Aug. 19, 1941. O. MÜLLER 2,253,390

CIRCUIT INTERRUPTER

Filed April 26, 1939 2 Sheets-Sheet 1

Fig. 1.

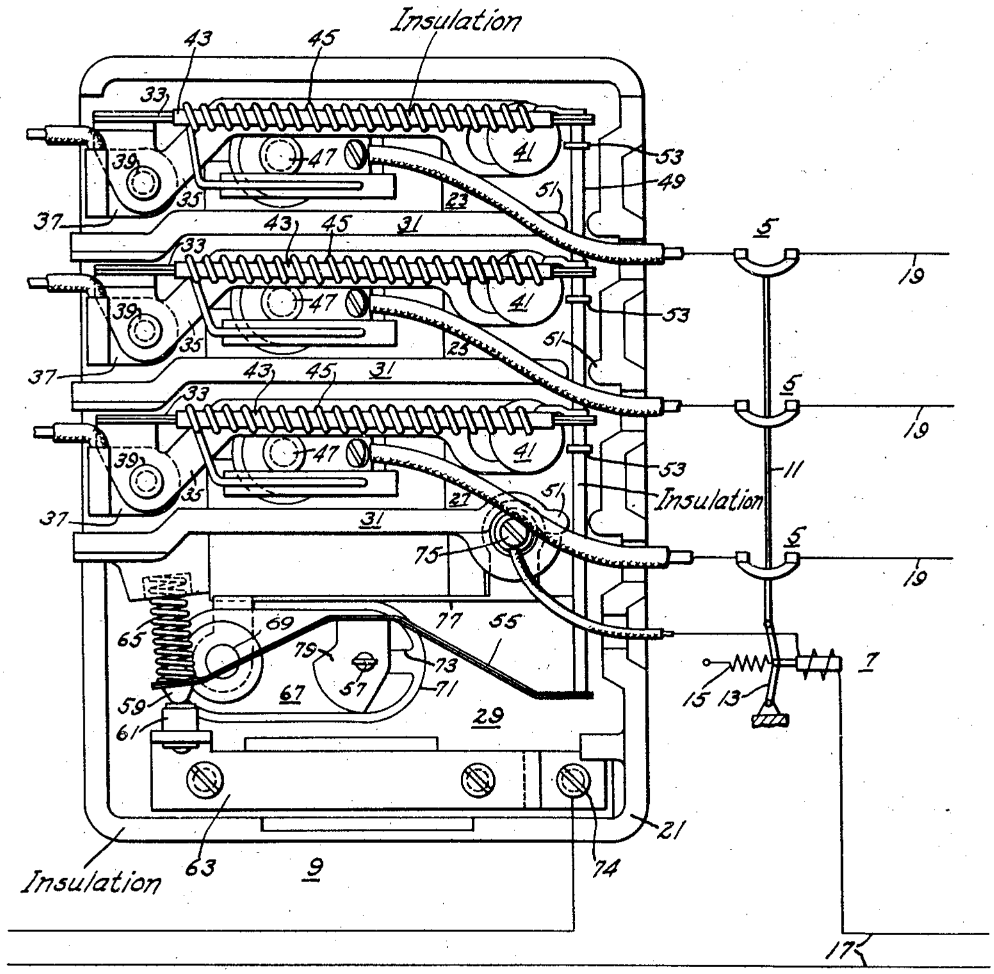
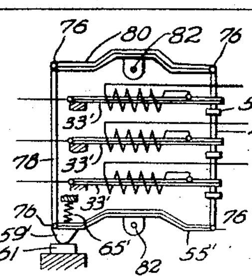


Fig. 4.



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Filed April 26, 1939 2 Sheets-Sheet 2

Fig. 2.

