June 7, 1966 M. M. GRAHAM 3,254,534

ILLUMINATED CONTROL DEVICES

Filed May 7, 1962

FIG. 1

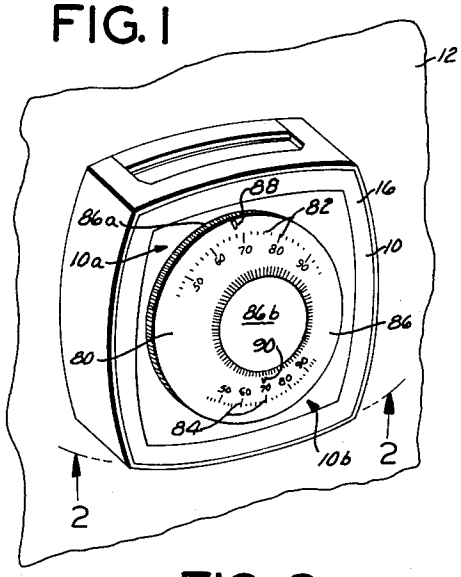


FIG. 2

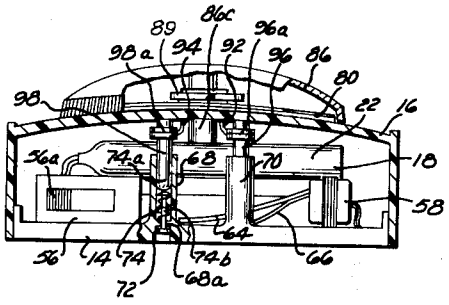


FIG. 3

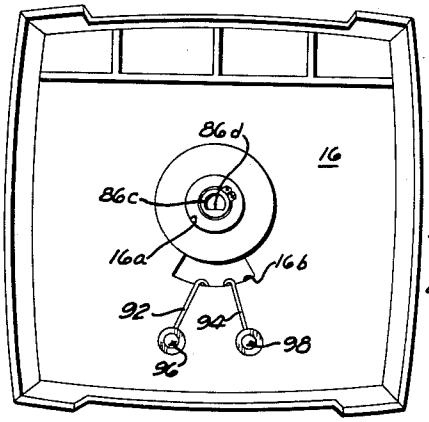
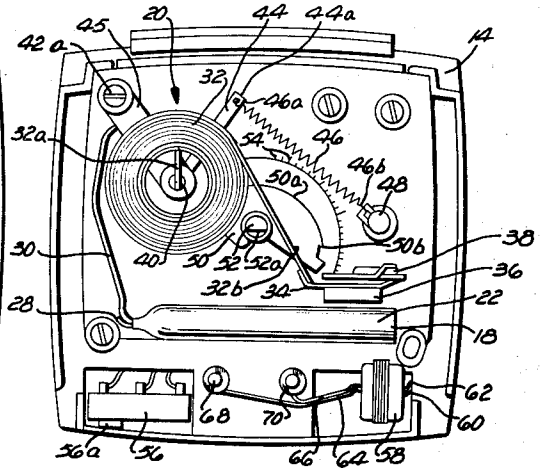


FIG. 4



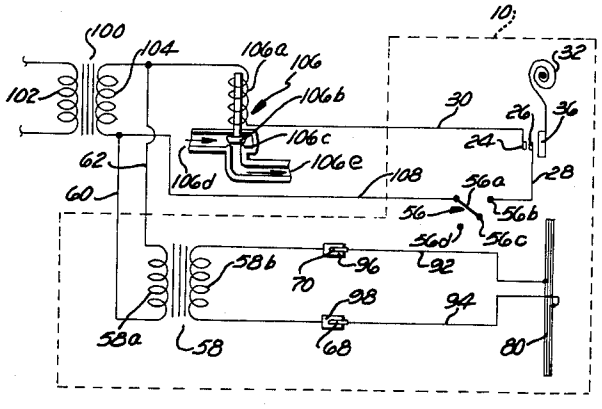


FIG. 5

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ILLUMINATED CONTROL DEVICES

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The present invention relates generally to illuminated control devices, but more particularly to control devices having illuminated indicating means incorporated therein.

In the past, control devices have been provided with lighting means employing either carbon arc lamps or incandescent lamps. Such lighting devices have not proved entirely satisfactory for certain types of control devices since carbon arc lamps and incandescent lamps are essentially point sources of light of relatively high intrinsic brightness. Carbon arc lamps generate light as a result of a short path electric discharge through air, whereas incandescent lamps produce light as a result of the relatively high resistance to electric current flow exhibited by tungsten filaments. Such point sources of light not only produce an over supply of light at the lamp itself and an under supply of light at points remote therefrom, but also generate considerable heat. This characteristic seriously limits the application of certain control devices, since such extraneous source of heat can destroy the accuracy of very sensitive temperature responsive devices.

