

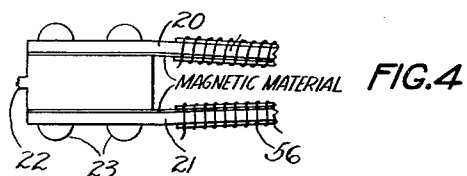
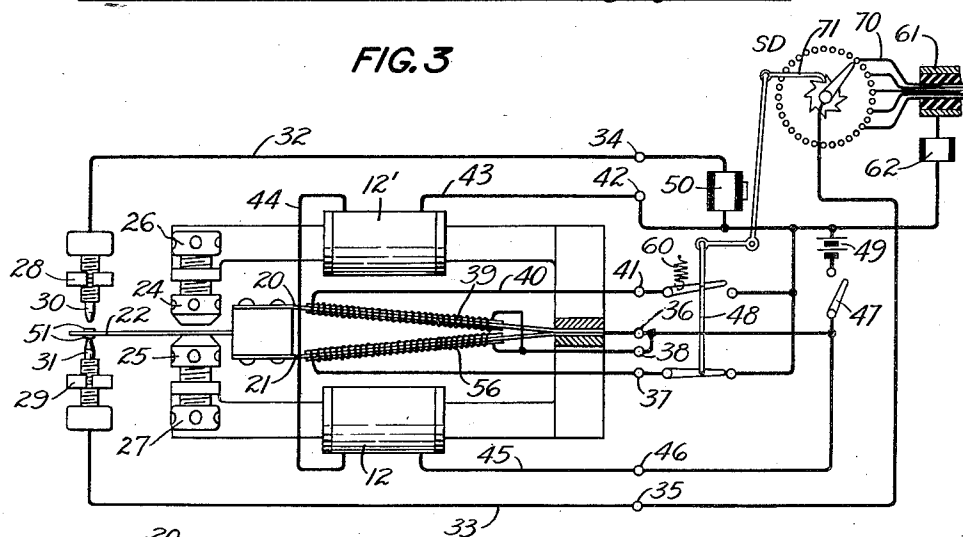
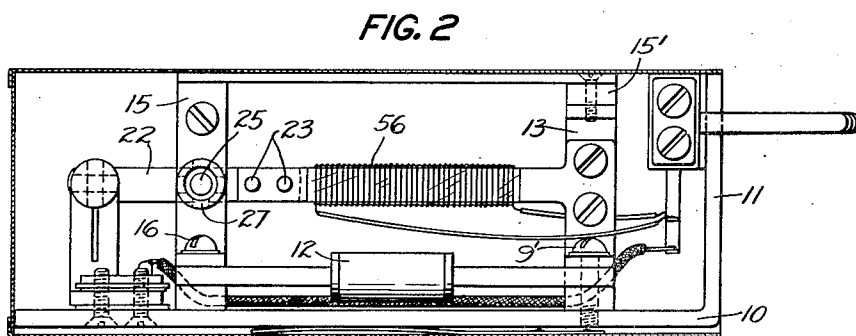
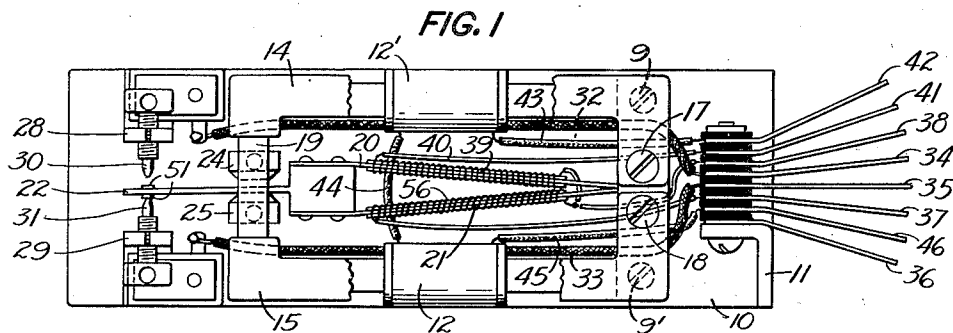
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THERMAL SWITCH

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## UNITED STATES PATENT OFFICE

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## THERMAL SWITCH

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This invention relates to switching apparatus and its object is to provide a thermally operated device in which contacts forming parts of the thermally operated switching device operating circuit are operated for controlling the operation of a switching device in a testing circuit or the like in a predetermined lapse of time.