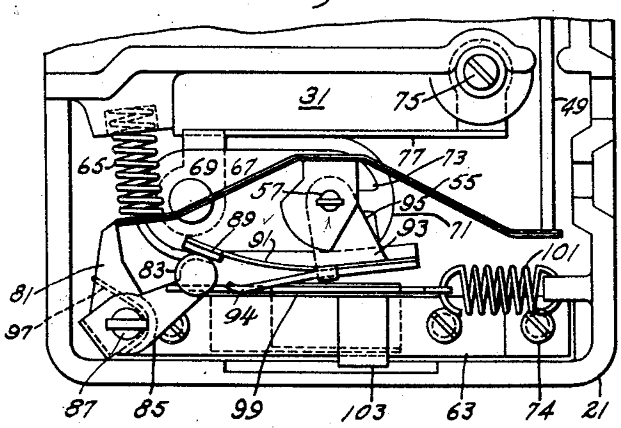
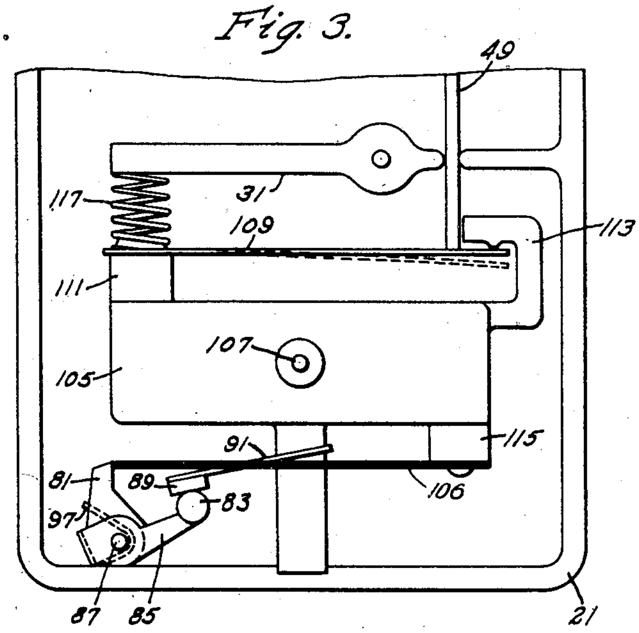


Fig. 3.



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UNITED STATES PATENT OFFICE

2,253,390

CIRCUIT INTERRUPTER

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Application April 26, 1939, Serial No. 270,214
In Germany April 26, 1938

15 Claims. (Cl. 200—113)

The invention relates to electrical circuit interrupters in general, and more particularly to circuit interrupters of the type having one or more current responsive thermal control elements operable in response to predetermined conditions to cause automatic opening of the interrupter.

An object of the invention is the provision of an improved circuit interrupter of the type described with a novel means for compensating the device for changes in ambient temperature.

Another object of the invention is the provision of an improved circuit interrupter embodying a train of elements operable by one or more current responsive bimetal control elements to cause automatic opening of the interrupter, and a single thermal element arranged in the chain of elements to compensate the device for changes in ambient temperature.

Another object of the invention is the provision of an improved multi-pole circuit interrupter embodying a plurality of current responsive bimetal control elements, each operable to cause automatic opening of the interrupter in response to predetermined conditions, and a single thermal element to compensate the device for changes in ambient temperature.

In addition to the above objects, the invention also provides a circuit interrupter having a novel construction and arrangement of parts which prevents false automatic opening of the interrupter in response to vibrations or jars as well as in response to changes in ambient temperature.

The acceleration forces produced by vibration or jars may be differentiated as follows: (1) The acceleration forces which originate in the elements taking part in the automatic release themselves; and (2) the acceleration forces which are impressed externally by the remaining parts of the interrupter on the elements taking part in the automatic release.

For the purpose of nullifying the effect of the acceleration forces under part (1) above, these acceleration forces are, in accordance with the invention, all distributed on the movable elements taking part in the automatic release in such a manner that they maintain their equilibrium with reference to their common rotation point or points.

A particularly simple and advantageous arrangement results if the ambient temperature compensating element is constructed as a double arm lever between the common slidable trip bar and the tripping contact or releasable element, and the lever pivoted at the common center of gravity of the movable elements.

For the purpose of nullifying the effect of the acceleration forces named in part (2) above, the ambient temperature compensating element is, in accordance with a further aspect of the invention, mounted on an additional inertia body or mass which is rotatably mounted at its center of gravity. A pre-tensioned spring is mounted on this body and engaged by one end of the common slidable trip bar. The arrangement is such that the mass of the inertia body and also the masses of the spring and the ambient temperature compensating element have the effect of a rigid structure movable as a rigid unit by the trip bar when the trip bar is moved in response to predetermined current conditions. However, when the trip bar is moved by vibrations or jars, this quick movement is taken up by the flexing of the pre-tensioned spring and the inertia body remains stationary so that the vibrations or jars will not cause tripping or release of the interrupter.

