

Dec. 14, 1954

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THERMAL INTERRUPTER
Filed July 21, 1952

2,697,152

FIG. 1

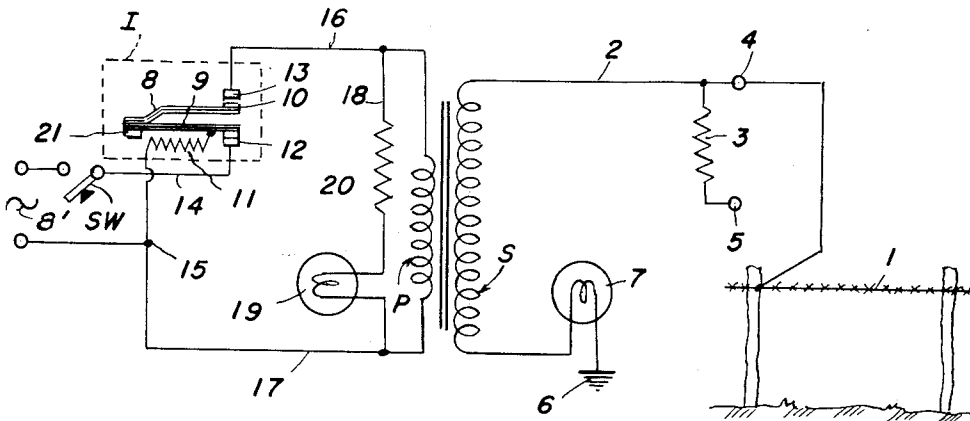
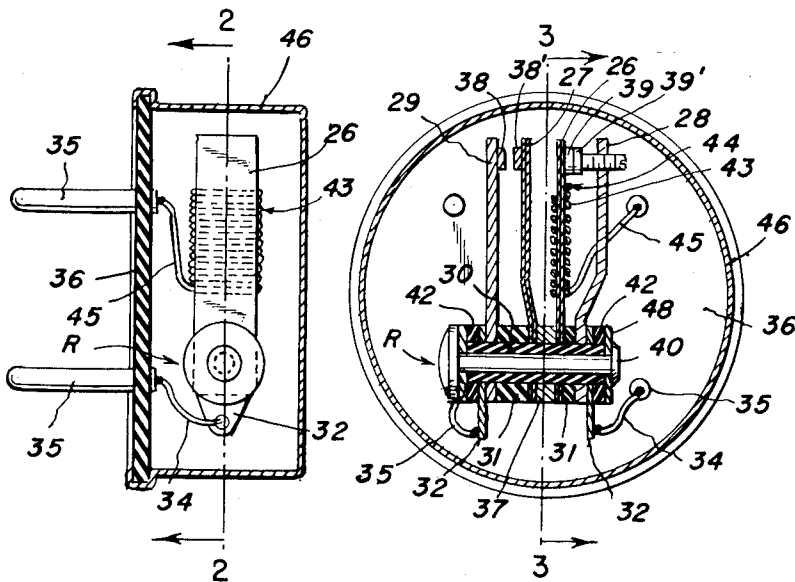


FIG. 3

FIG. 2



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2,697,152

THERMAL INTERRUPTER

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Application July 21, 1952, Serial No. 300,004

7 Claims. (Cl. 200—122)

This invention relates to a thermal interrupter of the thermal flasher type which is particularly adapted to control, in an intermittent manner, the supply of current or voltage to an electric fence whereby to energize such a fence. An interrupter, so used, is known in the trade as a "chopper" and it is used to energize the fence during only a very short period and, thereafter, to de-energize the fence to permit an animal to withdraw from the fence after it has been shocked.

It has been common practice in this art to employ a conventional type of thermal flasher which is provided with the usual bimetal element that is directly heated by a heating coil. A normally closed contact between the bimetal and an adjacent terminal is broken when the current through this coil and closed contact permits the coil to heat up and to cause the bimetal to bend. In the event that such coil becomes open circuited as by a burn-out or otherwise, the contact will become closed in a manner to supply current continuously to the fence and that would be objectionable because an animal will very likely receive a prolonged shock.

