

Aug. 18, 1959

J. W. WELSH

2,900,474

FLASHER

Filed May 12, 1958

2 Sheets-Sheet 1

FIG. 1

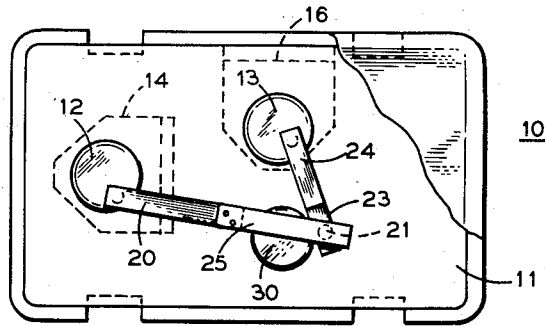


FIG. 2

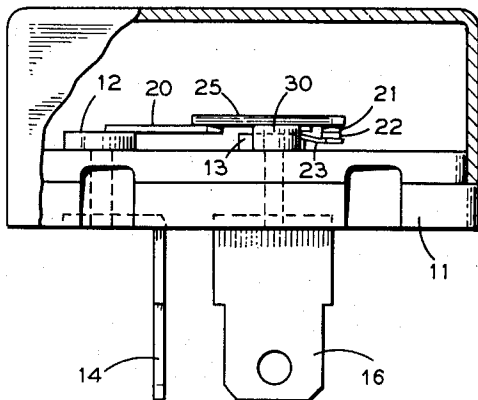


FIG. 3

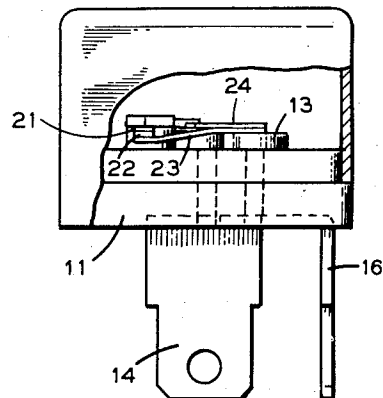
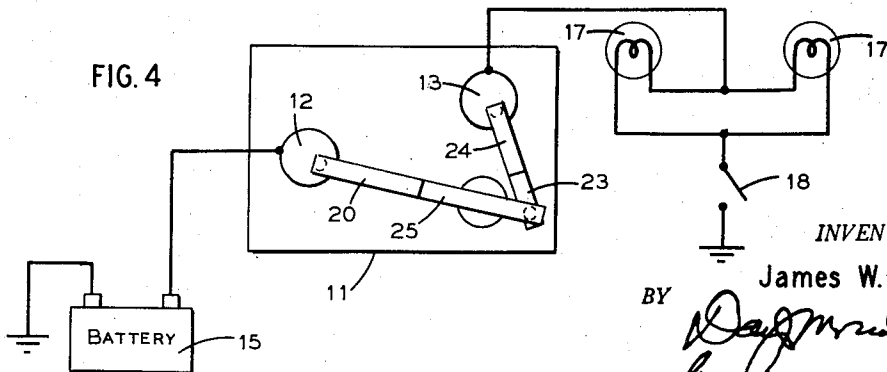