The novel features that are considered characteristic of the invention are set forth in particular in the appended claims. The invention itself, however, both as to structure and operation together with additional objects and advantages thereof will be best understood from the following detailed description of several embodiments thereof when read in conjunction with the accompanying drawings, in which:

Figure 1 is a partly schematic view of the circuit interrupter of the invention, the thermal control unit being shown in front plan, and the circuit, main contacts and operating means for the main contacts being shown schematically;

Fig. 2 is a fragmentary front plan view of a modified embodiment of the invention;

Fig. 3 is a fragmentary front plan view of a further modification of the invention embodying an additional inertia body and a pre-tensioned spring; and

Fig. 4 is a schematic view of another modification of the invention.

Referring to Figure 1 of the drawings, the circuit interrupter comprises in general a plurality of sets of main contacts **5**, one set for each pole of the interrupter, a common electromagnetic operating and holding means **7** for the contacts **5**, and a thermal control or release device indicated generally at **9** which is operable in response to predetermined current conditions in the circuit of any of the poles of the interrupter to cause automatic opening of the interrupter.

The main contacts **5** and their common electromagnetic operating means **7** may be of any conventional construction, and hence these elements together with the circuits have been shown schematically. The movable contact members of the contacts **5** are all mechanically connected for simultaneous actuation together by any conventional means represented schematically by a rod **11** and a toggle **13**. The contacts **5** are simultaneously actuated to closed circuit position and maintained in closed circuit position by energization of the electromagnetic means 7. Upon deenergization of the electromagnetic means, the contacts 5 are actuated to open circuit position by a spring means shown schematically at 15.

The energizing winding of the electromagnetic means 7 is connected in a control circuit 17 which is in turn connected to a suitable source of electric energy (not shown). Energization of the control circuit 17 may be controlled in any conventional manner as, for example, by a manually or electrically operated control switch (not shown). The main circuit or circuits controlled by the contacts 5 of the interrupter are represented by the lines 19. The thermal control or release device 9 contains a pair of contacts to be hereinafter described which are connected in series in the control circuit 17. These contacts are normally closed and are adapted to be opened in response to predetermined abnormal current conditions in any one of the lines 19 to effect deenergization of the electromagnetic operating means 7, and consequently opening of the contacts 5 of the interrupter.

The thermal control device 9 comprises a base or casing 21, preferably of molded insulating material, which is divided into a plurality of compartments 23, 25, 27 and 29 by partitions 31 formed integral with the casing. Suitable openings are provided in the walls of the casing 21 to accommodate the various conductors which enter the casing.

A plurality of current responsive thermal control elements 33, one for each pole of the interrupter, are mounted one in each of the upper compartments 23, 25 and 27 of the casing 21. The construction, mounting, and connection of each of the control elements 33 is identical so that a description of one will suffice.

Each of the thermal control elements is composed of a strip of bimetallic material and is rigidly secured at one end to an outwardly projecting bracket of an adjusting lever 35. The adjusting lever 35 is of conducting material and is pivotally mounted at one end on a terminal 37 by means of a screw 39. The screw 39 maintains the adjusting lever in good electrical contact with the terminal 37 and also serves as a pivot for the lever.

The free end of the adjusting lever is bifurcated and engages the opposite sides of an eccentrically rotatable adjusting member 41. Rotation of the adjusting member causes movement of the adjusting lever 35 about its pivot to change the position of the free end of the bimetal strip 33. This arrangement provides a means for accurately and individually calibrating and adjusting the several bimetal control elements 33 during the assembly of the interrupter, to predetermine the current conditions necessary to cause automatic operation of the device.

Each of the bimetallic strips 33 is enclosed for a major portion of its length by a sleeve 43 of insulating material on which is wound a heater coil 45 for heating the bimetal strip in response to the current flowing in the corresponding pole of the interrupter. The insulating sleeve 43 serves to electrically insulate the windings of the heater coil 45 from the bimetallic strip 33. One end of the heating coil is electrically connected to the free end of the bimetallic strip 33 and the other end of the heating coil is electrically connected to a terminal 47.

The two terminals 37 and 47 of each of the bimetallic control elements and their heating coils are electrically connected respectively in the corresponding main circuits 19, so that each bimetal control element is heated in response to the current flowing through its corresponding main circuit 19.

The electrical circuit through each pole of the interrupter extends from the left-hand terminal 37 through the bimetallic strip 33, back through the heating coil 45 to the opposite terminal 47 and through the main contacts 5 to the circuit 19.