According to the present invention, a novel and improved form of interrupter has been provided which comprises a primary bimetal element and a secondary bimetal element. The primary bimetal element functions as in a common form of thermal flasher to cause that bimetal to bend and break the heating coil circuit. The movement of this element, however, will not energize the fence transformer. The secondary bimetal element is positioned adjacent to the primary element and coil in a manner to receive heat from the single heating coil, associated with both of these elements. This secondary element serves only to make and break the primary circuit of the fence transformer and, when not heated, this secondary bimetal functions to maintain this transformer deenergized because this latter bimetal cooperates with the normally open contact.

The main object of the invention is to provide a novel form of thermal interrupter that has a primary bimetal element and a secondary bimetal element which unit has the usual normally closed contact associated with the primary element and with an auxiliary or normally open contact associated with the secondary element which latter bimetal element and contact is in series circuit with the primary coil of the fence transformer and which normally open contact functions, when open, to maintain the transformer and fence deenergized whenever the heating coil becomes ineffective to cause its associated bimetal to bend.

Another object is to provide a thermal interrupter that is compact in form and simple in structure and number of elements to the end that it can be produced at a relatively low cost.

Other objects, aside from those that will appear from a study of the specification, are to provide an interrupter that may be substituted for one of the common forms of flasher switches in use with an electric fence or that may be used to control any circuit in general that is to be intermittently energized.

In the accompanying drawings:

Fig. 1 is a schematic wiring diagram showing the improved interrupter as embodied in a well known electric fence circuit.

Fig. 2 is a view, in section, taken on line 2—2 of Fig. 3, and

Fig. 3 is a view, in section, taken on line 3—3 of Fig. 2. Referring to Fig. 1, the stock enclosing fence 1 com-

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prises, as usual, a single metallic bare wire. This wire becomes energized when the primary coil P of the fence transformer is energized since this wire is in series circuit with the transformer secondary coil S by way of conductor 2. When this wire is connected to terminal 4 of the impedance 3, the latter is not in circuit and a full voltage of from 2000 to 3000 volts exists between the wire 1 and the ground. With this wire connected to terminal 5 of this impedance, the shock current would be materially reduced due to this series impedance. The coil S is grounded at 6 and an indicator lamp 7 is in this grounded circuit to provide an operation signal.

An A. C. source 8' furnishes the energizing current to the coil P. The improved interrupter I comprises, in the main, a primary bimetal 9 and a secondary bimetal 8 secured to the bimetal 9 or mounted in a manner in contact therewith to readily receive heat from the heating coil 11 either by heat conduction through contact with bimetal 9 or, to a lesser degree, by heat radiated therefrom. Normally, when the main line switch Sw is open, the contact of pair 12 is closed and the back contact of pair 13 is open.

A conductor 14 connects one A. C. terminal with the lower one of contact pair 12 so that current may pass through bimetal 9 thence through coil 11 connected as at 15 to the bimetal 9 and back to the other A. C. terminal. The upper contact of pair 13 is in series circuit with the primary coil P by way of the conductor 16 and the return circuit is through the conductor 17 to the lower A. C. terminal, as shown. An operation signal 19, which may be a low wattage lamp or its equivalent is shunted across primary coil P in series with a resistance 20.

In normal operation, when the switch Sw is closed, a circuit is established through 14, 12, 9, 11 and 15 and the heating coil 11 will heat up. This will cause the bimetal 9 to flex upwardly to open contacts 12. However, the bimetal 10 will remain cool for a short period or until it becomes sufficiently heated by conduction from bimetal 9 and, in part, by radiation from the coil 11. This coil will then start to cool off as soon as contacts 12 open to permit this bimetal to flex backwardly to reclose contacts 12. Only after several repeated opening and closing cycles of contacts 12 will the bimetal 8 become sufficiently heated to cause it to flex upwardly to permit contacts 13 to close and the latter will remain closed so long as the contacts 12 continue to cycle.

