts of the outlet 68. As will be evident from the description given above, upon increase of the relative humidity within the box 60 to a desired point, consequent expansion of the paper layer of the element 94 and rotation of the end 96 will cause the end to move into engagement with the contact 98, closing the circuit to the heating lamp 72. As the lamp 72 heats the interior of the container 60, the relative humidity will fall, causing evaporation of moisture from the paper layer of the element 94. At some point the contraction of the paper layer will cause the coil end 96 to move out of engagement with the contact 98, opening the circuit to the lamp 72. The screw 92 may be utilized to adjust the relative position of the end 96 with reference to the contact 98 so as to maintain any desired range of humidity within the container 60.

Having illustrated and described a preferred embodiment of the invention, it should be apparent to those skilled in the art that the invention permits of modification in arrangement and detail. I claim as my invention all such modifications as come within the true spirit and scope of the appended claims.

I claim:

1. A dehumidifying controller comprising a mounting member, a pair of plug-in connectors mounted on said member, and means to provide a circuit including said connectors comprising a first contact mounted on said member, a strip of two-ply material adjacent said first contact, one ply of said strip being formed of electrically conductive, flexible metal, the other ply of said strip being formed of absorbent paper, said plies being adhered together throughout their lengths, means anchoring one end of said strip on said member, and a second contact on the other end of said strip in position to engage said first contact upon expansion of said other ply due to an increase in ambient atmospheric humidity.

2. A dehumidifying controller comprising a mounting member, a pair of plug-in connectors mounted on said member, and means to provide a circuit including said connectors comprising a first contact mounted on said member, a spirally coiled strip of two-ply material adjacent said first contact, one ply of said strip being formed of electrically conductive, flexible metal, the other ply of said strip being formed of absorbent paper, said plies being adhered together throughout their lengths, means anchoring one end of said strip on said member, and a second contact on the other end of said strip in position to engage said first contact upon expansion of said other ply due to an increase in ambient atmospheric humidity.

3. The construction set forth in claim 1 wherein said anchoring means is adjustable to vary the relative spacing of said first contact and said second contact.

4. The construction set forth in claim 1 wherein said anchoring means comprises a conductive metal screw threadedly mounted in contact with one of said connectors.

5. The construction set forth in claim 1 wherein said anchoring means electrically connects said strip to one of said connectors and said first contact is electrically connected to the other of said connectors.

6. The construction set forth in claim 1 wherein said anchoring means electrically connects said strip to one of said connectors and said first contact is insulated from said connectors.

7. The construction set forth in claim 2 wherein said anchoring means comprises a metal screw coaxial with said coil and threadedly mounted for rotation whereby to adjust the spacing of said contacts.

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