March 4, 1941. E. W. GENT 2,233,884

THERMAL SWITCH

Filed March 4, 1937

FIG. 1

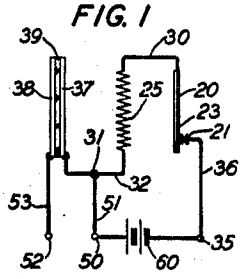


FIG. 2

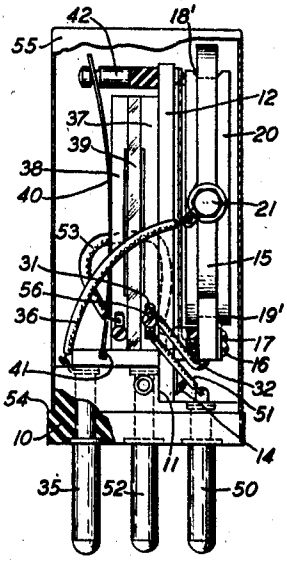


FIG. 3

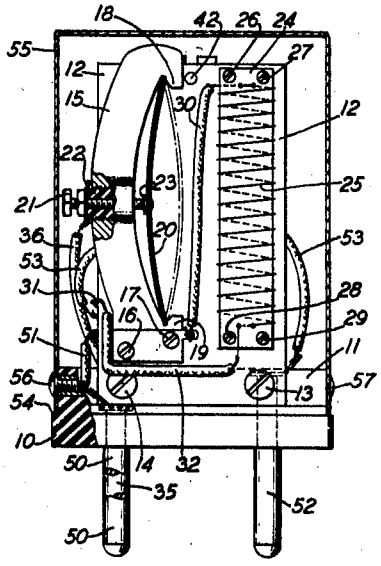
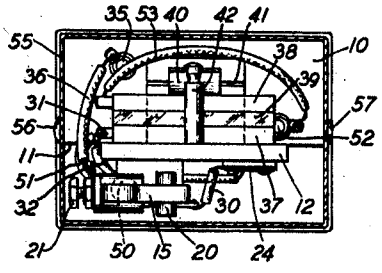


FIG. 4



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THERMAL SWITCH

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1 Claim. (Cl. 297—15)

This invention relates to thermal switches of the type in which the operation of a bimetallic strip is effective to close electrical contacts for controlling the operation of a heating element as used for example in a quartz crystal oscillator housing for compensating for atmospheric temperature variations.

In such thermal switches, however, it has been found that the distance or air gap variations between the electrical contact carried by the bimetallic strip and its cooperating contact carried by the support due to the expansion of the latter when submitted to a difference in temperature greatly affect the operation of the bimetallic strip and therefore that of the heating element controlled thereby.

The object of the invention is to provide a thermal switch of the type above referred to which will be simple, cheap to manufacture and which will operate in a positive and accurate manner.

A feature of the invention resides in the provision of a bimetallic strip which is formed by welding a leaf of a material possessing a maximum coefficient of expansion to a leaf of a material having substantially zero coefficient of expansion whereby maximum operating amplitude and sensitiveness of the bimetallic strip thus formed is obtained.

Another feature resides in the provision of a support which is made of a material having substantially zero coefficient of expansion whereby the variations in the temperature of this support do not substantially affect the operation of its cooperating bimetallic strip.

Still another feature resides in the provision of means formed with the support interlocking with means formed with the strip for holding the latter and a contact carried thereby in operative relation with an associated contacting member carried by the support.

Other novel features and advantages of the invention will appear by the following description and by the claim appended thereto, reference being had to the accompanying drawing in which

Fig. 1 is a diagrammatic view of the operating circuit of the thermal switch of the invention;

Fig. 2 is a side elevation view showing the casing and a number of operating parts with portions cut away;

Fig. 3 is a front elevation view showing the casing in section and a number of operating parts with portions cut away; and

Fig. 4 is a top assembly view showing the casing in section.

In the drawing, 10 indicates a base of insulating material formed with a shoulder portion 11 provided for mounting a metallic plate 12 in position perpendicular to the base 10, this plate being held securely against the shoulder portion 11 by screws 13 and 14 shown in Figs. 2, 3 and 4.