With the contacts 13 now closed, the primary coil P will become energized intermittently each time that contacts 12 cycle and the energizing current is by way of upper A. C. terminal, conductor 14, contacts 12, bimetal 9, through bimetal 8, through back contacts 13, conductor 16, coil P, conductor 17 and back to the lower A. C. terminal.

The constants of the interrupter elements are so designed as to cause the bimetal 9 to maintain the contacts 12 closed for only a short period, say one second more or less. During this period, the transformer secondary S and fence wire 1 are energized and any animal in contact with this wire will be in series circuit with this secondary through the ground return 6.

Closure of contacts 12 causes coil 11 to heat up to again reopen contacts 12 whereupon the circuit through the primary P is broken with the result that the fence wire is deenergized in a manner to permit the animal to back away from this now dead wire after it has been shocked but while it is no more under the influence of a shock current.

Considering the main object of the invention and its operational advantages, very often a heating coil as 11 will become defective. It might burn out to give an open circuit therethrough or it might become grounded onto the adjacent bimetal 9 in which latter case it would not provide ample heat to cause bimetal 9 to flex upwardly. As a result, the contacts 12 would remain closed and, as an undesired result, the fence wire 1 would remain energized if the interrupter embodies only the single bimetal now in common use.

However, if a defect as described should occur in this coil 11, it would cool off very quickly and permit bimetal 9 of the interrupter shown in Fig. 1 to also cool with the

advantageous result that bimetal 8 would also cool off, flex downwardly to permit contacts 13 to open and remain open. Hence the energizing circuit through the primary coil P would remain open and both signals 7 and 19 would indicate that the fence line is not energized.

The secondary element 8 is designed to maintain contacts 13 closed during cycling of the contacts 12 due to a higher heat retentivity of element 8 although the element 9 is permitted to flex downwardly again relatively soon after the circuit of coil 11 has opened.

Figs. 2 and 3 show, in detail, the actual construction of a preferred form of the interrupter I of Fig. 1. The elements thereof have been designed and correlated to provide an economical unit that may be readily assembled, repaired and adjusted. An elongated headed rivet R is used to retain the elements of the unit assembled. The two bimetals 26 and 27 and a pair of contact supporting bars 28 and 29 are spaced along this rivet which passes through openings formed in the lower ends of these four elements. The bars are spaced from the rivet by means of an insulating sleeve 30 and fibre washers 31 maintain the bars and the adjacent bimetals spaced from each other. Terminal eyelets or lugs 32 that contact the bars are soldered to a pair of short strong wires 33 and 34 which, at their remote ends, are soldered to two of the prongs 35 of the casing base 36. These wires support the entire interrupter unit. Metallic washers or rings 37 contact the bimetals 26 and 27 to connect same electrically and to permit heat transfer between the same.

The normally open contacts 38—38' are carried respectively by the bar 29 and the bimetal 27 and the normally closed contacts 39—39' are carried respectively by the bimetal 26 and the bar 28. The contact 39' is shown to be adjustable. The rivet R is peened over at 40 and against a metallic washer 41 in a manner to force all elements on the rivet towards each other and the rivet head to maintain all elements rigidly in position. A pair of fibre washers 42 serve to insulate lugs 32 from the rivet.

The bimetal 26 is wound with a heating coil 43 that is spaced from the bimetal by insulation. The upper end of this coil is shown as soldered as at 44 to the bimetal 26 and its lower end 45 is soldered to a third prong 35 on the base 36. Hence, three of these prongs serve as lead in terminals to the contact 38, the contact 39' and to the coil 43 and these connections correspond to the connections to the interrupter I of Fig. 1. The cycle of the device shown by Fig. 2 is the same as for the interrupter shown by Fig. 1.

