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2,873,328

THERMOSTAT FOR LOW POWER CIRCUITS

Filed Aug. 29, 1955

2 Sheets-Sheet 1

Fig. 1.

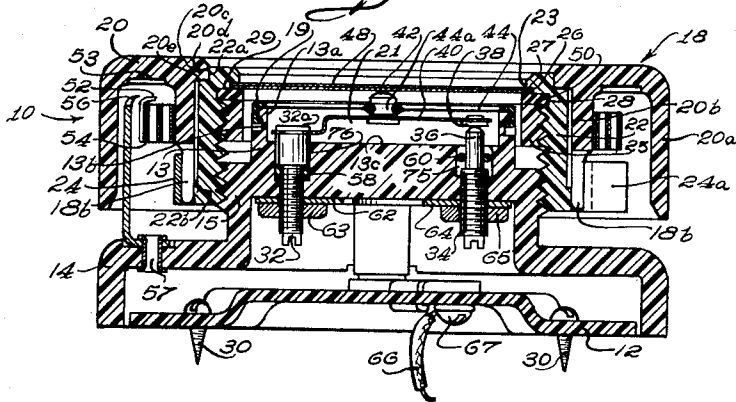


Fig. 2.

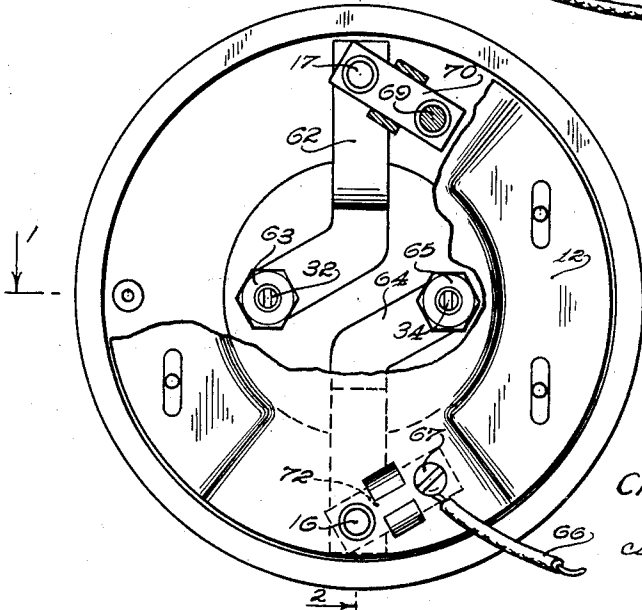
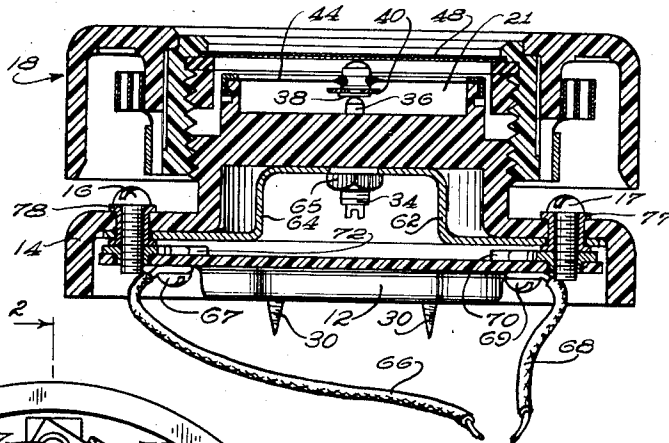


Fig. 3.

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2 Sheets-Sheet 2

Fig. 4.

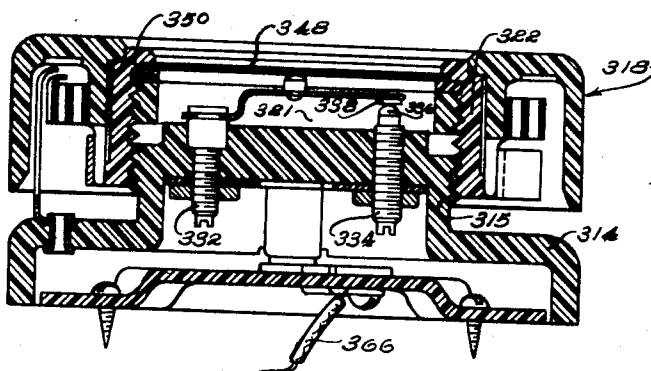
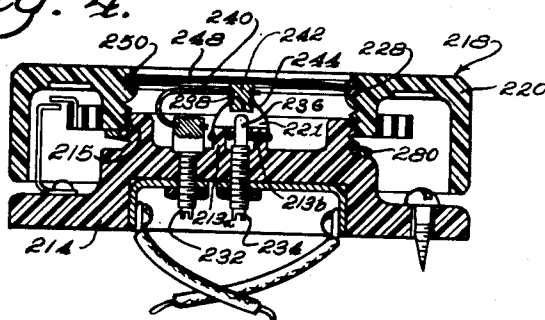


Fig. 5.

