

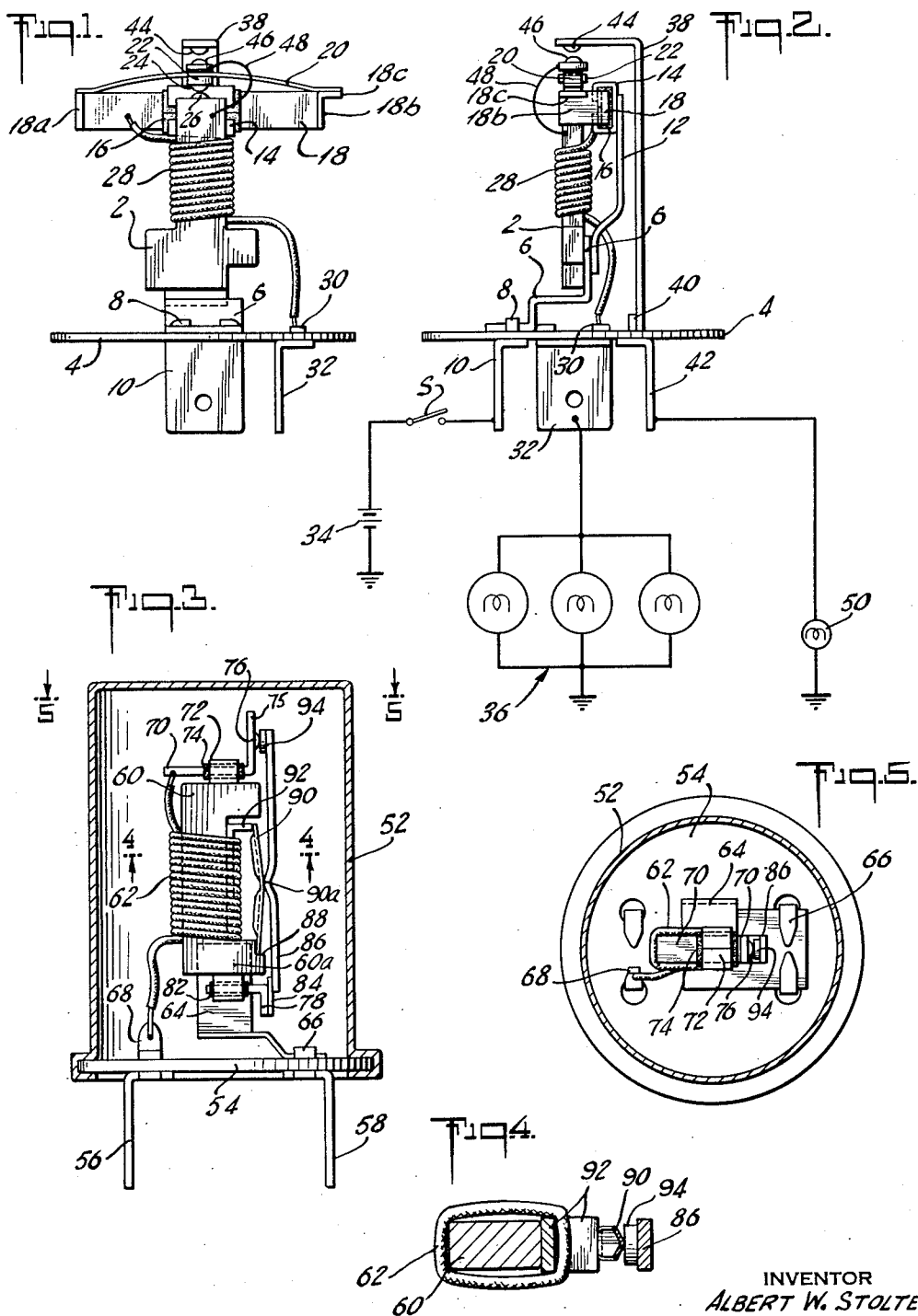
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ELECTROMAGNETIC FLASHER

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ELECTROMAGNETIC FLASHER

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The present invention relates to electromagnetic switches of the type employed for flashing a lamp load or the like and comprises a novel self-operating switch of this character which is quick acting, simple and sturdy of construction, and relatively insensitive to circuit current and line voltage fluctuations.