Each of the bimetallic strips 33 is adapted to be deflected downwardly when heated in response to predetermined current conditions to cause automatic opening of the interrupter by actuating a common insulating bar 49. The common trip bar 49 is guided for vertical movement in a casing 21 by guides 51 formed in the partitions 31. The trip bar 49 is provided with a plurality of spaced projections 53 rigidly secured to the bar, one for each of the bimetal strips 33. When any one of the bimetallic strips 33 is deflected downwardly a predetermined amount in response to predetermined current conditions, the free end of the bimetallic strip engages the corresponding projection 53 on the common bar 49 and causes downward movement of the bar 49 to effect automatic opening of the circuit interrupter.

In order to render the automatic operation of the thermal control device 9 independent of ambient temperature conditions, an ambient temperature compensating element 55 is provided in the train of movable elements taking part in the automatic operation of the device. The ambient temperature compensating element 55 comprises a double arm lever of bimetallic material which is pivotally supported intermediate its ends on a pivot pin 57. One end of the ambient temperature compensating element 55 is engaged by the lower end of the vertically movable common trip bar 49, and the opposite end of the ambient temperature compensating element 55 carries a movable contact 59 which normally engages a cooperating stationary contact 61 carried by a terminal strip 63. The ambient temperature compensating element 55 is biased in a counter-clockwise direction about its pivot 57 by means of a helical compression springs 65 interposed between the contact carrying end of the element 55 and a portion of the casing 21. The biasing spring 65 serves to normally maintain the movable contact 59 in engagement with the stationary contact 61.

The contacts 59 and 61 are electrically connected in series with the winding of the electromagnetic operating and holding means 7 in the control circuit 17, so that these contacts, when in closed position, serve to maintain the electromagnetic means 7 energized as long as the control circuit 17 is energized.

When any one of the bimetallic strips 33 is deflected downwardly in response to predetermined abnormal current conditions, the common bar 49 is moved downwardly thereby causing clockwise rotation of the ambient temperature compensating element 55 about its pivot 57 to effect opening of the contacts 59 and 61 against the biasing action of the spring 65. Opening of the contacts 59 and 61 causes deenergization of the electromagnetic means 7, effecting simultaneous actuation of the main contacts 5 of the interrupter to open circuit position.

Opening of the contacts 5 interrupts the main circuit 19, deenergizing the thermal control elements 33, thus allowing them to cool. As soon as the deflected bimetallic control element 33 has cooled a predetermined amount, it returns to its original position, allowing the biasing spring 65 to move the ambient temperature compensating element 55 in a counter-clockwise direction to its original position, restoring the contacts 59 and 61 to closed circuit position. The interrupter is now in re-set position ready to reclose upon energization of the control circuit 17.

The ambient temperature compensating element 55 functions to compensate the device for changes in ambient temperature in the following manner. The left-hand end of the ambient temperature compensating element is maintained in the position shown in Fig. 1 by the biasing action of the spring 65. Any changes in ambient temperature causes the ambient temperature compensating element 55 to flex townward in response to a rise in ambient temperature and upward in response to a decrease in ambient temperature. This deflecting movement of the free end of the ambient temperature compensating element 55 shifts the position of the common bar 49 in a corresponding direction changing the position of the projections 53, so that greater or less deflecting movement of the bimetallic control elements is required to effect automatic operation of the control device 9.

The pivot pin 57, which supports the ambient temperature compensating element 55, is carried by a free end of an adjusting lever 67 which is pivotally mounted about a fixed point 69, and disposed in a recess 71 in the back wall of the casing 21. The free end of the adjusting lever 67 is notched as indicated at 73 and is adapted to be moved up or down by an eccentric adjusting screw (not shown) to shift the position of the pivot pin 57 up or down. This construction and mounting arrangement provides a means for effecting simultaneous adjustment of the current-operating characteristics of all of the bimetallic control elements 33 within a given range. The adjusting lever 67 may be moved up or down to correspondingly shift the position of the pivot 57, this changes the original position of the common bar 49 and its projections 53 so that more or less deflecting movement of any of the bimetallic control elements 33 is required to cause automatic opening of the interrupter.

The stationary contact 61 is electrically connected by the conducting strip 63 to a terminal 74, and the movable contact 59 is electrically connected to a terminal 75 through the agency of the pivot 57 and lever 67 which are of conducting material, and through a conducting strip 77 which is connected to the terminal 75 at one end and which engages the pivot end of the lever 67 at its other end. If desired, a suitable flexible shunt conductor may be provided for electrically connecting the movable contact 59 to the conducting strip 77.