Fig. 6.

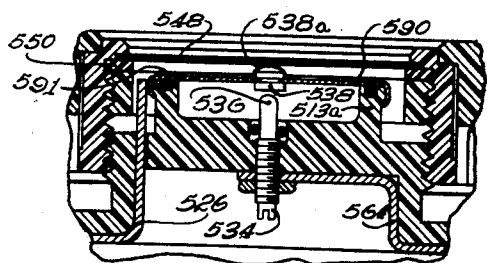
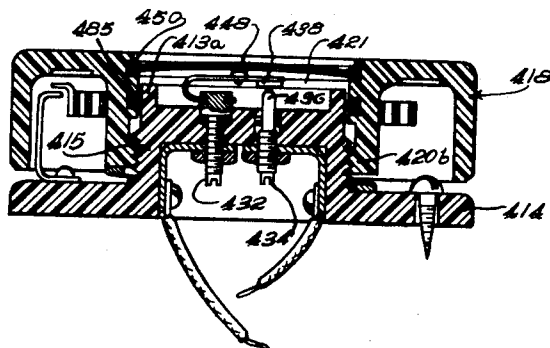


Fig. 7.

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2,873,328

THERMOSTAT FOR LOW POWER CIRCUITS

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Application August 29, 1955, Serial No. 531,205

24 Claims. (Cl. 200—138)

This invention relates, in general, to a condition responsive control device, and more particularly to a temperature responsive device for controlling low power circuits.

One of the main objects of the present invention is to provide a temperature responsive device of great sensitivity and promptness of response to the temperature of the medium to which it is responsive, and more particularly to provide means of the character described which is so sensitive as to eliminate the need for anticipating means, but which on the other hand will not result in too frequent or false cycling of the temperature controlling apparatus with which it may be employed.

Another object is to provide a temperature responsive device of the character described particularly adapted to control low power circuits, for example circuits having as a source of electric energy a thermoelectric generator or the like, and more particularly a device which introduces a minimum of contact resistance into such a circuit.

Another object is to provide in this type of device an externally exposed temperature responsive bi-metallic element having a relatively uniform rate of deformation per degree change in temperature which element directly actuates low and variable resistance circuit controlling contacts.

Another object of the present invention is to provide a device of the aforementioned character having a control point setting member with which the bi-metallic element is engaged for movement thereby, the actuating force of said bi-metallic element at one temperature and at one setting of said control point member providing a contact resistance of a value permitting the flow of a predetermined low electric current through said contacts, said element at a higher temperature affording an actuating force providing an increased contact resistance preventing said current flow therethrough.

Another object of the present invention is to provide a device as characterized above wherein the control point setting member is annular in shape and mounted on a base, the portion of control point member so mounted being of a throat like nature which, together with the base and the bi-metallic actuator, define an enclosure for the contacts.

Another object of the present invention is to provide a device of the aforementioned character having embodied therein sealing means to seal the enclosure for the contacts and thereby insure long lived, maintenance free sensitive operation.

A more specific object of the present invention is to provide a device of the aforementioned character wherein the control point setting member and the base are in mechanical, for example in threaded engagement and wherein sealing means of a film like nature is interposed between said threaded members to substantially prevent the entry of dust into the interior of the device through said threaded connection.

Still another object of the invention is to provide the

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above type of device with a flexible wall member in sealing engagement with the base and defining therewith a substantially hermetically sealed enclosure for the contacts.

Still another object of the present invention is to provide a device of the preceding nature having contact mounting and biasing means which coacts with the bi-metallic actuator to move the contacts into and out of engagement with a wiping action.

Another specific object of the present invention is to provide a device of the aforementioned kind wherein the flexible wall takes the form of an electrically conductive metallic disc carrying at least one of the low resistance contacts and biasing the latter toward one controlling position.

Still another object of the present invention is to provide the above device with a bi-metallic actuating member for the contacts which is of disc like shape and is carried in an externally exposed position by the control point setting member said external exposure providing extreme sensitivity of the device to thermal changes.

Still another object of the invention is to provide a device as described above wherein annular resilient mounting means is interposed between the bi-metallic disc and the control point setting member, said mounting means permitting substantially unrestrained radial movement of the peripheral edge of said bi-metallic disc upon deformation thereof and also tending to decay the amplitude of extraneous vibrations received by said disc, thereby preventing false actuation of the contacts.