The new flasher comprises essentially a core of material of high magnetic permeability carrying an energizing winding, an armature associated with the core, and an elongated thermal element fixed at its ends and secured at an intermediate point to the armature, the thermal element upon expansion under the influence of current therethrough acting to move the armature to retracted position and upon contraction to move the armature into attracted position. The armature carries a contact adapted to engage a fixed contact when the armature is in attracted position and the contacts when closed place the winding and thermal element in series across terminals of the device. Thus when a lamp load and a source of energy are connected across the flasher terminals, the lamps of the load will be lighted and the electromagnet of the flasher energized to increase contact pressure, the current flowing from the source of energy through the load, winding and thermal element in series. The current through the thermal element causes the element to expand and exert a force upon the armature in opposition to the magnetic attraction of the core. When the force exerted by the expanding element is sufficient to overcome the force of magnetic attraction, the armature moves to retracted position, opening the circuit at the contacts and thereby permitting cooling and contraction of the thermal element with consequent reclosing of the circuit and repetition of the cycle.

The thermal element may be of any electrically conductive material of relatively high positive coefficient of thermal expansion. It should be so shaped as to be relatively stiff over the portions thereof extending between the point of attachment to the armature and the fixed ends and relatively bendable at or near its point of attachment to the armature so that expansion provides a component of force on the armature in the desired direction. Also, to insure proper operation, the ends of the thermal element should be so fixed that the element, when cold, is constrained sufficiently to insure, when expanding, unidirectional movement of its point of attachment to the armature.

For a better understanding of the invention and of switches embodying the same, reference may be had to the accompanying drawings, of which—

Fig. 1 is a side view of a flasher embodying the invention and illustrative of the principle thereof;

Fig. 2 is a view of the flasher of Fig. 1 taken at right angles to the view of Fig. 1 and shown connected in a circuit to be flashed;

Fig. 3 is a side view of another flasher constructed in accordance with the invention and representing the presently preferred embodiment thereof;

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Fig. 4 is a sectional view of the thermal element of the flasher of Fig. 3 taken on the line 4—4 of that figure; and Fig. 5 is a top plan view of the flasher of Fig. 3 taken on the line 5—5 of that figure.

The flasher of Figs. 1 and 2 comprises a core 2 supported above a base 4 of insulating material by means of a generally L-shaped bracket 6. The bracket 6 has one leg clamped to the base by means of prongs 8 of a terminal connector 10, the prongs piercing the base on opposite sides of the leg of the bracket and being pinched down thereover. The core 2 is welded to the other leg of the bracket, which leg has also welded thereto an upright strip 12 upon the upper end of which is insulatedly mounted, as by means of a clamp 14 and insulating liner 16, a crossbar 18 spaced laterally from the core 2. The crossbar 18 is bent through a right angle at each end to provide spaced arms 18a and 18b to the upper surfaces of which are secured the ends of a thermal element 20, arm 18b being formed with a flange 18c providing an extended surface for attachment of the end of the thermal element thereto. Element 20, which comprises a relatively stiff strip of conductive material, as, for example, a nickel chromium alloy, having a positive coefficient of thermal expansion, extends over the core 2 and is so secured to the arms 18a and 18b as to assume a bowed shape, concave toward the core. The curvature of the thermal element 20 when cold is determined by the location on the flange 18c to which the end of the element is welded or otherwise secured. A block 22 of iron or other magnetically permeable material to serve as an armature is fixed to the center of the element 20 and carries a contact 24 adapted, when the thermal element is cold or cool, to engage a contact 26 mounted on the end of core 2. One end of a winding 28 on the core 2 is welded to the crossbar 18 and the other end is welded to a prong 30 of a terminal connector 32 carried by the base 4.

When a source of energy, as for example a battery 34 the negative terminal of which is grounded, is connected by means of switch S to terminal connector 10 of the above described device and a bank of lamps 36 is connected to terminal 32, as diagrammatically indicated in Fig. 2, current will flow from the battery 34 through the terminal connector 10 to the core 2 and from the core through the contacts 26 and 24, armature 22, thermal element 20, crossbar 18 and winding 28 to terminal connector 32, and from this connector through the lamps 36 to ground, energizing the electromagnet comprising the core 2 and winding 28 and lighting the lamps 36. The magnetic attraction of the armature 22 to the core, resulting from energization of the electromagnet increases the pressure between contacts 24 and 26. The current through the thermal element 20 causes it to expand and buckle outwardly. When the force of expansion overcomes the magnetic attraction of the electromagnet for the armature, the contacts separate, deenergizing the electromagnet by opening the circuit at the contacts 24 and 26 and extinguishing the lamps. The circuit being open, the thermal element 20 contracts until it again assumes its initial position, at which time the circuit recloses at the contacts and the cycle repeats.