According to this invention two thermostatic bars oppose each other when submitted simultaneously to similar degrees of temperature variations, but operate for closing contacts with a snap under the influence of a magnet upon a certain degree of temperature difference in the bars. More specifically the bars are secured together at one end, and an armature is mounted on their free ends which extends in attractable relation to the pole-pieces of a magnet which may be either of a permanent or electro-magnetic type. Heating elements in the form of coils are adapted to heat the bars alternately to cause the operation of the movable contacts against the pull of the magnets which normally hold the contacts firmly closed.

In the drawing Fig. 1 is a plan view of the relay with its protective casing removed. Fig. 2 is a side view thereof showing the protective casing in section. Fig. 3 is a diagrammatic view of the operating circuit of this relay and Fig. 4 is an enlarged view of the bimetallic bars.

In the drawing 10 indicates an elongated supporting copper plate having an upright extension 11 adapted to support a bank of terminals as shown in Figs. 1 and 2 provided for a purpose that will be hereinafter described in detail.

On plate 10 are mounted magnets 12 and 12' on the cores of which is mounted an upright support 13 of magnetic material, this support and the magnets being held on the plate 10 by screws 9 and 9' as shown in Fig. 1. On the free ends of the cores of magnets 12 and 12' brackets 14 and 15 are secured by screws 16, the opposite ends of these brackets being secured to support 13 by screws 17 and 18 respectively. These brackets are magnetically insulated from support 13 by a brass block 15' and are held in spaced rela-

tion on the front end of the magnets by a brass spacer member 19 shown in Fig. 1.

On the upright support 13 there is mounted a pair of bimetallic bars 20 and 21 each having one of its ends secured tightly to the support 13 from which they extend laterally in a V shaped formation. As shown in Figs. 1, 3 and 4 on the free ends of these bars is mounted an armature 22 which is securely held thereon by rivets 23.

On the upright portions of brackets 14 and 15 there is adjustably mounted a pair of pole-pieces 24 and 25 each of which is provided with a counter nut 26 and 27 for holding the pole-pieces in adjusted position with respect to armature 22.

On the front end of copper plate 10 there is insulatedly mounted a pair of upright supports 28 and 29 each provided with an adjustable contact member 30 and 31 disposed in engageable relation with contacts 51 carried by the armature 22. Contacts 30 and 31 are connected by wires 32 and 33 to wire terminals 34 and 35 of the terminal bank above mentioned, the return side of the circuit for contacts 30 and 31 being through the bimetallic bars 20 and 21, the lower portion of upright support 13, screws 9 extending through the plate 10, upright extension 11 and the terminal 36 disposed in contacting relation with the upright extension 11.

Bimetallic bar 21 carries a heating element 56 which is connected to the wire terminals 37 and 38, the latter also forming a return path for the heating element 39 carried by the bimetallic bar 20, the other connection for this heating element being through wire 40 attached to terminal 41.

The electric circuit for the magnets 12 and 12' extends from terminal 42, wire 43, magnet 12', wire 44, magnet 12, and wire 45 attached to terminal 46.

In Fig. 3 is shown diagrammatically a suitable circuit arrangement in which this thermostatic relay may be used for controlling the operation of a switching device SD adapted for impressing, in predetermined lapses of time, a high potential current on conductors enclosed or protected by a lead sheath 61.