Still another object of the present invention is to provide a device of the type aforementioned wherein the annular control point setting member is of channel-shaped cross section, said member defining an annular chamber for disposition therein of an annular or circular thermometer for indicating the ambient temperature.

Another object of the present invention is to provide a device as outlined above wherein pointer means on both the thermometer and the control point setting member coact with a common indicia bearing scale.

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

Figure 1 is a sectional view of one embodiment of a thermostat constructed in accordance with the teachings of the present invention, said view being taken along line 1—1 of Figure 3;

Figure 2 is a sectional view of the same embodiment shown in Figures 1 and 3 taken along the line 2—2 of Figure 3;

Figure 3 is a bottom plan view, partially in section, of the embodiment of the present invention shown in Figures 1 and 2;

Figure 4 is a sectional view of a second embodiment of the present invention;

Figure 5 is a sectional view of a third embodiment of the present invention;

Figure 6 is a sectional view of a fourth embodiment of the invention; and

Figure 7 is a fragmentary sectional view of a fifth embodiment of the invention.

Referring now to the drawings of the first embodiment shown in Figures 1—3, the numeral 10 indicates a thermostat which may be of a generally round shape in plan view and may comprise a cylindrical base member 14 having a reduced diameter axially extending central extent 15, a portion of which is externally threaded to

receive complementary threads of a control point setting member here indicated generally by the numeral 18, and which will be explained more fully hereinafter. A further reduced diameter portion 13 of the base 14 extends axially outwardly and terminates in a tubular extent 13a defining a cup-shaped recess 13c. A resilient diaphragm 44 closes the recess 13c and defines therewith an enclosure 21 for a pair of low and variable resistance contacts 36 and 38 which will also be described more fully later. The diaphragm 44 may be sealingly mounted on the end of the extent 13a as by a clamping ring 19 which may be spun over into a suitable circumferential groove 13b formed in the outer wall of extent 13a.

A threaded adjustable terminal member 34 extends into the enclosure 21 through a suitable counterbore threaded aperture 75 in the base 14 and terminates in a reduced diameter contact portion 36 of the device. Within the counterbore of the aperture 75 and around the portion 36 of the terminal member 34 a seal may be provided by a suitable O-ring 60. Another threaded adjustable terminal member 32, also sealingly extends into the enclosure 21 through a suitable counterbored threaded aperture 76 in the base 14 and terminates in an enlarged diameter portion 32a which carries an electrically conductive leaf spring type of contact carrying and biasing member 40. The seal between the terminal 32 and the base 14 may be provided by a packing member 58 which may take the form of a resilient washer or the like compressed within the counterbore of the aperture 76. The biasing member 40 is preferably fixed at one end only, to permit controlling movement of the contact 38 carried at its other end.

The diaphragm 44 may be composed of rubber, a semi-resilient non-porous plastic or other suitable flexible material, and is formed with a central aperture 44a, the peripheral edges of which may be slightly thickened as shown. Intermediate the ends of the member 40 a circumferentially grooved cylindrical nub 42 is fixed thereto and sealingly extends through the aperture 44a, the thickened margin of which is designed to snugly fit within the groove of said nub as shown. If desired, the diaphragm 44 may be sealingly bonded to the member 42 by any of many commercially available bonding agents.

The control point adjusting member 18 is annular in shape, and comprises an annular channel-shaped member 20 having concentric outer and inner axially extending annular flanges 20a and 20b respectively. The member 20 also has a radially inwardly directed flange 20c defining a central aperture 20d and an annular shoulder 20e. The inner flange 20b may be formed with a plurality of slots extending axially inwardly from the edge thereof which define a plurality of fingers 18b.

An annular insert member 22 has a reduced external diameter end portion 22a which snugly fits into the aperture 20d and has an enlarged external diameter opposite end portion 22b which is frictionally engaged by the fingers 18b, and a clamping ring 24 formed with a pair of spaced radially extending lugs 24a may surround the inner flange 20b to hold the fingers 18b in engagement with the portion 22b. For removal of said clamp 24 a screw driver or the like may be inserted between the lugs 24a to thereby loosen the clamp. The reduced diameter portion 22a of the insert 22 defines an annular radial shoulder which abuts the shoulder 20e of the member 20.

The insert 22 is internally threaded for engagement with the threaded base extent 15 and mounting of the control point setting member 18 thereon. The insert 22 is also formed with a central aperture 23 and with a counterbore 26 defining an annular shoulder 27. An internal annular groove 28 defines an annular shoulder 29.