Certain types of control devices, as for instance thermostatic devices and the like, are often located in areas which are, at certain times, poorly lighted. Since such devices usually require periodic adjustment, it is desirable that they be provided with lighting means. Also, since such devices usually include a suitably calibrated dial and an indicator for cooperation therewith, it has been found most desirable to have light of constant intensity across the entire dial, rather than to have one or more point sources of light as above described.

It is an object of the present invention to provide a self-illuminating control device.

It is an object of the present invention to provide an adjustable control device, the adjustment means of which is provided with light of substantially constant intensity.

Another object of this invention is to provide an adjustable control device having an adjustment dial the entire surface of which is afforded light of substantially constant intensity.

Another object of the present invention is to teach the construction of an adjustable thermostatic control device having its own light source whereby suitable adjustments can be made to the device irrespective of variations in external ambient lighting conditions.

A further object of the present invention is to provide a control device as characterized above wherein an indicia-carrying dial also functions as the source of light for providing light of proper intensity thereacross.

A still further object of the present invention is to provide a control device as characterized above wherein the indicia-carrying dial member is formed of electroluminescent material.

It is also an object of the present invention to provide a control device as characterized above which is simple and inexpensive to manufacture and which is rugged and dependable in operation.

The novel features which I consider characteristic of my invention are set forth with particularity in the appended claims. The device itself, however, both as to its organization and mode of operation, together with additional objects and advantages thereof, will best be understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

FIGURE 1 is a fragmentary perspective view of a portion of a wall or panel carrying a control device according to the present invention;

FIGURE 2 is a fragmentary sectional view taken substantially along line 2—2 of FIGURE 1;

FIGURE 3 is a bottom plan view of the cover member of the control device of FIGURE 1;

FIGURE 4 is a top plan view of such control device with the cover member removed; and

FIGURE 5 is a diagrammatic showing of the electrical circuitry of the present invention.

Like reference characters indicate corresponding parts throughout the several views of the drawings.

Referring to FIGURE 1 of the drawings, there is shown therein a preferred form of the present invention, such as control device **10** suitably mounted on a wall or panel **12**. Control device **10** is a thermostatic control device which not only includes means for adjusting a response condition, as will hereinafter be explained in detail, but also carries suitable means for indicating variations in the condition being controlled. That is, device **10** of FIGURE 1 includes a temperature adjustment portion **10***a* and a temperature indicating or thermometer portion **10***b*.

The particular showing of a thermostatic device and the following description thereof are not to be interpreted as a limitation of the scope of the present invention. Rather, it is contemplated that the present invention can be applied, to advantage, to substantially any type or style of control device having an indicating dial or other type of indicia-carrying member which must be periodically viewed or adjusted.

Thermostatic device **10** comprises a base member **14** mounted, by suitable mounting bolts or screws, to the wall or panel **12**, and a cup-shaped cover member **16** which cooperates with the base member to provide an enclosure. Within such enclosure and mounted on base member **14**, as shown most clearly in FIGURE 4, is an encapsulated circuit controlling device **18** and a magnetic actuator **20** therefor. It has been found preferable to employ an hermetically sealed encapsulated circuit controlling device to prevent faulty or erratic operation due to accumulation of foreign material on the contacts of the circuit controlling device as frequently occurs when such contacts are exposed to atmospheric conditions.

Device **18** comprises a tubular envelope **22** having closed opposite end portions and which may be formed of substantially any non-magnetic material such as glass, plastic material or the like. Within hermetically sealed envelope **22** are two or more relatively movable electrical contacts, shown diagrammatically at **24** and **26** in FIGURE 5. One such contact is mounted in a stationary position within envelope **22** while the other is pivotally mounted with respect thereto for movement between open and closed circuit conditions. Additionally, there is provided within envelope **22** a magnetic member (not shown) attached to or operatively associated with the movable contact for actuating the latter as will hereinafter be explained. Suitable lead wires as shown at **28** and **30** extend from enclosure **20** and are connected in circuit with the electrical contacts **24** and **26**.

The actuating means **20** for switch **18** comprises a spirally wound bimetallic element **32** having a stationary inner end **32***a* and an extended, substantially straight outer end **32***b*. The outer end of bimetallic member **32** carries a mounting bracket **34** on which is mounted a permanent magnet **36** disposed adjacent circuit controlling member **18** as shown most clearly in FIGURE 4.

A limit stop **38** is provided on base member **14** to limit the travel of magnetic member **36** away from circuit controlling device **18**.