In order to prevent the train of movable elements comprising the common bar 49, the ambient temperature compensating element 55 and the movable contact 59 from being moved to cause false automatic opening of the interrupter by vibrations or jars, the entire train of moving elements is statically balanced with respect to the common pivot or rotational point 57 of such train so that the acceleration forces produced by vibrations or jars are distributed over all of these elements in such a manner that the acceleration forces are in equilibrium with respect to the common pivot axis 57. This is attained by having the common pivot 57 of the movable train of elements 49, 55, 59 located at the common center of gravity of this train of movable elements.

The elements 49, 55, 59 and any parts carried thereby are constructed and arranged so that the masses on either side of the common pivot 57 are balanced with respect to this common pivot. An additional inertia body 79 may be secured to the ambient temperature compensating element 55 for the purpose of statically balancing the entire train of movable elements with respect to the pivot 57.

With the balanced construction described above, it will be readily apparent that any vibrations or jars applied to the interrupter will not cause movement of the train of elements 49, 55, 59 due to the fact that the acceleration forces produced on these elements by vibrations or jars, are in equilibrium with reference to the common pivot 57 of the train of elements.

Static balancing of the train of movable elements taking part in the automatic operation of the breaker may also be attained with reference to a plurality of common pivot or rotational points by having the common trip bar and the ambient temperature compensating element arranged as a part of a movable parallelogram, the joints or corners of which are formed by hinges. The connecting bars of the parallelogram which are hingedly connected to the common bar may be supported on fixed or adjustable pivot points. This construction is illustrated schematically in Fig. 4. The same reference characters with a prime mark added have been used in this figure to designate the parts which correspond to those of the original embodiment. Referring to Fig. 4, the common bar 49', which is moved by any one of the current responsive control elements 33', forms one side of a movable parallelogram and is hingedly or pivotally connected at its lower end to one end of the ambient temperature compensating element 55' which forms the next adjacent side of the parallelogram. Connecting bar 78 and a second bimetallic element 80, similar to the element 55', complete the movable parallelogram. The ends forming the corners of the parallelogram are pivotally or hingedly connected together as indicated at 76. The parallelogram pivots on two common rotational points or pivots 82 which are vertically aligned and disposed so that the parts are balanced with respect to these common pivots. The control elements 33' are engageable with collars or projections 53' secured to the bar 49' for moving the bar. A spring 65' biases the movable parallelogram in a counter-clockwise direction to normally maintain the movable contact 59' in closed circuit position. The operation of this modification is briefly as follows: When any one of the current responsive bimetal elements 33' is deflected downwardly in response to an overload in its circuit, the bar 49' is moved downwardly thereby causing the element 55' to move clockwise about the pivot 82 and effect opening of the contacts 59'—61. It will be understood that the entire parallelogram comprising the parts 49', 55', 78, and 80 is moved about the pivots 82 by the operation of any one of the current responsive bimetal elements 33'.

The ambient temperature compensating element 55' and the bimetal element 80 operate to shift the position of the bar 49' upwardly or downwardly, as the case may be, in response to changes in ambient temperature so as to maintain a fixed distance between the ends of the current responsive bimetal elements 33' and the collars 53' on the release bar 49' regardless of changes in ambient temperature.

If complete static balance of the movable train of elements is not found to be necessary, a degree of balance may be obtained by supporting the ambient temperature compensating element 55 at its center of gravity.

A modification of the invention is shown in Fig. 2. In this modification of the invention the ambient temperature compensating element 55 which is of bimetallic material is biased by the spring 65 so that its left-hand end normally engages and restrains a releasable latch member 81. The movable contact 83 in this embodiment is carried by a lever 85 which is pivoted on a pin 87 and directly connected with releasable latch member 81. The latch member 81 may form an internal part of the lever 85 if desired.

The cooperating stationary contact 89 which is normally engaged by the movable contact 83 as long as the latch 81 is held in latched position by the element 55 is carried by a resilient conducting strip 91 which provides the contact pressure. The conducting strip 91 is secured to a carrier 93 of conducting material having a projecting portion 95 which engages the pivot 57 and the adjusting lever 67. The stationary contact 89 is thus electrically connected to the adjusting lever 67 and through the same to the conducting strip 77. The carrier 93 is also provided with an extension 94 which limits downward movement of the resilient contact carrying strip 91.

The latch 81 and lever 85 are biased in a clockwise direction by means of a spring 97 which acts to move the lever 85 and movable contact 83 to open circuit position when the latch 81 is released by clockwise movement of the ambient temperature compensating element 55 upon downward movement of the common actuating bar 49.

