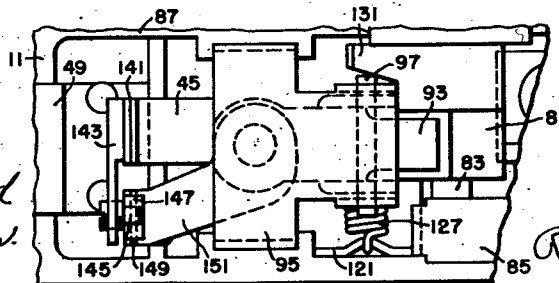
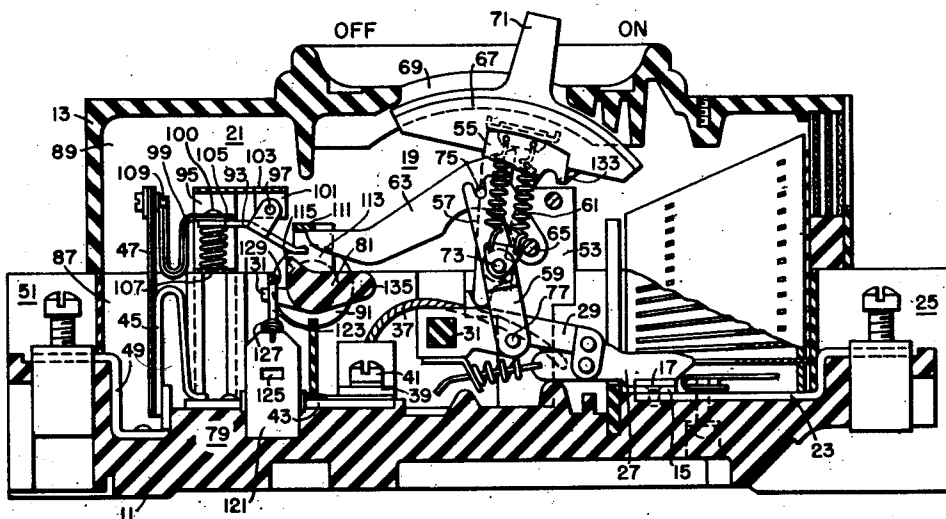
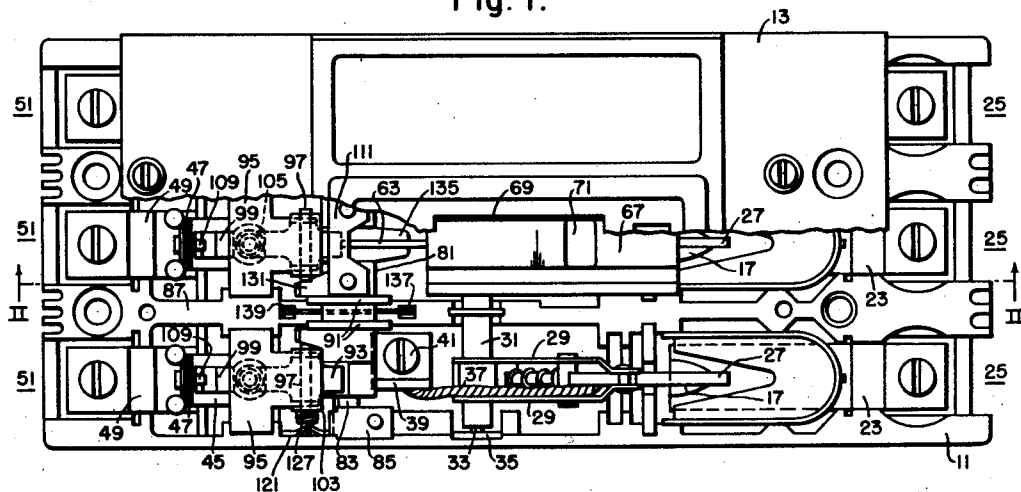


A. R. CELLERINI ET AL

CIRCUIT BREAKER

3 Sheets-Sheet 1



Robert C Baird
Paint. Harlow.

BY
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June 11, 1957

A. R. CELLERINI ET AL

2,795,670

CIRCUIT BREAKER

Filed Feb. 19, 1954

3 Sheets-Sheet 2

Fig. 3.

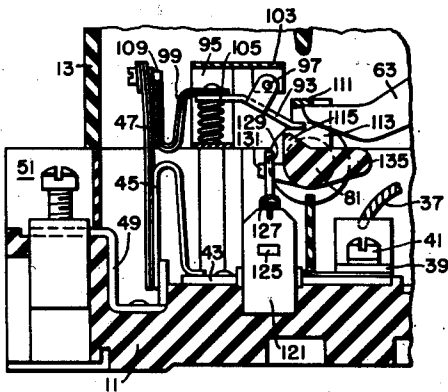


Fig. 4.