A bi-metallic contact actuator disc 48 is positioned within the counterbore 26 with the peripheral edge thereof engaging the shoulder 26. The diameter of the

counterbore 26 is preferably such that when the bi-metal actuator element 48 is in undeformed or flat position, said element snugly fits into said counterbore. Thus, deformation of the center of the disc 48 in either direction cannot be obstructed or restrained by said counterbore.

An annular resilient mounting ring 50 is positioned in the groove 28 in abutting relationship with the disc 48 as shown, and an externally threaded clamping ring is threaded into the insert 22 and engages the resilient ring 50 to effect clamping of the periphery of the disc 48 between the shoulder 27 and the ring 50. It is preferred but not required, that the outer diameter of the mounting ring 50 be larger than the diameter of the disc 48 in a flat state, and that the inner diameter be less than the diameter of the aperture 23.

The contact actuating element 48 is preferably of circular shape and may be formed, as by a stamping operation, from a sheet of suitable bi-metallic material. It is preferred to use a bi-metal that has a uniform deformation per degree change in temperature, in the neighborhood of .0028 of an inch per degree F. In the instant device, it is possible to utilize the bi-metal disc on one side of center only, or through center, since no snap action is necessary or desired, as will be explained more fully later.

The channel or U-shaped member 20 is preferably composed of a transparent plastic and on the inner surface thereof preferably carries indicia means 53 in the form of a calibrated dial or scale which may be stamped in the plastic and filled with a suitable paint or the like. A pointer 56 for indicating the control point setting of the device may be attached to the base, as by a rivet 57, and is visible from the outside of the device through the member 20. An annular bi-metallic thermometer 54 is preferably mounted on the inner annular flange 20b of the member 20 and is so situated and calibrated that the pointer 52 thereof also cooperates with the indicia means 53 on the member 20.

As shown in Figure 2 a mounting plate 12 is adapted to be fixed to a wall, as by screws 30, and has connecting lugs 70 and 72 fixed thereto. Screws 69 and 67 afford electrical connection of the lugs 70 and 72 with wires 68 and 66 of the circuit to be controlled by the thermostat 10. Conductor strips 62 and 64 are fixed to the base member 14, as by hollow rivets 77 and 78, and are connected in circuit with the terminal members 32 and 34 respectively, as by nuts 63 and 65 respectively threaded on said terminals as shown. The base member 14 is removably mounted on the mounting plate 12 by screws 16 and 17 which extend through the hollow rivets 78 and 77 respectively and are threaded into suitable apertures in the lugs 72 and 70. It will be observed that attachment of the base 14 to the plate 12 by the screws 16 and 17, in this manner, also completes the electrical circuit between the conductors 66 and 68 and the contact terminals 34 and 32.

The aforementioned electrical circuit extends from the conductor 66 through the lug 72, rivet 78, conductor strip 64, terminal 34 and its contact tip 36. The electrical circuit then continues from the fixed contact 36 through contact 38, electrically conductive spring 40, terminal 32, conductor strip 62, and lug 70 to the lead wire 68.

The device is preferably calibrated in a test room having a fixed ambient temperature in the following manner: The control point setting member 18 is rotated on the threaded portion 15 of the base 14 until the control point setting indicator 56 indicates said fixed ambient temperature on the indicia scale 53. The adjustable terminal member 34, which also affords a factory adjustment or calibration means, is then adjusted to set the control point of the thermostat 10 at the aforementioned fixed ambient temperature.

In operation of the improved thermostat, the bimetal

disc 48 senses the ambient temperature and deforms in accordance with changes therein. When the ambient temperature drops below the control point temperature for which the member 18 is set, the disc 48 deforms inwardly and through the raised nub 42 overcomes the bias of the biasing spring 40 and biases the contact 38 toward the contact 36 to increase the contact pressure between said contacts. Upon an increase in the ambient temperature the reverse operation takes place, i. e., the disc 48 deforms outwardly and allows the bias of the spring 40 to reduce the contact pressure between the contacts 36 and 38.

In the control of low power circuits employing a thermoelectric generator or the like (not shown) a change in contact pressure providing a change in the resistance at the contacts while they are in physical engagement may be sufficient to effect a controlling change in the low power current flow through the contacts 36 and 38. Due to the fact that thermoelectric voltage is relatively minute, arcing at the contacts does not appear to take place and thus snap acting contact actuator is not needed.

The thermostat is extremely sensitive to ambient temperature changes due to the externally exposed nature of the bi-metal actuating disc 48, there being no protective cover or can to provide a thermal mass increasing the thermal lag of the device. In spite of its great sensitivity, the instant thermostat is not, however, subject to fluttering or intermittent false operation caused by extraneous vibrations from, for example, sound waves. The annular resilient mounting ring 50, by virtue of its position and resiliency, affords a substantial damping action which decays the amplitude of any such extraneous vibrations picked up by the exposed actuating disc 48 and prevents false actuation of the contacts.