Magnetic member **36** is disposed adjacent device **18** such as to magnetically influence the movable electrical contact therewithin. As permanent magnet **36** approaches circuit controlling device **18** a point is reached where the magnetic lines of force from magnet **36** are sufficient to influence the aforementioned magnetic member (not shown) associated with the movable electrical contact within enclosure **20** to move it into engagement with the aforementioned stationary contact. In this manner, the circuit to be controlled by device **18** is completed. As the permanent magnet **36** is moved away from the circuit controlling device **18** under the influence of bimetallic actuator **20** as will hereinafter be explained, a point is reached where the magnetic lines of force of member **36** are no longer sufficient to retain the movable contact in its said closed circuit position against the biasing force of suitable biasing means (not shown) which is provided within enclosure **22** for that purpose.

Bimetallic element **32**, of course, is formed of a pair of elements having dissimilar coefficients of thermal expansion. As such, as the spirally wound elements absorb and lose heat due to variations in ambient temperature to which they are exposed, they expand or contract by different amounts, the result being that the entire element **32** is deformed so as to be slightly wound or unwound from its previous condition. Since end **32***a* of bimetal **32** is stationary, such deformation effects movement of end **32***b*, and hence magnet **36**, with respect to device **18**.

The stationary end **32***a* of bimetal **32** is firmly secured to a pivot pin **40** which is pivotally carried by a mounting lever **45**. An adjustment lever **44** is firmly attached to pin **40** such that movement of lever **44** effects rotation of pivot pin **40** with respect to mounting lever **45**. The outer end **44***a* of member **44** is provided with a through opening for receiving one end **46***a* of a tension spring **46**. The other end **46***b* of spring **46** is suitably attached to base member **14** as shown at **48**.

Adjustment means in the form of a cam member **50** pivotally mounted on base **14** by means of a pivot pin **52** is provided for effecting movement of lever **44** against the force of tension spring **46**. Such cooperation between cam member **50** and lever **44** is effected by means of an arm (not shown) which extends laterally from lever **44** for engagement with cam surface **50***a* of cam member **50**. The cam surface is so designed that as pin **52** is rotated in a counterclockwise direction as viewed in FIGURE 4, the pivotal lever **44** is moved correspondingly in a counterclockwise direction against the force of spring **46**. Such action, of course, causes pin **40** to be pivoted in a counterclockwise direction so as to cause the bimetallic member **32** to move magnetic member **36** away from the circuit controlling device **18**.

The cam surface **50***a* of member **50** is formed with an indicator point **50***b* in close proximity to suitable indicia as shown at **54** on base member **14**. Such indicia, as will hereinafter become more apparent, may be calibrated to indicate temperature if desired, and in any event, constitutes a reference for the adjustment of cam member **50**.

The upper end portion of pivot pin **52** is provided with a flat **52***a*.

Also mounted on base **14** is a manually operable circuit controlling device or switch **56** having an actuating lever **56***a*. Switch **56** is connected in circuit with the electrical contacts **24** and **26** of device **18** as will hereinafter be described with reference to FIGURE 5 of the drawings.

A transformer **58** having input leads **60** and **62** and output leads **64** and **66** is also mounted on base **14**. Input leads **60** and **62** extend from the control device **10** for connection to a suitable source of power as will hereinafter be described.

The output leads **64** and **66** of transformer **58** are connected to electrical terminals which are recessed within

tubular housings **68** and **70** formed on base **14**. It is contemplated that base member **14** may be molded of plastic materials, and hence the tubular housings **68** and **70** may be formed integral therewith. However, in the alternative such housings could be formed separately and attached to base **14** if desired.

As shown most clearly in FIGURE 2 of the drawings, each of the tubular housings **68** and **70** is formed with a through opening having a reduced portion as a result of an annular shoulder or flange as shown at **68***a*. A terminal member **74** is provided in each of the housings **68** and **70**, the terminal member **74** shown in FIGURE 2 being provided with an enlarged end portion **74***a*. A compression spring **72** is interposed between the end portion **74***a* of terminal member **74** and the annular shoulder **68***a*.

Terminal member **74** has an elongated shank **74***b* which extends through the reduced portion of the opening formed in housing **68**. The lower end of shank **74***b* is staked or is provided with suitable fastening means to provide a limit stop for the upward movement of terminal **74** by compression spring **72**. The output leads **64** and **66** from transformer **58** are individually attached to the terminals through suitable transverse openings in the side wall of the tubular housings **68** and **70**.

The cup-shaped cover **16** may also be formed of plastic, and is generally of such size and shape as to resiliently engage base **14**. If desired, suitable interlocking indentations and protuberances may be provided on the members **14** and **16** to insure firm engagement of the cover on the base member.