The lever 85, movable contact 83 and the latch 81 are re-set to the closed and latched position by means of a manually operable resetting member 99. The resetting member 99 is mounted for horizontal sliding movement at the lower end of the casing 21 and is biased to an inoperative position by a spring 101. The resetting member 99 is also provided with a manual operating handle 103 by means of which it may be moved to the left against the bias of the spring 101 to effect resetting of the lever 85 to closed latched circuit position after cooling of the bimetal control elements. When the resetting handle is moved to the left to reset the interrupter, the resetting member 99, which is moved by the handle, engages the latch arm 81 and moves this arm and the connected contact arm 85 in a counterclockwise direction to the closed and latched position shown in Fig. 2.

The structure of this embodiment of the invention is identical to that of the original embodiment shown in Fig. 1 and described in connection therewith except for the arrangement and construction of the contacts 83 and 89 and the latch 81. Hence the same reference characters have been used in Fig. 2 to designate the corresponding elements and parts which are identical to those shown in Fig. 1.

The operation of the device shown in Fig. 2 is briefly as follows. The common bar 49 is moved downwardly by deflection of any one of the current responsive bimetal control elements 33 in response to predetermined current conditions. This downward movement of the bar 49 effects clockwise rotation of the ambient temperature compensating element 55 bodily about its pivot 57, causing the free end thereof to disengage the latch 81. As soon as the latch 81 is thus released, the spring 97 moves the lever 85 and contact 83 to open circuit position. This effects deenergization of the electromagnetic operating means 7, causing opening of the contacts 5 of the interrupter in the same manner as previously described in connection with Fig. 1.

To re-set the interrupter following the above described tripping or releasing operation, the resetting member 99 is moved to the left by means of the resetting handle 103 to return the lever 85 and contact 83 to the closed and latched position shown in Fig. 2. The interrupter contacts 5 will then be closed upon energization of the control circuit 17.

The ambient temperature compensating element 55 functions in substantially the same manner as described in connection with Fig. 1. A change in ambient temperature causes the element 55 to be deflected up or down, as the case may be, to change the original position of the common bar 49. A stop on the casing 21 is engageable by the underside of the latch end of the bimetal element 55 to limit movement of this end of the bimetal beyond the latching position shown in Fig. 2.

The current operating characteristics of the device may be adjusted by changing the position of the adjusting lever 67 in the same manner as described for the embodiment shown in Fig. 1. In such instance, the position of the stationary contact 89 must also be adjusted for the new position of the pivot 57. A suitable screw (not shown) is provided to maintain the pivot 57 and the stationary contact carrier in adjusted position.

The movable train of elements taking part in the automatic release in the embodiment shown in Fig. 2 are all statically balanced with respect to the pivot 57 in the same manner as for the embodiment shown in Fig. 1, that is to say, the common pivot 57 is disposed at the center of gravity of the entire train of movable elements.

A further modification of the invention is shown in Fig. 3. In this embodiment, an additional inertial body 105 of relatively large mass is provided for preventing false tripping of the breaker by shocks or jarring forces. The inertial body 105 is pivotally mounted at 107 at the center of gravity of the body 105 and parts carried thereby. A pre-tensioned spring 109 is secured at one end to a projection 111 of the body 105. The free end of the spring 109 normally engages a stirrup shaped stop 113 carried by the body 105. The common insulating bar 49 which is actuated by any one of the current responsive bimetal control elements 33 engages the pre-tension spring 109 at its lower end at a point adjacent the stop 113.

An ambient temperature compensating element 106, which is of bimetallic material, is secured at its right-hand end to a projection 115 of the inertial body 105. The free end of the ambient temperature compensating element 106 normally engages and restrains the latch portion 81 of the contact lever 85 to maintain the movable contact 83 in engagement with the resiliently supported stationary contact 89 in the same manner as in the embodiment shown in Fig. 2.

A spring 117 corresponding in function and operation to the spring 65 of the embodiments previously described, biases the body 105 in a counter-clockwise direction. This spring serves to yieldingly maintain the body 105 and the parts carried thereby in the position shown in Fig. 3, and also acts to return the body 105 to the normal position shown following an automatic releasing operation of the device.