The contacts 36 and 38 are preferably made of silver so as to give the desired low resistance characteristics. In order to prevent corrosion and prevent contamination of the contacts by foreign matter which would change these low resistance characteristics, the enclosure 21 is substantially hermetically sealed. This prevents for example sulphur in the air from corroding the silver contacts and also prevents dust particles from fouling the contacts.

While as before stated, a controlling change in the current flow through the contacts may be made while the contacts are in physical engagement, the contacts do not have to be in physical engagement at all times and under all conditions. In the event that the temperature goes sufficiently high to allow the contacts to physically separate, a wiping action occurs between the contacts. This is due to the fact that the raised central nub 42 is positioned intermediate the ends of the biasing member 40, so that the mechanical action is a brushing of the contact 38 as it moves into and out of engagement with the fixed contact 36.

Figure 4 is a view of a second embodiment of the invention and is similar in many respects to the view of the first embodiment shown in Figure 1. In Figure 4 the parts corresponding to similar parts in Figures 1 to 3 are indicated by the same reference numeral with the prefix 2. For example the control point setting member is indicated in Figure 1 by the numeral 18 and in Figure 4 by the numeral 218. The major structural differences shown therein are that the control point setting member 218 does not have the clamping ring 25 shown in Figures 1 and 2 but instead is formed with an annular groove 228 in which is seated a resilient mounting ring 250 of generally U-shaped cross-section. The ring 250 surrounds and receives the peripheral edge of the disc 248 to afford a resilient support therefor. In Figure 4 the tubular extension 213a surrounds the contact 234 only and is provided with a circumferential groove 213b for receiving the thickened lip of a cup-shaped resilient diaphragm 244. Since as terminal 232 extends through base 214 outside of the contact enclosure 221, the sealing means for that terminal is eliminated. Further, in Figure 4 the nub

242 is positioned at the end of spring arm 240 and thus the contact 238 approaches contact 236 with a relatively "straight on" action in contradistinction to a wiping action. A helical spring 280 may be interposed between the base 214 and the control point setting member 218 to bias the member 218 axially and prevent any play between the threads of said members to assure accuracy in the positioning of the control point setting member and prevent tolerance in adjusting movement thereof.

Figure 5 represents the third embodiment of the present invention being similar to the embodiment shown in Figures 1 through 3 modified in that it has no flexible diaphragm to seal off the contact enclosure 321. The elements in Figure 5 corresponding to similar elements in Figure 1 are indicated by the same reference numerals but with the prefix 3. In the embodiment of Figure 5 the threads formed on the threaded extent 315 and the complementary threads on the insert 322 are preferably coated with a film of light oil or grease which fills any spaces between the threads to prevent substantially all particles of dust from entering the contact enclosure 321 therethrough. By way of example only, certain commercially available silicone greases may be used for this purpose, said greases having stable qualities under a variety of conditions. In order to seal the spaces between the threads on the terminal members 332 and 334 and the complementary threads on the base 314, additional films of sealing material, such as the aforementioned silicone grease, may also be applied. The annular resilient mounting ring 350 provides a seal between the actuating disc 348 and the control point setting member 318, and thus the bi-metal actuator disc 348 forms one end of the contact enclosure 321. The contacts 336 and 338 are preferably made of gold or other suitable material which has the characteristic of being both low resistance and corrosion free even upon exposure to air.

Figure 6 shows a fourth embodiment of the invention, and the elements thereof corresponding to similar elements in Figure 1 are indicated by the same numerals bearing the prefix 4. The thermostat shown in Figure 6 most closely resembles the second embodiment shown in Figure 4, and differs therefrom in the structure forming the contact enclosure 421 and in the contact movement therein. In Figure 6 there is no diaphragm for the contact enclosure 421, the inner flange 420b of the member 418 being formed with a suitable groove for receiving an O-ring 485 which cooperates with a straight outer surface of the tubular extent 413a to provide a seal between the member 418 and said tubular extent. Additionally, the threads between the base portion 415 and the control point setting member 418 may be coated with a light grease, however, this is merely an extra precautionary measure and is not absolutely necessary. The terminal members 432 and 434 in Figure 6 are provided with sealing means similar to that provided for the contacts 32 and 34 in Figure 1. The contact enclosure 421 is thus substantially hermetically sealed while allowing relative movement of control point member 418 upon the base 414. It will be observed that in this embodiment the contact 438 moves into and out of engagement with the contact 436 with a wiping action of the type which is present in the forms of the invention shown in Figures 1 and 5.