FIG. 4



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FIG. 5

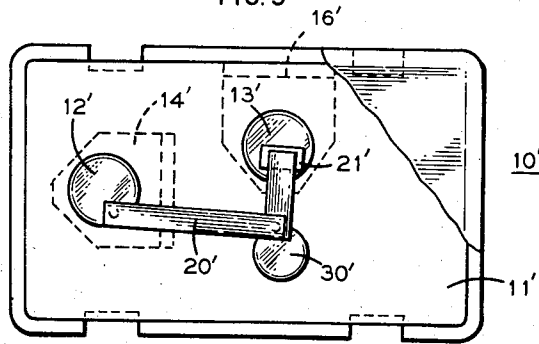


FIG. 6

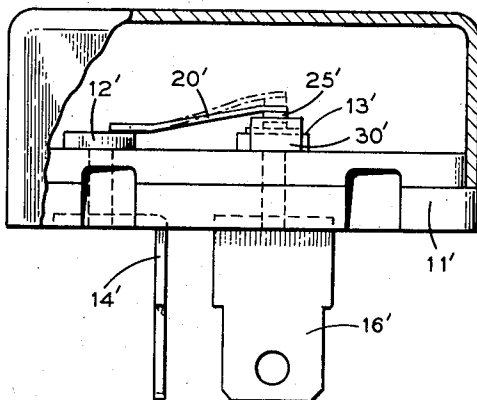


FIG. 7

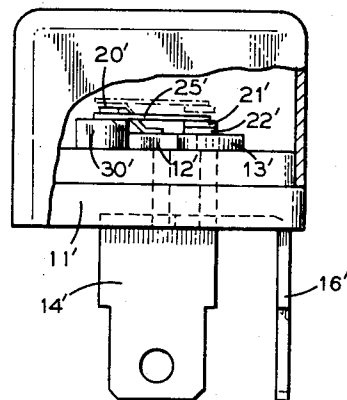
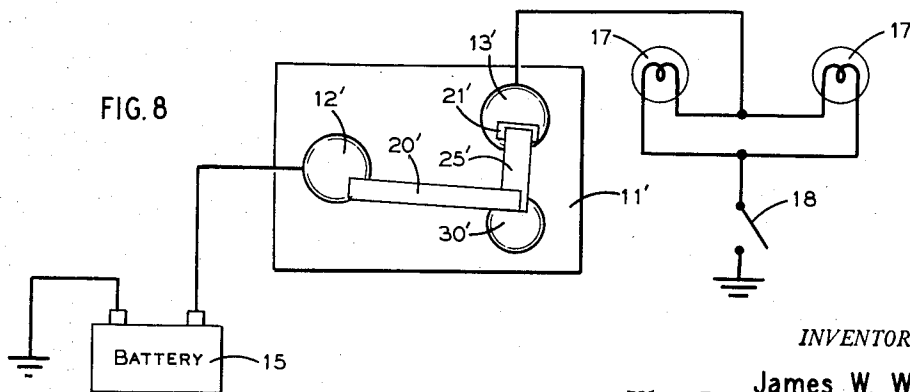


FIG. 8



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4 Claims. (Cl. 200—113)

This invention relates to thermomotive circuit breakers and, more particularly, to such type of circuit breakers employing a novel combination of thermal and magnetic forces to effect snap action making and breaking of current carrying contacts.

In most known types of thermally operated circuit breakers, the contact pressure decreases, during the opening cycle, until actual separation of the contacts. The decreasing contact pressure increases the contact resistance and decreases the life of the contacts. Recognizing this problem, many attempts have been made to rearrange the circuit breaker parameters to improve the maintenance of contact pressure during the opening cycle.

In most such switches or circuit breakers, a wiping action is provided to improve the contact life. However, the mechanical resistance characteristic of such wiping action greatly increases the power requirements of the circuit breaker. To keep power losses at a minimum, the wiping action must be sacrificed with consequent more rapid deterioration of the contacts greatly decreasing the contact life.

The aforementioned contact deteriorating conditions can be overcome by a switch design in which (1) full contact pressure is maintained during building up of contact separating pressure to a value exceeding the holding pressure with consequent snap action separation of the contacts, and (2) the gradually increasing contact closing force is suddenly and greatly augmented by a second closing force to snap the contacts closed. Under these two conditions, arcing of the contacts is substantially eliminated and the contact life indefinitely prolonged. However, providing these two conditions in a simple compact unit, such as an automotive flasher, and in a circuit breaker having an acceptably long life of its operating parts, has been a difficult problem to solve.

In accordance with the present invention, a switch meeting the foregoing conditions compact and simple in construction, and having a long life of its operating parts is provided by utilizing a novel combination of thermomotive and magnetic forces to effect snap action separation and closing of the contacts. More specifically, a relatively elongated bimetallic strip has one end anchored and has an elongated magnetic armature or a permanent magnet secured to its free end and cooperable with a fixedly mounted permanent magnet. The end of the armature remote from its attachment carries a first circuit controlling contact which is cooperable with a second circuit controlling contact relatively fixed as compared to the first contact.

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The circuit includes the bimetallic strip and the contacts so that the strip is heated by the current flow there-through, building up kinetic energy in a contact separating direction. However, the magnet and armature are so designed and located relative to the fixed end of the strip that the magnetic holding force maintains the contacts firmly engaged until the kinetic energy separating force exceeds a relatively large value. At such time, the strip moves the armature away from the magnet with a terrific acceleration, the movement being in the direction of decreasing magnetic force. Such magnetic force decreases as the square of the distance from the magnet. Thus, the contacts are literally snapped apart, with the separation stopping when the stored kinetic energy in the strip reaches zero at the beginning of reverse spring tension.

