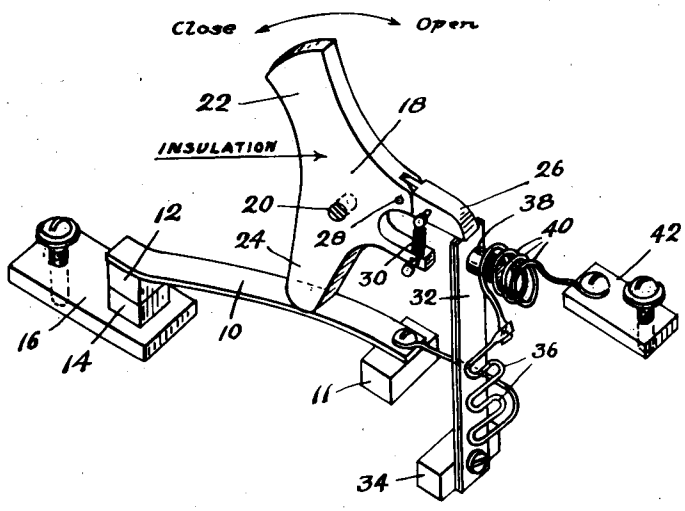
May 30, 1939. E. H. TAYLOR 2,160,424

ELECTRIC SWITCH AND TRIPPING MECHANISM THEREFOR

Filed Nov. 2, 1937



Inventor.
Elmer H. Taylor
by T. J. Greenwood
atty

Patented May 30, 1939 2,160,424

UNITED STATES PATENT OFFICE

2,160,424

ELECTRIC SWITCH AND TRIPPING MECHANISM THEREFOR

Elmer H. Taylor, Newburyport, Mass., assignor to The Chase-Shawmut Company, Newburyport, Mass., a corporation of Massachusetts

Application November 2, 1937, Serial No. 172,412

4 Claims. (Cl. 200—88)

This invention relates to electric switches and circuit breakers especially adapted although not necessarily restricted to the control of house lighting and low powered circuits and wherein the circuit breaker is automatically opened upon overload by a tripping device including a warpable bimetal strip adapted to be heated and warped into a tripping position in response to an excessive current traversing the switch circuit.

One of the advantages secured by the use of the bimetal strip is the time that it takes for the strip to heat and warp in response to currents of moderate overload so that the breaker does not operate instantly in response to moderate overloads. On short-circuits, however, as on heavy overloads approaching a short-circuit value, it is desired to have the circuit breaker open instantly without any time delay as otherwise the heavy current may almost instantly heat a short-circuited lamp cord and the like to a degree that can start a fire before the breaker opens. The bimetal strip, however, is inherently deficient in providing instantaneous opening of the breaker on short-circuit since it requires a certain amount of time to become sufficiently heated to effect the opening of the breaker even under the most favorable conditions. The time lag of the bimetal strip can be reduced by reducing the mass of the strip but there is a decided practical limit to the reduction of mass as the strip will become too weak to support the breaker-opening pressure on the associated latch member and will have insufficient operating force to overcome the friction between it and the latch member. A bimetal strip which has mass enough to surely resist the operating stresses on it and force enough, when heated, to overcome the load on it has such mass that it cannot open the breaker instantly on short-circuits.

Hence an object of the present invention is the provision of a switch and circuit breaker having a bimetal warpable strip for tripping the breaker upon overload with external means for heating the strip to secure delayed opening of the breaker upon moderate overloads and electromagnetic means including a solenoid for warping the strip to secure instant opening of the breaker upon short-circuit, the heating means for warping the strip and the electromagnetic means for warping the strip being structurally separate and independently operable of each other so that each may independently function, the strip heating means being adjusted to give suitable time relay of breaker opening on moderate overloads and the electromagnetic means being adjusted to be inactive on moderate overloads and to give instant operation on short-circuit.

Another object of the invention is generally to improve the construction of electric switches and circuit breakers.

The figure is a diagrammatic perspective view of a circuit breaker embodying the present invention.

The electric switch and circuit breaker illustrated in the figure includes a resilient strip **10** fixed to a support block **11** at one end and carrying a movable contact member **12** at the other end which cooperates with a stationary contact member **14** secured to a supporting and terminal plate **16**. The switch is operated manually by an operating member **18** pivoted on the pin **20** and having a thumb piece or handle **22** which is moved in a clockwise direction to close the switch and in the opposite direction to open the switch.

The operating member has a cam projection **24** which bears against the resilient contact carrying strip **10** and is adapted to flex the strip in a circuit closing direction. The operating member is provided with a latch member **26** which is pivoted to the operating member at **28** and is normally held down or in an inoperative position by the tensile spring **30** connected to a part of the operating member. The latch member normally engages the top edge of a bimetal warpable strip **32** which consists of two metals having dissimilar coefficients of thermal expansion joined together back to back. The thermal strip at the lower end is secured to a suitable support **34**. The thermal strip is adapted to be caused to warp towards the right to pass out from under the latch member **26** whereupon the inherent resiliency of the contact supporting strip **10** serves to open the switch and to move the operating member into a switch open position. The switch may be opened manually by moving the operating member in a clockwise direction and causing the spring **30** to yield and thus release the latch member **26** from the bimetal strip. The tension of the spring **30** holding the latch member down is normally greater than the pressure of the contact carrying strip **10** on the operating member so that the latch member holds the switch closed unless the switch is automatically or manually opened.