The tension of the spring 109 is selected of such strength that for relatively slow downward motions of the common bar 49, caused by deflection of any one of the current responsive bimetallic control elements 33, the spring 109 remains in engagement with the stop 113 so that the motion of the bar 49 is transferred to the body 105, causing clockwise movement of the body 105 about its pivot 107 to effect release of the latch 81 and consequently automatic opening of the contacts 83, 89 and the interrupter. However, when the bar 49 is moved quickly, as, for example, by vibrations or jars, the spring 109 flexes as indicated by the dotted lines to take up the quick movement of the bar 49. The inertial body 105, due to its relatively heavy mass, and the fact that it is pivoted at its center of gravity remains stationary during flexing of the spring 109. Thus the accelerating forces produced by vibrations or jars will not cause automatic operation of the device. It will be noted that the tension spring 109 and the ambient temperature compensating element 55 extend parallel to the surfaces of the inertial body 105, thus providing a compact structure with no objectionably projecting parts.

The current operating adjustment of the device shown in Fig. 3 may take place in the same manner as in the devices disclosed in Figs. 1 and 2. The lever 85, movable contact 83 and latch 81 are reset to the closed and latched position by a manually operable resetting means (not shown), which is of the same construction as the resetting means shown in Fig. 2.

While the invention has been disclosed in accordance with the provisions of the patent statutes, it is to be understood that various changes in the structural details thereof may be made without departing from the spirit of the invention. It is desired, therefore, that the appended claims be given the broadest reasonable interpretation permissible in the light of the prior art.

I claim as my invention:

1. A circuit interrupter having, in combination, a train of elements movable to cause automatic opening of the interrupter, a bimetallic control element operable in response to predetermined conditions to move said train of elements to cause automatic opening of the interrupter and an ambient temperature compensating device arranged in the train of elements and movable therewith, the train of elements being movable about at least one common rotation point and being statically balanced with respect thereto.

2. A circuit interrupter having, in combination, means operable to cause opening of the interrupter, a train of elements including an ambient temperature compensating element movable with respect to at least one common rotation center to cause sa'd means to effect opening of the interrupter, and a current responsive bimetal control element operable in response to predetermined conditions to move said train of elements for causing said means to effect said opening of said contacts, said common rotation center being disposed substantially at the common center of gravity of said chain of elements.

3. In a circuit interrupter, relatively movable contacts, means including an ambient temperature compensating element movable about a common pivot to cause opening of said contacts, and a current responsive bimetal control element operable in response to predetermined conditions to bodily move said ambient temperature compensating element to cause said opening of said contacts, said common pivot being disposed substantially at the common center of gravity of the ambient temperature compensating element and the means movable therewith.

4. In a circuit interrupter, relatively movable contacts, means including an ambient temperature compensating element of bimetallic material pivotally mounted substantially at its center of gravity and movable about its pivot to cause opening of said contacts, and a current responsive bimetal control element operable in response to predetermined conditions to move said ambient temperature compensating element about said pivot to cause said opening of contacts.

5. In a circuit interrupter, relatively movable contacts, means including an ambient temperature compensating element of bimetallic material movable about a common pivot to cause opening of said contacts, a trip member for moving said means and ambient temperature compensating element about said pivot, and one or more current responsive bimetal control elements operable in response to predetermined conditions to move said trip member to cause said means to effect said opening of the contacts, said pivot being located substantially at the common center of gravity of the ambient temperature compensating element and parts movable therewith.

6. In a circuit interrupter, relatively movable contacts, means including a current responsive bimetal control element operable in response to predetermined conditions to cause opening of said contacts, and an ambient temperature compensating element pivotally mounted substantially at its center of gravity and moved bodily by said bimetal element in causing said opening of said contacts, said ambient temperature compensating element acting to compensate for movement of said control element by changes in ambient temperature.

7. In a circuit interrupter, relatively movable contacts, means operable to cause opening of said contacts comprising a current responsive bimetal control element movable in response to predetermined current conditions, and a pivoted ambient temperature compensating element of bimetallic material movable about its pivot by said control element to cause opening of said contacts, said ambient temperature compensating element being pivotally mounted at a point such that the acceleration forces on said compensating element resulting from vibrations or jars are balanced with respect to the pivot axis of said element.

8. In a multi-pole circuit interrupter, a device operable to cause automatic opening of the interrupter comprising a plurality of current responsive bimetal control elements one for each pole of the interrupter each movable in response to predetermined current conditions of its corresponding pole to cause the device to effect opening of the interrupter, a common bar movable by any one of said control elements in response to said predetermined conditions, and a pivoted

ambient temperature compensating element of bimetallic material engaged by said bar and movable bodily about its pivot by said bar upon movement of any one of said control elements in response to said predetermined conditions to cause automatic opening of the interrupter, the pivot of said ambient temperature compensating element being located at the common center of gravity of said ambient temperature compensating element and parts movable therewith.