Figure 7 shows a view of a fifth embodiment of the invention and the elements thereof corresponding to similar elements in Figure 1 are indicated by the same numerals bearing the prefix 5. In Figure 7 a flexible metallic diaphragm member 590 sealingly carries the contact 538 and sealingly engages the tubular extent 513a, for example by compressing an O-ring 591 disposed in an annular groove formed in the end face of the extent 513a. The diaphragm member 590 biases the contact 538 toward a separated position with respect to the contact 536 and into engagement with the inner surface of

the bi-metal actuator disc 548. The diaphragm member 590 may be made of Phosphor-bronze or other material that has suitable spring-like characteristics and which also serve as a low resistance conductor for very low power current. In Figure 7, the electrical conductor strip 526 is connected in circuit with the diaphragm member 590 directly as by soldering or brazing.

Although specific embodiments of the invention have been shown and described, it is with full awareness that many modifications thereof are possible. The invention therefore is not to be restricted except insofar as is necessitated by the prior art and by the spirit of the appended claims.

What is claimed as the invention is:

1. A control device for low power circuits comprising, enclosed low and variable resistance cooperating contacts biased toward separated relation, temperature responsive actuators means comprising an externally exposed bi-metallic element having a relatively uniform rate of deformation per degree change in temperature for actuating said contacts in opposition to said bias, and an adjustable control point setting member with which said bi-metallic element is engaged for movement thereby, the actuating force of said bi-metallic element at one temperature providing said contacts with sufficient contact pressure to afford a contact resistance of a value permitting the flow of a predetermined low electric current therethrough, said bi-metallic element, on a predetermined change in temperature providing an actuating force affording a substantially different contact pressure increasing the contact resistance to a value preventing the flow of said predetermined low electric current therethrough.

2. A control device for low power circuits comprising, a base, enclosed low and variable resistance cooperating contacts biased toward separated relation, temperature responsive actuator means comprising an externally exposed bi-metallic element having a relatively uniform rate of deformation per degree change in temperature for actuating said contacts in opposition to said bias, an adjustable control point setting member mounted on said base and with which said bi-metallic element is engaged for movement thereby, the actuating force of said bi-metallic element at one temperature and at one predetermined position of the adjustable member relative to the base providing said contacts with sufficient contact pressure to afford a contact resistance of a value permitting the flow of a predetermined low electric current therethrough, said bi-metallic element on a predetermined change in temperature providing an actuating force affording a substantially reduced contact pressure increasing the contact resistance to a value preventing the flow of said predetermined small electric current therethrough.

3. A control device for low power circuits comprising, a base member, low and variable resistance cooperating contacts biased toward separated relation, temperature responsive actuator means comprising an externally exposed bi-metallic element having a relatively uniform rate of deformation per degree change in temperature for actuating said contacts in opposition to said bias, and an adjustable control point setting member with which said bi-metallic element is engaged for movement thereby, said base member and actuator means defining an enclosure for said contacts, the actuating force of said bi-metallic element at one temperature providing said contacts with sufficient contact pressure to afford a contact resistance of a value permitting the flow of a predetermined low electric current therethrough, said bi-metallic element on a predetermined change in temperature providing an actuating force affording a substantially different contact pressure increasing the contact resistance to a value preventing the flow of said predetermined small electric current therethrough.

4. In a control device for low power circuits having low and variable resistance contacts, an adjustable control

point setting member having a throat portion, a base member having a portion engaging said throat portion, to close off one end of the latter, and a bi-metallic contact actuating member mounted in the opposite end of said throat portion to close off the other end of the latter, said base portion, throat portion and bi-metallic member defining an enclosure for said low resistance contacts.

5. In a control device for low power circuits having low and variable resistance contacts, an adjustable control point setting member having a throat portion, a base member having a portion threadedly and sealingly engaging said throat portion to close off one end of the latter, and a bi-metallic contact actuating member sealingly mounted in an externally exposed position in the opposite end of said throat portion to close off the other end of the latter, said base portion, throat portion and bi-metallic member defining a sealed enclosure for said low resistance contacts.

6. In a control device for low power circuits having low and variable resistance contacts, an adjustable control point setting member having a throat portion, a base member having a portion engaging said throat portion to close off one end of the latter, sealing means for said base portion and throat portion affording a seal therebetween, a bi-metallic contact actuating member, and means sealingly mounting said bi-metallic member in the opposite end of said throat portion to close off the other end of the latter, said base portion, throat portion and bi-metallic member defining a sealed enclosure for said low resistance contacts.