Cover **16** is provided with an indicia-carrying plate **80** which is firmly fastened to the outer face of the cover and is provided with a generally circular outer periphery and is formed with a circular centrally located opening. Member **80** of FIGURE 1 is provided with suitable temperature indicia **82** arranged arcuately along its upper edge and corresponding temperature indicia **84** similarly arranged along its bottom edge. Indicia **82** and **84** may be applied in any appropriate manner, such as by being painted, etched, carved, or the like in indicia plate **80**.

As will hereinafter be described in further detail, the indicia plate **80** also constitutes the light source for the entire control device **10**. Such plate **80** is formed of electroluminescent material which may comprise phosphor suspended in a dielectric medium. Such electroluminescent materials are of laminated construction and are readily available in todays commercial market places.

Pivotally mounted on the cover **16** of device **10** is a transparent adjusting member or knob **86** which carries an indicating mark or point **88** at one location adjacent its outer periphery. The entire peripheral edge of adjustment member **86** may be knurled to provide finger gripping means for easy rotation of member **86**. The central portion **86***b* of adjusting member **86** may be non-transparent and may carry suitable advertising if desired.

As shown most clearly in FIGURE 3 of the drawings, the adjusting member **86** is pivotally mounted within a centrally located opening **16***a* in cover **16**. For this purpose, member **86** is provided with a shaft **86***c* which is formed with an opening having a flat **86***d* corresponding to the flat **52***a* on the upper end portion of pivot pin **52**.

Positioned behind the non-transparent central portion **86***b* of member **86** is a temperature responsive device as for instance a bimetallic element **89** which carries an indicator **90** which is movable with respect to the temperature scale having indicia **84** for indicating the prevailing ambient temperature.

Cover **16** is further formed with an arcuate opening **16***b* adjacent opening **16***a*. A pair of lead wires **92** and **94** extend through opening **16***b* and are connected to opposite sides of the aforedescribed electroluminescent indicia-carrying member **80**. Lead wire **92** is connected to a terminal post **96** which is rigidly attached to the underside of cover **16** and depends therefrom as shown in FIGURE 2. In like manner, lead wire **94** is connected to a

like terminal post **98** which also depends from cover **16** in spaced relation to the terminal post **96**.

Each such terminal post **96** and **98** is formed of electrically conductive material of such size and shape as to slidably fit within the tubular housings **70** and **68** respectively. Each terminal is provided with an annular shoulder or flange as shown at **96***a* and **98***a* respectively. The lead wires **92** and **94** are connected to such terminal members at such flanges.

The terminal members **96** and **98** are insulatedly mounted on the cover **16** so that the electrical circuit therebetween is through the electroluminescent indicia-carrying member **80**. In this regard, the lead wires **92** and **94** may be connected to opposite surfaces of the plate **80** by any appropriate means as for instance clips or small bolts (neither of which is shown in the drawings).

It is thus seen that by positioning cover **16** on base member **14** the adjustment member **86** is connected to the cam member **50** through the hollow shaft **86***c* of member **86** and the pivot pin **52** which carries cam member **50**. Engagement of the flats **86***c* and **52***a* insures that rotation of adjustment member **86** on cover **16** will vary the position of cam member **50**.

Referring to FIGURE 5 of the drawings, the thermostatic device is shown therein within the broken line **10**.

The domestic heating apparatus to be controlled by device **10** is connected to the usual household source of electrical energy of 110 volts. A transformer **100** has its primary winding **102** connected to the 110 volt source. The secondary winding **104** of transformer **100** affords approximately 24 volts for energizing a solenoid operated flow control valve **106** which is connected in the fuel supply conduit of the main burner of the heating unit. Although the present invention is by no means limited to use with a 24 volt control circuit, it is so described herein due to the fact that such systems are quite common today.

The main flow control valve **106** comprises an electromagnetic winding **106***a* which is energizable to move a flow control member **106***b* from flow preventing position in engagement with a valve seat **106***c* to flow permitting position in spaced relation thereto. When this occurs, combustible fuel is permitted to flow from the inlet **106***d* to the outlet **106***e* of the valve **106** to afford fuel flow to the main burner of the heating unit.

One side of secondary winding **104** is connected to one side of electromagnetic winding **106***a* of valve **106**. The other side of winding **106***a* is connected to lead wire **30** of thermostatic device **10**.

Lead wire **28** from circuit controlling device **18** is connected to one terminal of the manually operable switch **56**. The movable contactor **56***a* of switch **56** is connected to the other side of secondary winding **104** of transformer **100** through a lead wire **108**.