The following claims are made:

1. A thermal interrupter of the thermal flasher type comprising a primary bimetal element and a secondary bimetal element, means to secure said elements together at a corresponding pair of ends thereof in a manner to permit electrical and heat conduction between said elements, a first contact positioned adjacent to the free end of the primary element and normally closed into contact therewith, a second contact spaced from the free end of the secondary element but out of contact therewith normally and prior to flexing of said latter element, a heating coil for heating the primary element and being operably responsive to closure of the first named contact, said elements being spaced from each other except at the point where the elements are secured together, said secondary element being heated by its thermal contact with the primary element after the latter element has become heated and in a manner to cause the secondary element to flex towards said second contact to cause closure of the secondary element against the second named contact a predetermined time after repeated closures of the circuit to the heating coil, with the result that, in the event the heating coil becomes defective, said bimetal elements will cool and flex in a manner to cause the second contact to open and remain open.

2. A thermal interrupter comprising a primary bimetal element and a secondary bimetal element, means for holding corresponding ends of said elements in electrical contact and in a manner to permit the secondary element to be heated by contact with the primary element, said holding means rigidly supporting said elements at their con-

tacting ends to permit independent flexure of both elements, the free end of the primary element having an end contact, a second contact positioned to be normally closed against said end contact, a heating coil for said primary element, and having one end thereof connected to the latter element electrically, the free end of the coil being connected to a power source conductor, a third contact on the free end of the secondary element, a fourth contact positioned adjacent the third contact and, normally, not in engagement therewith, whereby both elements are adapted to flex due to heat from said coil to cause opening of the normally closed contacts and to cause closure of the normally open contacts said secondary element becoming flexed to close the third and fourth contacts a predetermined time after several repeated closures of the first and second contacts with the result that, in the event the heating coil becomes defective, said bimetal elements will cool and flex in a manner to cause the third and fourth contacts to open and remain open.

3. In an interrupter as set forth in claim 2 wherein the normally closed contacts are permitted to cycle to open and closed positions for a limited number of cycles to permit the secondary element to become heated by heat conduction from the primary element thereby to cause the normally open contacts to permanently close whereby an energizing circuit connected to the fourth contact will become closed through the normally open contacts.

4. In an interrupter as set forth in claim 2 wherein, each successive opening of the normally closed contacts will permit the primary element to cool to a degree to cause reclosing of the normally closed contacts and a re-energization of the heating coil, in a series of repeated cycles, during which cycling period the third and fourth normally open contacts will remain closed due to the degree of heat retentivity of the secondary bimetal element and which has become heated by conduction from the primary element across the supported contacting ends of the two elements.

5. In an interrupter as set forth in claim 2, a base member, a series of terminal prongs secured to the base, a pair of supporting bars, the second and fourth contacts being carried respectively by said bars, means to position the primary and secondary elements between said bars, and a lead wire connecting each supporting bar to a respective prong and serving to support the bars and elements upon said base.

6. In a thermal interrupter, a base member, a series of terminal prongs carried thereby, an elongated metallic supporting member, a primary bimetal element and a secondary bimetal element supported by said member at corresponding ends of the elements, means to connect said ends together in a manner to permit electrical and heat conduction between the elements, an insulating sleeve for spacing the elements from said member, a contact on the free end of each element, a contact normally closed against the primary element contact and another contact normally open with respect to the contact on the end of the secondary element, a heating coil associated with the primary element and serving to heat the latter element to cause opening of the normally closed contacts, said secondary element being, in turn, heated by conduction of heat from the primary element.

7. In an interrupter as set forth in claim 2, a pair of power supply conductors, one conductor being connected to the second named contact and the other conductor being connected to the free end of the heating coil to cause heating of that coil, and a circuit to be energized intermittently, one end of said circuit being connected to the fourth contact and the other end of the circuit being connected to said other conductor.

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