If it is desired to alternately flash two circuits, it is only necessary to provide a contact engageable when the thermal element is in expanded position and a circuit controlled by such contact. In the embodiment of the invention illustrated in Figs. 1 and 2, such additional means are disclosed and comprise a bracket 38 mounted upon the prong 40 of a third terminal connector 42 and carrying at its upper end a fixed contact 44 adapted, when the thermal element is expanded, to be engaged by contact 46 insulatedly mounted on the thermal element and connected by a flexible lead 48 to the core 2. With this ar-

rangement when a lamp 50 or other circuit element is connected between connector 42 and ground, the circuit therefor is closed when element 20 has expanded sufficiently to bring contact 46 into engagement with contact 44, the circuit comprising battery 34, terminal connector 10, core 2, flexible lead 48, contacts 46 and 44, bracket 38, terminal 42 and lamp 50. Thus the circuit of lamp 50 flashes alternately with that of lamps 36.

In the embodiment of the invention illustrated in Figs. 1 and 2, the thermal element is a flat strip constrained to arcuate shape by the attachment of its ends to the cross-bar 18. Because of the initial constrained position of the thermal element, unidirectional movement of its center results when the element expands. If desired, the portions of the element between the ends and the part to which the armature is connected could be stiffened as by bending these parts along the longitudinal axis of the element to provide a cross-section in the form of a V. Alternatively, or additionally, the central section to which the armature is attached could be thinner or of less width to provide a relatively yielding portion in the center of the strip. Other suitable configurations of the thermal element will occur to those skilled in the art.

In Figs. 3, 4 and 5 a flasher generally similar to that of Figs. 1 and 2 is illustrated. The flasher of Figs. 3 to 5 incorporates means for adjusting contact spacing and for adjusting the initial constrained position of the thermal element. This embodiment of the invention is thus preferred as compared to that illustrated in Figs. 1 and 2. In Figs. 3 to 5 the flasher is shown enclosed within a casing 52 crimped to the insulating base 54 to which are secured terminal connectors 56 and 58. The core 60 of the flasher of this embodiment is a flat, generally U-shaped member, the middle section of which carries an insulating winding 62 comprising the winding of the electromagnet. The core 60 is secured, as by welding, to a bracket 64 mounted on the base 54 by means of the prongs 66 of terminal 58. One end of the coil 62 is welded to a lug 68 of terminal connector 56 and the other end of the winding 62 is welded to a contact holder 70. Holder 70 is insulatedly mounted on the upper end of the core 60 by means of a clamp 72 having an insulated lining 74, the holder 70 having an upwardly extending portion upon which is mounted a contact 76. The position of contact 76 may be adjusted by bending the upright portion of holder 70 by means of a suitable tool. One leg of an L-shaped bracket 78 is mounted on the base of the lower leg 60a of core 60 by means of a clamp provided with an insulating lining 82, the other leg of the bracket 78 extending downwardly and having welded thereto a short flat spring 84 comprising the hinge and flexible support for an armature 86. Leg 60a of the core 60 has a shoulder 88 formed thereon and one end of a thermal element 90 is welded to this shoulder 88, the other end of the thermal element being welded to one leg of an adjusting L-shaped bracket 92 the other leg of which is welded to the central portion of the core 60 within the turns of winding 62. Adjustment of the position of the upper end of element 90 can be made by bending the horizontal leg of the bracket 92. The thermal element 90 has a short flat section 90a at its midpoint and is welded at this section to the armature 86, the armature being slightly bent at its point of attachment to the thermal element to provide a flat protruding section for junction with the thermal element. Between the section 90a and each end of the thermal element, the cross-section of the thermal element is generally V-shaped as indicated in Fig. 4, the element being concave toward the core. A contact 94 is carried on the end of the armature 86 for engagement with contact 76 when the thermal element is cold or cool. Suitable contact pressure when no current is supplied to the terminals 56 and 58 is insured by initial adjustment of holder 70 and bracket 78.

The operation of the above described device is substantially similar to that of the device of Figs. 1 and 2.

When a lamp load or the like and a source of energy are connected in series across the terminals 56 and 58, current will flow through the winding 62, contacts 76 and 94, armature 86, thermal element 90 to the core and from the core through bracket 64 to terminal 58. Positive contact pressure is assured by the magnetic attraction of the armature to the core by energization of the electromagnet. Upon expansion of the thermal element under the current flowing therethrough, the thermal element will expand and push the armature toward retracted position. When the contacts 76 and 94 separate, the circuit is opened and the thermal element will begin to contract to reclose the circuit and repeat the cycle of operation. Due to the relative stiffness of the legs of the thermal element, relatively large movement of its center portion 90a results when the element expands, and this movement is in a direction to move the armature to contact opening position.