9. In a multi-pole circuit interrupter, a device operable to cause automatic opening of the interrupter comprising a plurality of current responsive bimetal control elements one for each pole of the interrupter each movable in response to predetermined current conditions of its corresponding pole to cause the device to effect opening of the interrupter, a common bar movable by any one of said control elements in response to said predetermined conditions, and a pivoted ambient temperature compensating element of bimetallic material engaged by said bar and movable about its pivot by said bar upon movement of any one of said control elements in response to said predetermined conditions to cause automatic opening of the interrupter, said ambient temperature compensating element being pivotally mounted at the common center of gravity of said compensating element, said bar, and any parts carried by said element and bar.

10. In a multi-pole circuit interrupter, means including contacts actuatable to cause interruption of the circuit, means operable to actuate said contacts to cause automatic opening of the interrupter comprising a plurality of thermal control devices, each operable in response to predetermined current conditions in its corresponding pole of the interrupter to cause the actuation of said contacts, a common bar movable by any one of said control devices in response to said predetermined conditions, and a single ambient temperature compensating element of bimetallic material movable by said bar to cause the actuation of said contacts upon movement of any one of said control devices in response to said predetermined current conditions, said bar and said compensating element being movable about a common rotational point located substantially at the common center of gravity of said bar and said compensating element and parts movable therewith.

11. In a circuit interrupter, means comprising a train of elements having at least one common rotational point and movable one by the other to cause opening of the interrupter, one or more current responsive bimetal control elements operable in response to predetermined current conditions to move said train of elements to cause opening of the interrupter, an ambient temperature compensating element arranged in the train of elements and movable therewith in causing opening of the interrupter, said train of elements being balanced with respect to said common rotational point or points.

12. In a circuit interrupter, means operable to cause opening of the interrupter comprising a bimetal ambient temperature compensating element rotatably mounted about a point between its ends and movable about said rotational point by said means to cause opening of the interrupter, a common bar connected to said ambient temperature compensating element for moving said element about said rotational point, and one or more current responsive bimetal control elements each operable in response to predetermined current conditions to move said bar and thus move said ambient temperature compensating element to effect opening of the interrupter, said ambient temperature compensating element being rotatably mounted with its rotational point at the common center of gravity of said ambient temperature compensating element, said common bar, and any parts connected to said element and bar.

13. In a circuit interrupter, means operable to cause opening of the interrupter comprising a rotatably mounted inertial body of relatively heavy mass, a tension spring on said body, a common bar engaging said spring for partially rotating said body when said bar is moved relatively slowly, an ambient temperature compensating element carried by said body and movable therewith, and one or more current responsive bimetal control elements each operable in response to predetermined current conditions to move said bar relatively slowly for causing partial rotation of said body to effect said opening of the interrupter, said inertial body being rotatably mounted with its axis of rotation at the common center of gravity of said body and the elements carried thereby and connected thereto, said tension spring being flexed by quick movements of said bar in response to vibrations and jars to prevent movement of said body in response to vibrations and jars.

14. In a circuit interrupter, means operable to cause opening of the interrupter comprising a rotatably mounted inertial body of relatively heavy mass, a tension spring on said body, a common bar engaging said spring for partially rotating said body when said bar is moved relatively slowly, an ambient temperature compensating element carried by said body and movable therewith, said tension spring and said ambient temperature compensating element extending parallel to the surfaces of said body, and one or more current responsive bimetal control elements each operable in response to predetermined current conditions to move said bar relatively slowly for causing partial rotation of said body to effect said opening of the interrupter, said inertial body being rotatably mounted with its axis of rotation at the common center of gravity of said body and the elements carried thereby and connected thereto, said tension spring being flexed by quick movements of said bar in response to vibrations and jars to prevent movement of said body in response to vibrations and jars.

15. In a circuit interrupter, means operable to cause opening of the interrupter comprising a bimetal ambient temperature compensating element pivotally mounted intermediate its ends and movable bodily about its pivot by said means to cause opening of the interrupter, a common bar connected to said element for moving said element about its pivot, one or more current responsive bimetal control elements each operable in response to predetermined conditions to move said bar and thus move said ambient temperature compensating element about its pivot to effect opening of the interrupter, and adjusting means for moving the pivot support of said ambient temperature compensating element to vary the current-operating point of said control elements.

OTTO MÜLLER.