A support 15 formed with an arcuated shape in the plane of its thickness so as to obtain maximum rigidity for a minimum thickness in such a plane is made of a material having substantially zero coefficient of expansion such as a nickel steel alloy. This support is insulatively mounted on plate 12 and is secured thereon by screws 16 and 17. Support 15 is provided at its ends across its thickness with hooked portions 18 and 19 shown in Fig. 3 for engaging the V-shaped recesses 18' and 19' at the ends in a manner to position the width of the strip at right angles to the plane of support 15 while the effective bimetallic strip 20 of a length of the strip 20, that is, the length directly across the hooks 18 and 19 of the support 15 is slightly longer so as to cause this strip to normally flex in the position as shown in Fig. 3, this strip being made of a brass leaf and a leaf of nickel steel having substantially zero coefficient of expansion.

An adjustable contact in the form of a screw 21 engages an insulating bushing 22 in the support 15, this contact being normally engaged by contact 23 carried by the metallic strip for completing an energizing circuit to a heater element which will be hereinafter described in detail.

On the metallic plate 12 and adjacent the bimetallic strip 20 is mounted the heater element consisting of an insulating strip 24 serving as a core for the resistor wire 25 coiled thereon, the strip 24 being held securely at each end on the plate 12 by two sets of screws 26—27 and 28—29 shown in Fig. 3.

To the opposite side of plate 12 are mounted the electrodes 37 and 38 and a quartz crystal plate 39 shown in Figs. 2 and 4. The electrodes 37 and 38 and the plate 39 are held firmly against the metallic plate 12 by a clamping spring 40 having its lower end portion engaged in a slot 41 in the base 10 and its upper disposed end portion engaging in a groove in the end of an insulating stud 42 secured in the metallic plate 12.

The adjustable contact 21 is electrically connected to a plug 35 by a wire 36 shown in Figs. 2, 3 and 4, this plug having one end embedded in the base 10. The resistor wire 25 at one end

is electrically connected to the bimetallic strip 20 and therefore to the support 15 by a wire 30 while the other end of resistor wire 25 is connected to a terminal 31 by a wire 32. The terminal 31 is secured to the electrode 37 by a screw 56 and one end of the resistor wire 25 and the electrode 37 connected to a plug 50 by a wire 51, while the electrode 38 is connected to a plug 52 by a wire 53, the plugs 50 and 52 having each end embedded in the base 10 in position to form, in cooperation with plug 35, a triangular formation for engaging a group of similarly disposed connecting jacks not shown.

The base 10 is formed with a peripheral shoulder portion 54 against which the edge of a casing 55 abuts to form therewith a dustproof closure between the base 10 and the casing 55, this casing being securely held on the base 10 by screws 56 and 57 shown in Figs. 3 and 4.

In the operation of the thermal switch of the invention and supposing the bimetallic strip in the position shown in Fig. 3, that is, with contacts 21 and 23 closed which occurs upon a drop in the temperature, the current will flow from the positive side of battery 60 through wire 36, the contacts 21 and 23, the bimetallic bar 20, the wire 30, the resistor wire 25 to the negative side of battery 60 through conductors 32 and 51, thus energizing the heater element. The heat generated by said element heats the bimetallic bar 20 which upon reaching a sufficiently high temperature is caused, through the elongation of the brass element in the bimetallic strip, to move in the position shown in dotted lines in Fig. 3, for breaking the heater element circuit and thereby maintaining the temperature in the housing 55 within a few degrees of temperature difference, which may be controlled by the adjustment of the contact 21. By the use of a material having a substantially zero coefficient of expansion for the support 15 and for one of the elements of the bimetallic strip 20 added to the arcuated shape of the support 15 and its consequent great rigidity, a thermostat device is obtained which operates with a high degree of accuracy and thereby makes possible to maintain the operating temperature of the quartz crystal plate substantially constant.

What is claimed is:

In a thermal switch, a base, a plate secured to said base perpendicularly thereof, an oblong-shaped bimetallic strip, a plate-like arcuate mounting of unit structure for said strip having a reenforced portion midway between its ends and means formed at one of its ends for securing it to said plate in a plane parallel thereto, and projections at the ends of said mounting converging towards each other to form hook portions, and notches formed at each end of said strip for engaging said hook portions so as to position the plane of said mounting at right angles to the width of said strip.

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