7. In a control device for low power circuits having low and variable resistance contacts, an adjustable control point setting member having a throat portion, a base member having a portion threadedly engaging said throat portion to close off one end of the latter, sealing means including a film of sealing material interposed between said base portion and throat portion affording a seal therebetween, a bi-metallic contact actuating member, and means sealingly mounting said bi-metallic member in the opposite end of said throat portion to close off the other end of the latter, said base portion, throat portion and bi-metallic member defining a sealed enclosure for said low resistance contacts.

8. A thermostat for low power circuits comprising enclosed low and variable resistance cooperating contacts, a base, an electrically conductive biasing member having one end fixed to said base and the other end operatively associated with one of said contacts to bias said contacts toward separated relation, a temperature responsive externally exposed bi-metallic element having relatively uniform rate of deformation per degree change in temperature operatively engaged with said biasing member intermediate its length for actuating said one contact in opposition to said bias, and an adjustable control point setting member with which said bi-metallic element is engaged for movement thereby, deformation of said bi-metallic element in response to a predetermined temperature effecting actuation of said biasing member and movement of said contacts into engagement with a wiping action.

9. A control device for low power circuits comprising, a base, a flexible wall member in sealing engagement with said base and defining therewith an enclosure, low and variable resistance cooperating contacts disposed within said enclosure and biased toward a first position, temperature responsive actuator means comprising an externally exposed bi-metallic element having a relatively uniform rate of deformation per degree change in temperature for directly actuating said contacts in opposition to said bias, and an adjustable control point setting member mounted on said base and with which said bi-metallic element is engaged for movement thereby.

10. A control device for low power circuits comprising, cooperating contacts biased toward a first position, temperature responsive means for actuating said contacts

against said bias comprising, an externally exposed bi-metallic disc shaped element having a relatively uniform rate of deformation per degree change in temperature, an adjustable control point setting member with which said bi-metallic element is engaged for movement thereby, and including annular resilient mounting means for positioning said bi-metallic element in operative engagement with said control point setting member in a manner to permit substantially unrestrained radial movement of the peripheral edge of the bi-metallic element upon deformation of said element.

11. A thermostat for low power circuits comprising, enclosed low and variable resistance cooperating contacts biased toward a first position, a temperature responsive bi-metallic disc having a relatively uniform rate of deformation per degree change in ambient temperature positioned for actuating said contacts in opposition to said bias, an annular adjustable control point setting member of channel-shaped cross-section defining an annular chamber, said bi-metallic disc being peripherally carried by said annular member in an externally exposed position for movement therewith, and an annular thermometer disposed within the annular chamber of said control point setting member and operatively coacting therewith for indicating ambient temperature.

12. A thermostat for low power circuits comprising, enclosed low and variable resistance cooperating contacts biased toward a first position, a temperature responsive bi-metallic disc having a relatively uniform rate of deformation per degree change in ambient temperature positioned for actuating said contacts in opposition to said bias, an annular adjustable control point setting member a portion of which is transparent and of channel-shaped cross-section defining an annular chamber, said bi-metallic disc being peripherally carried by said annular member in an externally exposed position for movement therewith, an annular thermometer disposed within the annular chamber and visible through said transparent portion of said control point setting member, and cooperating indicia and pointer means on said base and control point setting member also visible through said transparent portion of the latter to afford a predetermined setting thereof.

13. A thermostat for low power circuits comprising, enclosed low and variable resistance cooperating contacts biased toward a first position, a temperature responsive bi-metallic disc having a relatively uniform rate of deformation per degree change in ambient temperature positioned for actuating said contacts in opposition to said bias, an annular adjustable control point setting member of channel-shaped cross-section defining an annular chamber, said bi-metallic disc being peripherally carried by said annular member in an externally exposed position for movement therewith, thermometer means disposed within the annular chamber of said control point setting member, and pointer means for said control point setting member and thermometer means cooperable with both said means for indicating on a common indicia bearing scale both the control point setting and the ambient temperature.

14. In a control device for low power circuits having contacts, an adjustable bi-metallic contact actuating member movable as a unit between controlling positions, and resilient mounting means for said bi-metallic member movable with said member and tending to decay the amplitude of extraneous vibrations thereof and the effect of said vibrations upon actuation of said contacts to thereby make control of said contacts responsive only to the controlling position of said bimetallic member.

15. In a control device for low power circuits having low resistance contacts, an adjustable control point setting means, a bi-metallic contact actuating element carried by said means in an externally exposed position, and resilient shock-resistant mounting means for said actuating element tending to decay the amplitude of extraneous

vibrations received by the latter to thereby minimize the effect thereof upon said contacts.