Switch **56** is shown diagrammatically in FIGURE 5 of the drawings as having three positions. When in a first position in engagement with stationary contact **56***b*, movable contactor **56***a* completes the heating circuit for energization of valve **106** in response to operation of circuit controlling device **18**. The remaining stationary contacts **56***c* and **56***d* can be used respectively to afford an off position for the entire control apparatus and a cooling or air-circulating position if desired. That is, whereas stationary contact **56***c* might represent an off position, when contactor **56***a* is in engagement with contact **56***d* an air circulating fan which is part of the heating unit can be energized or an entire air refrigerating system can be energized. Neither of such devices or apparatuses is shown in the drawing.

The input leads **60** and **62** of transformer **58** are connected across the secondary winding **104** of transformer **100**. Transformer **58** is so constructed that when 24 volts is impressed across its primary winding **58***a* a potential of approximately 70 volts is developed across the secondary winding **58***b* thereof. This is necessary since approximately 70 volts is necessary for properly energizing the electroluminescent indicia plate **80**. As shown in FIGURE 5 of the drawings, the plate **80** is connected in series circuit arrangement with the secondary winding **58***b* of transformer **58** through the aforedescribed terminal members **96** and **98** on cover **16** and tubular terminal members **68** and **70** on base member **14**. In this manner an electrical potential of 70 volts is impressed across the opposite faces of the electroluminescent member **80**. This causes the entire member **80** to constitute what is commonly termed an area source of light. Thus, the entire indicia-carrying member **80** glows so as to afford constant light intensity over the entire surface thereof.

Since the member **80** carries temperature indicia for both the thermostatic portion **10***a* and the thermometer portion **10***b* of the device **10**, it is seen that the member **80** provides the combination of functions whereby the adjustment of the thermostatic device is more readily and easily accomplished. Since the indicia **82** and **84** carried by plate **80** must be periodically closely viewed in order to make proper adjustment of the thermostatic unit **10**, it is appropriate that such indicia plate **80** be self-illuminating.

Upon removal of cover **16** from base **14**, the terminal posts **96** and **98** are separated from their respective terminal members within the housings **68** and **70**. Thus the 70 volt potential afforded by transformer **58** is not exposed for possible contact by service personnel.

With cover **16** properly positioned on base member **14** not only is adjustment member **86** properly connected to cam member **50** through shaft **86***c* and pin **52**, but suitable electrical potential is afforded across plate **80**. Thereafter variations in ambient temperature effect deformation of the bimetal **32** so as to effect operation of switch **18**. Operation of the latter, of course, controls the energization and de-energization of winding **106***a* of flow control device **106**.

The response temperature of device **10** can be readily changed by suitable manipulation of adjustment member **86**. Rotating member **86** so as to align indicating pointer **88** with the proper graduation in the temperature scale having indicia **82** causes cam member **50** and spring **46** to alter the position of stationary end portion **32***a* of bimetal **32**. Such action, of course, alters the relationship between magnet **36** and switch **18**. Thus, the response temperature of device **10** is altered as desired.

It is thus seen that the present invention provides a control device which is easier to adjust and which is easier to view under adverse ambient lighting conditions.

Although I have shown and described certain specific embodiments of my invention I am fully aware that many modifications thereof are possible. My invention, therefore, is not to be restricted except insofar as is necessitated by the prior art and by the spirit of the appended claims.

I claim:

1. A self-illuminated room thermostat, comprising:

an enclosure having a base member and a cover on said base member having a portion formed of electroluminescent material, said portion of said cover being provided with ambient temperature indicia and response temperature indicia;

adjustable temperature responsive means in said enclosure;

an adjustable knob supported on said enclosure over said cover and operatively connected to said adjustable temperature responsive means, said adjustment knob being cooperable with said response temperature indicia on said cover;

ambient temperature means on said cover cooperable with said ambient temperature indicia to provide an indication of room temperature;

and means on said enclosure for electrically energizing

said electroluminescent material to cause said material to afford light and thereby facilitate adjustment of said adjustment knob with respect to said response temperature indicia.

2. A self-illuminated room thermostat as set forth in claim 1 wherein, said means for electrically energizing said electroluminescent material includes complemental, normally electrically connected circuit components carried by said cover and said base member, respectively, and electrically disconnectable when demounting said cover from said base member to thereby de-energize said electroluminescent material.

3. A self-illuminated room thermostat as set forth in claim 1 wherein, said means for electrically energizing said electroluminescent material includes a transformer.

4. A self-illuminated room thermostat as set forth in claim 2 wherein, said means for electrically energizing said electroluminescent material includes a transformer.

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