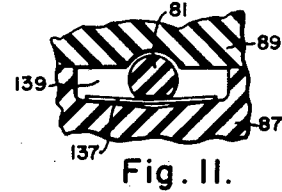
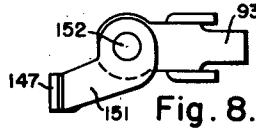
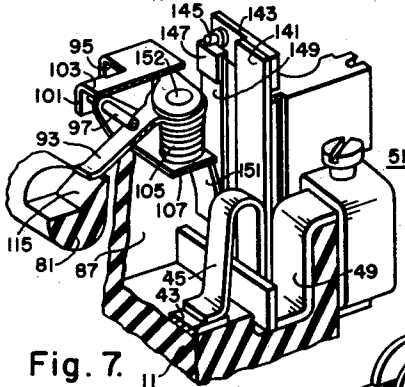
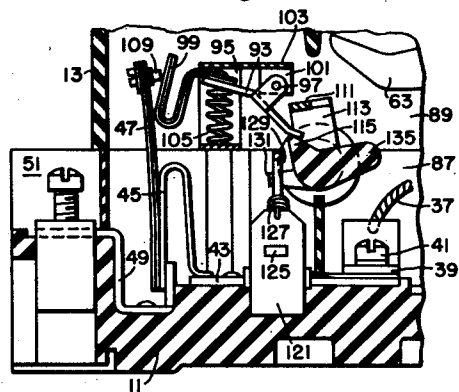


Fig. 7.

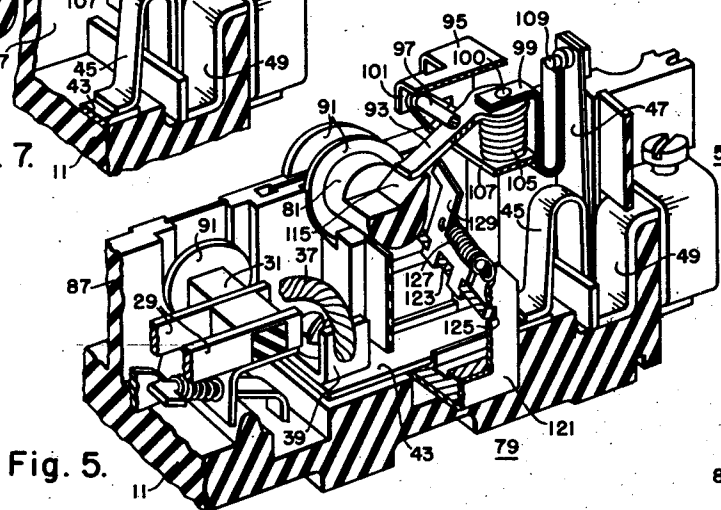


Fig. 5.

Fig. 9.

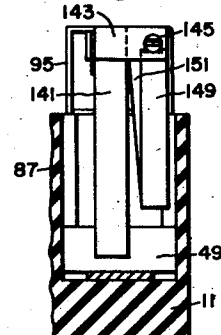
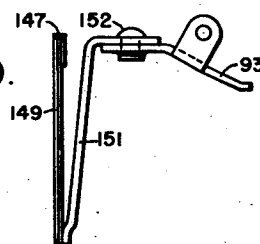


Fig. 10.



June 11, 1957

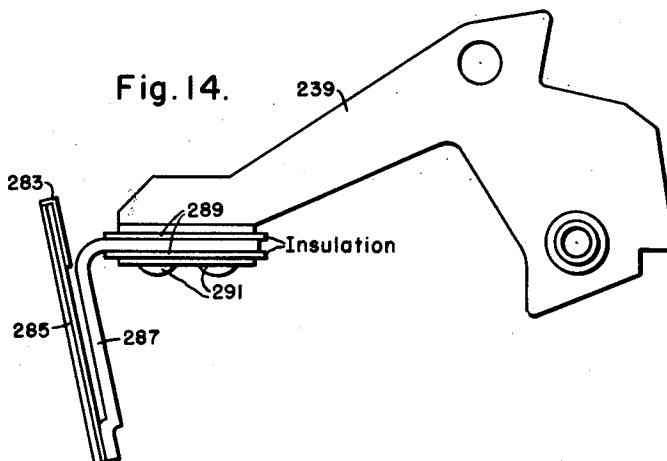
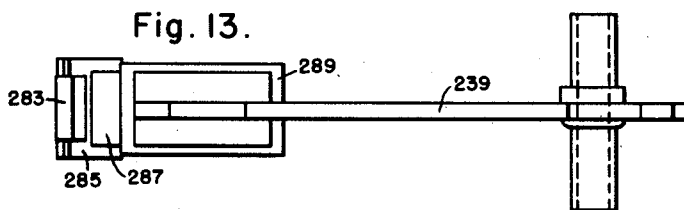
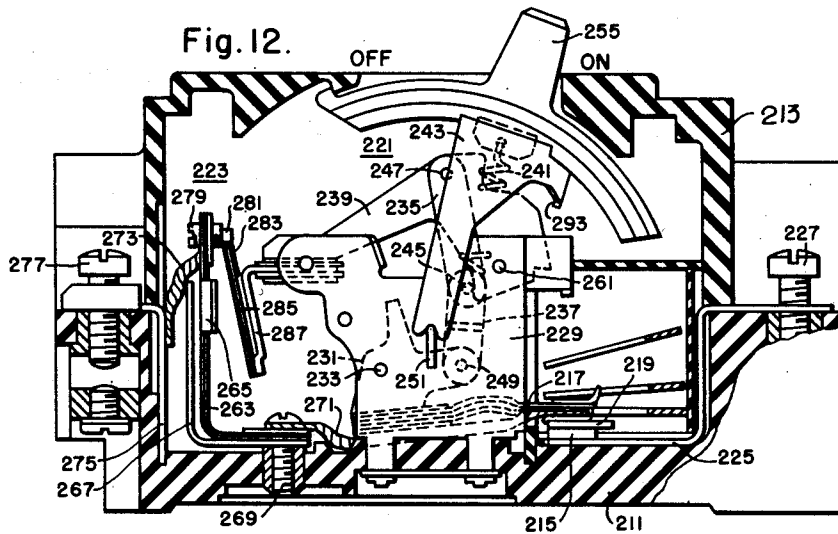
A. R. CELLERINI ET AL