As the bimetallic strip cools, the armature is moved toward the magnet. When the magnetic field is effective on the armature, the contact closing force, augmenting the force of the bimetallic strip, increases with the square of the distance the armature moves toward the magnet.

For an understanding of the invention principles, reference is made to the following description of typical embodiments thereof as illustrated in the accompanying drawings. In the drawings:

Fig. 1 is a plan view of one form of circuit breaker embodying the invention;

Fig. 2 is an end elevation view thereof;

Fig. 3 is a front elevation view thereof;

Fig. 4 is a schematic wiring diagram thereof;

Fig. 5 is a view similar to Fig. 1 of a preferred embodiment of the invention;

Fig. 6 is an end elevation view thereof;

Fig. 7 is a front elevation view thereof, and

Fig. 8 is a schematic wiring diagram thereof.

Referring to Figs. 1, 2, 3 and 4, the circuit breaker or flasher 10 comprises a dielectric base 11 on which are rivets 12, 13 electrically and mechanically connected to or integral with prongs 14, 16 engageable in a suitable receptacle to connect flasher 10 in circuit. For example, prong 14 (rivet 12) may be connected to the ungrounded terminal of a battery 15, and prong 16 (rivet 13) may be connected to a lamp load 17, 17 which may be connected to ground through a switch 18. When switch 18 is closed, a load circuit is completed including flasher 10 in series therein.

In accordance with the invention, a relatively elongated bimetallic strip 20 has one end brazed or welded to rivet 12, and has a magnetic armature 25 secured to its free end. Armature 25 may be a bar of cold rolled steel or may be a permanent magnet. Preferably, it is a bar of cold rolled steel or other suitable paramagnetic material.

A high strength permanent magnet 30 is mounted in or on base 11 beneath armature 25, and is selected so that it retains its magnetic strength substantially unimpaired due either to aging or relatively high temperature environment. For example, permanent magnet 30 may be one of the series of "Alnico" magnets manufactured by the General Electric Co.

In the embodiment of Figs. 1, 2 and 3, a relatively movable first contact 21 is secured to the undersurface of armature 25 and normally engaged with a relatively fixed second contact 22 on the upper surface of a spring 23 having

one end welded or brazed to rivet 13. For a purpose to be described, a bar 24 is secured to rivet 13, by welding or brazing, and overlies a major part of spring 23. In the closed condition of contacts 21, 22, spring 23 is deflected away from bar 24 toward base 11.

Bimetallic strip 20 acts to store kinetic energy prior to separation of contacts 21, 22 to open the circuit, and also acts as the member moving the contacts toward the closed position during the initial part of the closing cycle. This strip is so designed, with respect to magnet 30 and armature 25, that the kinetic energy stored in the strip will build up to such a value, before balancing the holding force of armature 25 and magnet 30 that, upon the kinetic energy exceeding the magnetic holding force, the contact separating movement will be tremendously accelerated resulting in snap opening of the contacts.

Armature 25 and magnet 30 are so correlated with strip 20 that the contacts 21 and 22 are held in full pressure engagement with each other by magnetic force until a very substantial amount of kinetic energy has been built up in strip 20 so that, when the contact separating force finally exceeds the magnetic contact holding force, the movement of contact 21 away from contact 22 will be extremely rapid, in actual effect snapping the contacts apart.

The foregoing actions are initiated by closing the switch 18 so that a heating current flows through bimetallic strip 20. The pressure holding the contacts closed is augmented by the spring strip 23 deflected toward base 11 when contacts 21 and 22 are engaged. During the initial part of the contact opening movement, contact 22 remains engaged with contact 21 as spring 23 moves outward to its normal position. However, bar 24 limits the outward movement of spring 23.

The acceleration of contact 21 away from contact 22 is increased with the distance of armature 25 from magnet 30, as the effect of magnet 30 decreases with the square of the distance. The outward acceleration of contact 21 is continued until the kinetic energy in strip 20 is reduced to zero by reverse spring action of strip 20.

As the load circuit is broken by separation of contacts 21, 22, strip 20 cools and moves armature 25 toward magnet 30. As armature 25 enters the effective field of the magnet, the attractive force thereon increases as the square of the decreasing spacing of the armature from the magnet. Thus the closing movement is greatly accelerated by the combined action of strip 20 and of magnet 30 on armature 25. Just before armature 25 engages magnet 30, contact 21 snaps against contact 22 and deflects spring 23 toward base 11.