In the operation of this relay the closure of switch 47 completes a circuit from one side of battery 49, the winding of magnets 12 and 12' to the other side of battery 49. The armature 22 which normally rests against the pole-piece 25 is held magnetically against this pole-piece by a magnetic circuit which includes the magnetic material of the bimetallic bars 20 and 21 and the bracket 13 secured to the cores of the magnets, the other side of this circuit being through pole-piece 25 and the lower end of bracket 15 secured at the armature end of the magnet cores. A circuit is also closed through the heating element 56 from one side of the battery through the switch wiper 47, terminal 38, the heating element, terminal 37, the closed wiper of switching device 48 and back to the other side of battery 49. Another circuit is closed through one side of battery 49, wiper 47, terminal 36, plate 10, support 13, the bimetallic bars 20 and 21, the armature 22, contacts 51 and 31, wire 33, attached to terminal 35, the wiper of switching device SD, the conductor 70 enclosed in lead sheath 61, the signaling device 62, and the other side of battery 49. Under this circuit condition and supposing the insulation of the conductor 70 is defective, the current will flow through signalling device 62 for indicating a break in the insulation of the conductor. However, if the insulation of the conductor is in good condition the signalling device 62 is not operated. Upon the switching of the current in heating element 56 by the closure of switch 47 the bimetallic bar 21 becomes thereby heated to a point so as to move the armature and the contact carried thereby in engageable relation with contact 30 against the magnetic attraction of pole-piece 25 which causes the armature to move with a snapping action due to the tension acquired to overcome the pull of magnets.

The closure of contact 51 with contact 30 energizes magnet 50 through an obvious circuit, the energization of this magnet being effective to operate the switching device 48 to open the circuit of heating element 56 to permit the cooling of bimetallic bar 21 and simultaneously closing the circuit of heating element 39. The bimetallic bar 20 is thus heated to a point sufficient to overcome the pull or attraction of the magnet for moving the armature 22 and the contact carried thereby by in reengagement with contact 31 and thus causing the deenergization of magnet 50 to permit the switching device 48 to return to normal under the action of its retracting spring 60. The back and forth movement of the magnetic armature under control of the bimetallic bars being effective to move the wiper of switch SD one step onto an auxiliary terminal of the switching device SD.

It is to be noted that by the use of a heat-

ing element on each bimetallic bar such a device is not entirely dependent for operation upon the alternating dissipation of the latent heat in the bars. These bars are caused to operate under the combined effects of the heater elements thus making it possible to obtain the operation of the contacts carried by the armature 22 in very accurate periods of time. The connection of the heating elements in parallel with the magnets effectively compensate for voltage variations in the current supply source, because a change in the action of the magnets due to voltage fluctuations correspondingly affects the operation of the bimetallic bars and the voltage fluctuations therefore have no effect on the operating time of the device.

In this device the provision of two bimetallic bars offers means for compensating for differences in temperature of the atmosphere since the heat effect in one bar is compensated by a similar heat effect in the other bar and therefore the armature is not deviated from its normal adjusted position by similar changes in the bar temperatures, while the particular method used for holding these bars on their supporting member, avoids rigidity in the structure of the thermostatic element which is thus permitted to move in a positive manner in response to a few degrees temperature difference in the bars.

What is claimed is:

1. In combination a magnet having opposed pole-pieces, a support, a pair of bimetallic bars secured together on said support and extending in a V formation therefrom to form a pivotal point for the bars, a heating coil on each bar, an armature for said magnet secured to said bars and extending between said pole pieces, circuits, each including one of said heating coils, a two-position switch controlled by the bimetallic bars and in each position closing a circuit through one heating coil, whereby circuits are successively closed through said heating coils to cause the bimetallic bars to flex at their point of support for actuating the armature.

2. In a thermal switch, a supporting plate, a pair of bimetallic bars secured together at one end of said plate and the free ends extending in a flared formation therefrom, a magnet having opposed pole-pieces, an armature for said magnet mounted on said bars and having a contact, a pair of contacts mounted on said plates and adapted to be engaged by said armature contact, heating coils on said bars, circuits, each including one of said coils, a two-point switch controlled by said bars and in each position closing a circuit through one of said coils for causing the operation of said bars, the magnet causing the bars to engage the contacts with a snapping action.

3. A thermal switch characterized in this that bimetallic bars having heating coils are

disposed in a V formation and attached to a support to form a pivotal point for the bars, these bars carrying a contact for alternately engaging contacts carried by the support.

In witness whereof, I hereunto subscribe my name this 2nd day of January, 1929.

BENJAMIN F. RUNYON.

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