The switch herein described is intended to be representative of any type of switch having a latch member or the equivalent which is engaged by the bimetal strip **32** to hold the switch releasably in circuit closed position and to effect

the opening of the switch by the warping of the bimetal strip upon overload.

The bimetal strip is heated by an electric heater element or grid **36** consisting of an electric conductor of suitable resistance disposed closely adjacent a flat face of the strip so as to impart heat to the strip to cause it to warp away from the latch member **26**. The spacing between the heater element and the bimetal strip and the construction and resistance of the heater element determine the rate at which the bimetal strip is heated for any current traversing the heater element.

In accordance with the present invention the heater element is arranged to operate the bimetal strip only when the switch is traversed by moderate overload currents and for higher currents means are provided to warp the bimetal strip instantly to provide instant opening of the switch. To this end the bimetal strip at its upper end is provided with an armature **38** which is located partly within a solenoid **40** which is connected in series with the heater element and the terminals **16** and **42** of the switch. The solenoid consists of a few but sufficient number of spaced turns of bare low resistance as copper conductor which is not adapted to become heated on moderate overloads; and the solenoid is not adapted to warp the bimetal strip on overload currents at which the heater element **36** is ultimately effective. When, however, the solenoid is traversed by short-circuit current it becomes instantly active to attract its armature and warp the bimetal strip out from under the latch member **26**, thereby to effect the opening of the breaker. It will be appreciated that for any magnetizing current less than that for which the solenoid is designed to be effectively operative the armature will remain unattracted thereby but when the solenoid is traversed by the current at which it is intended to operate the armature will be instantly attracted.

With this arrangement the breaker is provided with the desirable delayed response to moderate overloads and instant response to short-circuits. The arrangement of the heater element and the solenoid as separate units but both operating, although independently, to warp the bimetal strip, is highly desirable since for one reason because the adjustment of the amount of delay in the opening of the breaker on moderate overloads can be set without regard to the design and disposition of the solenoid; and the solenoid can be designed to operate at any desired value of current without regard to the construction and arrangement of the heating element. This provides a flexibility of design not otherwise attainable. Since the solenoid operates instantly upon short-circuit the heater element has no time to become heated and to impart heat to the bimetal strip on such currents. The solenoid, of course, is ineffective for any current of a value less than that at which it is designed to operate.

The solenoid and armature is associated with an unheated part of the bimetal strip so that the magnetic permeability of the armature is not deleteriously affected by the temperature of the hot part of the strip, which would change the operating point of the solenoid if the strip should be hot prior to the occurrence of the short-circuit, as is liable to be the case.

I claim:

1. In a switch-tripping device, a warpable bimetal latch-holding strip, an electric heater element independent of said strip for heating said bimetal strip to cause it to warp to a latch-releasing position, and electromagnetic means including a solenoid separate from said heating means and strip acting on said bimetal strip to warp it into a latch-release position whereby to effect the automatic tripping of the switch, said heater element being arranged to provide delayed warping of said bimetal strip when said element is traversed by a moderate overload current and said electromagnetic means being arranged to provide instant warping of said bimetal strip when said electromagnetic means is traversed by heavy overload current.

2. An electric circuit breaker comprising separable contact members, operating mechanism therefor including a latch member for holding said contact members releasably in engaged position, a warpable bimetal strip releasably engaged with said latch member, an electric heater element disposed independent of but closely adjacent said bimetal strip to heat it and effect the warping thereof away from holding engagement with said latch member thereby to effect the separation of said contact members, and electro-magnetic means including a solenoid independent of said bimetal strip acting on said strip for warping said strip instantly away from holding engagement with said latch member, said heater element and said electromagnetic means being connected in series and traversed by the same current, said electromagnetic means being inoperative for the moderate currents that render said heater element operative in ultimately warping said bimetal strip and being operable to effect the instant warping of said strip on strong overloads independently of the action of said heater element.

3. An electric circuit breaker comprising separable contact members, operating mechanism therefor including a latching member adapted normally to maintain said contact members in engaged condition, a bimetal strip fixed at one end and normally engaging said latching member with its other end, an armature carried by said strip near said other end, a solenoid cooperating with said armature, an electric heater element disposed in heat imparting relation with said bimetal strip between said solenoid and said fixed end, said heater element and said bimetal strip being connected in series with each other and with said contact members, said heater element being arranged to provide delayed warping of said bimetal strip and release of said latching member when traversed by overload currents up to a predetermined value, said solenoid being ineffective to attract said armature when traversed by such currents and effective to attract said armature and instantly warp said bimetal strip when traversed by currents exceeding said predetermined value.

4. In a switch-stripping device, a latch-holding warpable bimetal strip having a fixed end and a free latch-engaging end, an electric heater element disposed adjacent said strip near the fixed end thereof for heating the strip and effecting delayed warping thereof into a latch-release position on moderate switch overloads, and electromagnetic means in series with said heater element and acting on the free end part of said strip for effecting instant warping thereof into latch-free position on high overloads.

ELMER H. TAYLOR.