The above described flasher requires relatively few elements, provides for initial or factory adjustment of the parts, and the contacts thereof break with a snap action. It is relatively insensitive to changes in operating current and voltage and has no delicate elements that are apt to need replacement or repair. Obviously, if it is desired to provide means for alternately flashing a separate circuit means such as described in connection with the embodiment of the invention described in Figs. 1 and 2 could be provided, namely, additional contacts closed when the thermal element is in expanded position, and connections thereto to a third terminal mounted on the base 54.

The invention has now been described with reference to two embodiments thereof, in each of which an armature secured to a thermal element is moved by the thermal element upon expansion and contraction, the normal position of the armature when no current is supplied being that of circuit closing condition. In each, opening of a circuit results when the force of expansion of a thermal element exceeds the force of attraction of an electromagnet for its armature. As each of these opposing forces varies as a function of the square of the current or voltage and as the thermal element and winding of the electromagnet are in series, relative insensitivity to voltage or current fluctuations results.

Obviously, various changes could be made in the specific constructions illustrated without departing from the spirit of the invention or the scope of the accompanying claims.

I claim:

1. In an electromagnetic flasher of the type having a core, a winding thereon, a movable armature and contacts brought into engagement when the armature moves into attracted position, the improvement which comprises an elongated expansible element for moving the armature to engage the contacts, said element being secured at a locality intermediate its ends to said armature and having its ends mounted in fixed relation to the core, at least the parts of the element between said locality and the ends of the element being stiff enough to provide a force on the armature when the element expands that exceeds the opposing magnetic force acting on the armature when the winding is energized, said core, winding, and element being electrically connected in series when said contacts are engaged and said element when cold holding said armature in contact engaging position.

2. The improvement according to claim 1 wherein said element comprises a metallic strip creased longitudinally between said locality and the ends of the element to provide stiffness and oriented with respect to the core to present its concave surface thereto.

3. The improvement according to claim 1 wherein the spacing between the fixed ends of the element is less than the length of the element when cold, the midpoint of the element being spaced farther than the ends of the element from the core whereby expansion of the element insures movement of the armature away from the core.

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4. The improvement according to claim 1 wherein the ends of said element are mounted on the core, one end of said armature is hingedly and insulatedly mounted on said core, one of said contacts is insulatedly mounted on said core and electrically connected to one end of said winding and the cooperating contact is carried by the free end of said armature whereby when a circuit including a source of electrical energy is connected across said core and the other end of said winding, current will flow in series through said circuit, said core, element, armature and winding when the contacts are engaged and will be interrupted when the element expands and moves the armature to contact open position.

5. An electromagnetic flasher comprising in combination a core having a winding thereon, a contact fixedly mounted with respect to the core, a movable armature and a contact carried thereby engageable with said first contact when the armature is in attracted position, an elongated element of electrically conductive material having a positive coefficient of thermal expansion fixedly mounted at its ends and attached at a locality intermediate its ends to said armature, said element when contracted holding said armature in contact engaging position, expansion of said element with passage of current there-through creating a force on said armature in opposition to the magnetic force of attraction acting on the armature when said winding is energized and said winding and element being electrically connected in series when said contacts are in engagement.

6. The flasher according to claim 5 including means for initially adjusting the spacing between the ends of the element.

7. An electromagnetic flasher comprising in combination a core having a winding thereon and a movable armature associated therewith, an elongated expansible element fixed at its ends and secured at a point intermediate its ends to said armature, a contact fixed with respect to the core and a contact movable with the armature and engageable with the fixed contact when the

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armature is in attracted position, said winding, when energized, creating a magnetic holding force on said armature, said winding, armature, element and core being electrically connected in series when said contacts are in engagement, and said thermal element being so constrained by the fixing of its ends that upon expansion with passage of current therethrough the element overcomes the magnetic holding force acting on the armature and moves the armature toward contact open position and upon contraction returns the armature to contact engaging position.

8. The flasher according to claim 7 wherein the ends of said thermal element are mounted on the core, one end of the armature is pivotally and insulatedly mounted on the core, the other end of the armature carries said movable contact and the element and armature are fixed together intermediate their ends for movement of the armature by the element with expansion and contraction thereof.

9. The flasher according to claim 8 wherein said element intermediate its ends and its locality of attachment to the armature is stiffened by deformation to insure unidirectional movement of the armature with expansion of the element.

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