The preferred arrangement of Figs. 5, 6, 7 and 8 is somewhat modified from that of Figs. 1, 2, 3 and 4 in that spring 23 and bar 24 are omitted. In Figs. 5 to 8, armature 25' is secured to the end of bimetallic strip 20' to extend at substantially right angles to strip 20' toward rivet 13'. The free end of armature 25' carries a contact 21' engageable with a contact 22' on rivet 13'. Magnet 30' is disposed beneath armature 25' but nearer to its junction with strip 20'. This permits a cantilever spring action of armature 25' to augment the snapping open and closed of contacts 21', 22'. Otherwise, the design and material selection considerations, as well as the opening and closing action are essentially the same as those of the flasher of Figs. 1 to 4.

As a further feature, the striking of the armature against the magnet, as well as the substantially simultaneous snapping of the contacts against each other, provides a very distinct clicking sound, audible above the usual noises of an automotive vehicle, to audibly indicate operation of the flasher.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the invention principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. A thermostatic circuit breaker comprising, in combination, a dielectric base; a first fixed terminal on said base; a relatively elongated bimetallic strip having one end electrically and mechanically fixed to said first terminal; a relatively elongated paramagnetic member electrically and mechanically secured to the free end of said bimetallic strip to extend therefrom; a first contact fixed to said member; a permanent magnet fixed to said base beneath said member to attract the latter against said magnet; a second fixed terminal on said base; and a second contact electrically connected to said second terminal and substantially fixed relative to said first contact; said first and second contacts being held in pressure engagement when said armature is attracted against said magnet; said bimetallic strip, upon the establishment of current flow between said terminals and thus through said strip, tending to deflect in a contact separating direction and, when restrained against such deflection, storing a progressively increasing amount of kinetic energy tending to so deflect said strip; the relative strength of said magnet in producing a magnetic field acting on said member being correlated with the deflecting force of said bimetallic strip to retain said member engaged with said magnet until the kinetic energy developed in said strip has attained a high value sufficient to snap said member away from said magnet when the deflecting force of said strip exceeds the holding force of said magnet on said member to snap said contacts apart, the separation of said contacts being accelerated by the rapid decrease in the strength of the magnetic field acting on said member as said member moves away from said magnet; said strip, upon disengagement of said contacts, cooling and deflecting to move said member toward said magnet, said movement being accelerated, to snap said contacts together due to the rapid increase in the strength of the magnetic field acting on said member, as said member approaches said magnet, augmenting the contact closing action of said strip said second contact being on said second terminal, and said member extending laterally at an angle not exceeding 90° from the end of said strip over said second terminal, with the first contact being at the free end of said member.

2. A thermostatic circuit breaker comprising, in combination, a dielectric base; a first fixed terminal on said base; a relatively elongated bimetallic strip having one end electrically and mechanically fixed to said first terminal; a relatively elongated paramagnetic member electrically and mechanically secured to the free end of said bimetallic strip to extend therefrom; a first contact fixed to said member; a permanent magnet fixed to said base beneath said member to attract the latter against said magnet; a second fixed terminal on said base; and a second contact electrically connected to said second terminal and substantially fixed relative to said first contact; said first and second contacts being held in pressure engagement when said armature is attracted against said magnet; said bimetallic strip, upon the establishment of current flow between said terminals and thus through said strip, tending to deflect in a contact separating direction and, when restrained against such deflection, storing a progressively increasing amount of kinetic energy tending to so deflect said strip; the relative strength of said magnet in producing a magnetic field acting on said member being correlated with the deflecting force of said bimetallic strip to retain said member engaged with said magnet until the kinetic energy developed in said strip has attained a high value sufficient to snap said member away from said magnet when the deflecting force of said strip exceeds the holding force of said magnet on said member to snap said contacts apart, the separation of said contacts being accelerated by the rapid decrease in the strength of the magnetic field acting on said member as said member moves away from said magnet; said strip, upon disengagement of said contacts, cooling and

deflecting to move said member toward said magnet, said movement being accelerated, to snap said contacts together due to the rapid increase in the strength of the magnetic field acting on said member, as said member approaches said magnet, augmenting the contact closing action of said strip; said second contact being on the free end of a spring secured to said second terminal to extend beneath said member, said spring being deflected toward said base when the contacts are engaged.

3. A thermostatic circuit breaker as claimed in claim 10
2 including a bar secured to said second terminal and extending along part of the upper surface of said spring to limit outward movement of said spring.

4. A thermostatic circuit breaker as claimed in claim

1 including a pair of receptacle engaging prongs each mechanically and electrically secured to one of said terminals.

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