16. In a control device for low power circuits having enclosed low and variable resistance contacts, an adjustable control point setting member, a temperature responsive bi-metallic disc carried by said member in an externally exposed position for actuating said enclosed contacts, and an annular resilient mounting ring peripherally sealing said disc to said control point setting member, said ring tending to decay the amplitude of extraneous vibrations received by said disc while permitting substantially unrestrained radial movement thereof.

17. In a control device having contacts, an adjustable control point setting member having a throat portion, a base member having a portion engaging said throat portion to close off one end of the latter, and a bi-metallic contact actuating member mounted in the opposite end of said throat portion to close off the other end of the latter, said base portion, throat portion and bi-metallic member defining an enclosure for said contacts.

18. A control device for low power circuits comprising, a member, low and variable resistance cooperating contacts having a separated relation, temperature responsive actuator means comprising a bi-metallic element cooperating with said member and having a relative uniform rate of deformation per degree change in temperature for actuating said contacts, and an adjustable control point setting member for adjusting the relative position of said contacts, said member and said actuator means defining an enclosure for said contacts, the actuating force of said bi-metallic element at one temperature providing said contacts with sufficient contact pressure to afford contact resistance of a value permitting the flow of a predetermined low electric current therethrough, said bi-metallic element under predetermined change in temperature providing an actuating force affording a substantially different contact pressure increasing the contact resistance to a value preventing the flow of said predetermined small electric current therethrough.

19. A control device for low power circuits comprising, low and variable resistance cooperating contacts biased toward separated relation, temperature responsive actuator means comprising a bimetallic element for actuating said contacts in opposition to said bias, and an adjustable control point setting member with which said bimetallic element is engaged for movement thereby, the actuating force of said bimetallic element at one temperature providing said contacts with sufficient contact pressure to afford a contact resistance of a value permitting the flow of a predetermined low electric current therethrough, said bimetallic element, on a predetermined change in temperature providing an actuating force affording a substantially different contact pressure increasing the contact resistance to a value preventing the flow of said predetermined low electric current therethrough.

20. A control device for low power circuits comprising, low and variable resistance cooperating contacts having circuit-making and circuit-interrupting positions, temperature responsive actuator means comprising a bimetallic element having a relatively uniform rate of deformation per degree change in temperature for actuating said contacts, and an adjustable control point setting member with which said bimetallic element is engaged for movement thereby, the actuating force of said bimetallic element at one temperature providing said contacts with sufficient contact pressure to afford a circuit-making position permitting the flow of a predetermined low electric current therethrough, said bimetallic element, on a predetermined change in temperature providing an actuating force affording a substantially different contact pressure to afford a circuit-interrupting position preventing the flow of said predetermined low electric current therethrough.

21. An ambient temperature responsive control device for low power circuits comprising, a base, low resistance

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cooperating contacts having a circuit-interrupting and circuit-making position, ambient temperature responsive actuator means for said contacts comprising, a bimetallic element having a relatively uniform rate of deformation per degree change in ambient temperature, an adjustable control point setting member mounted on said base and carrying said bimetallic element for movement therewith, said actuating means at one predetermined setting of the adjustable member affording the actuation of said contacts from said circuit-interrupting position to said circuit-making position in response to a predetermined change in ambient temperature.

22. A control device for low power circuits comprising, cooperating contacts biased toward a first position, ambient temperature responsive means for actuating said contacts against said bias comprising, a bimetallic element having a relatively uniform rate of deformation per degree change in temperature, an adjustable control point setting member with which said bimetallic element is engaged for movement thereby, and including resilient mounting means for positioning said bimetallic element in operative engagement with said control point setting member in a manner to permit substantially unrestrained movement of the peripheral edge of the bimetallic element upon deformation of said element.

23. A thermostat for low power circuits comprising, cooperating contacts biased toward a first position, temperature responsive bimetallic means having a relatively uniform rate of deformation per degree change in temperature positioned for actuating said contacts in opposition to said bias, an adjustable control point setting member, said bimetallic means being carried by said ad-

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justable member for movement therewith, and a thermometer carried by said control point setting member for indicating ambient temperature.

24. A control device for low power circuits comprising, enclosed low and variable resistance cooperating contacts having a separated relation, temperature responsive actuator means comprising a bimetallic element having a relatively uniform rate of deformation per degree change in temperature for actuating said contacts, and an adjustable control point setting member for adjusting the relative position of said contacts within said enclosure, the actuating force of said bimetallic element at one temperature providing said contacts with sufficient contact pressure to afford contact resistance of a value permitting the flow of a predetermined low electric current there-
 15 through, said bimetallic element under predetermined change in temperature providing an actuating force affording a substantially different contact pressure increasing the contact resistance to a value preventing the flow of said
 20 predetermined small electric current therethrough.

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