2,795,670

CIRCUIT BREAKER

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3 Sheets-Sheet 3



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2,795,670

CIRCUIT BREAKER

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Application February 19, 1954, Serial No. 411,506

14 Claims. (Cl. 200—88)

This invention relates to circuit breakers for controlling lighting and moderate power circuits, and more particularly to ambient temperature compensation of the thermal trip device.

An object of the invention is to provide a circuit breaker embodying an improved thermally and magnetically responsive trip device including a spring actuated trip member and a temperature compensating element wherein the temperature compensating element is mounted on the spring actuated trip member.

Another object of the invention is to provide a circuit breaker embodying an improved thermally and magnetically responsive trip device with an ambient temperature compensating element in which the tripping thermal element does not have to overcome the rigidity of the compensating element in order to trip the breaker.

Another object of the invention is to provide a circuit breaker embodying a current responsive tripping bimetal element and an improved ambient temperature compensating construction.

The invention, 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 said drawings:

Figure 1 is a top plan view of a circuit breaker embodying the principles of the invention, a part of the cover being shown broken away to more clearly show some of the parts.

Fig. 2 is a vertical sectional view of the circuit breaker taken on line II—II, of Fig. 1, and looking in the direction indicated by the arrows, the circuit breaker being shown in the closed position.

Fig. 3 is a vertical sectional view of the trip device showing the positions assumed by the current responsive bimetal element and the temperature compensating bimetal element in response to an increase in the ambient temperature.

Fig. 4 is a view similar to Fig. 3 but showing the trip device in the tripped position when tripped by the current responsive bimetal element.

Fig. 5 is a perspective view showing the trip device for one pole of the breaker.

Fig. 6 is an enlarged front elevational view with the cover removed showing a modification of the trip device.

Fig. 7 is a perspective view of a portion of the modification shown in Fig. 6.

Figs. 8, 9 and 10 are views showing the spring actuated trip member of the modification shown in Figs. 6 and 7 with the compensating bimetal element attached thereto.

Fig. 11 shows the biasing spring for the common trip bar.

Fig. 12 illustrates the invention as applied to a single pole circuit breaker.

Fig. 13 is a top plan view of the releasable cradle of the circuit breaker shown in Fig. 12 with the compensating bimetal element mounted thereon.

Fig. 14 is a detailed elevational view of the releasable cradle shown in Fig. 13.

The invention is illustrated as applied to a circuit

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breaker of the type disclosed in Patent No. 2,458,151, issued January 4, 1949 to Hiller D. Dorfman and Gerald J. Freese and assigned to the assignee of the present invention.

Referring to Figs. 1 and 2 of the drawings, the circuit breaker is of the multi-pole type and comprises generally a base 11 and a cover 13 both of molded insulating material. Each pole of the circuit breaker comprises a stationary contact 15, a movable contact 17, an operating mechanism 19 and a trip device indicated generally at 21.

The stationary contact 15 is rigidly mounted on the inner end of a conducting strip 23 which extends out through an opening in the end wall of the base 11 and has a terminal connector 25 mounted on its outer end. The movable contact 17 for each pole is rigidly mounted on a contact arm 27 pivotally mounted on a switch arm 29 comprising a pair of spaced arms suitably mounted on a tie bar 31 which extends across all of the poles of the breaker and supports the switch arms 29 for the several poles for unitary movement to open and closed positions. The tie bar 31 is constructed of insulating material and is pivotally supported at its ends by means of pins 33 (only one being shown) engaging bearing members 35 (Fig. 1) only one of which is shown.

The contact arm 27 is connected by means of a flexible conductor 37 to a terminal 39 secured to the base 11 by a screw 41 which also serves to secure one end of a conductor 43 to the base. Suitably secured to the other end of the conductor, for instance, by welding is one end of a heater element 45 which extends upwardly and has a reverse bend therein, the other end of the heater 45 being secured preferably by welding to the inner end of a conductor 49 which extends out through an opening in the adjacent end wall of the base 11 and has a terminal connector 51 mounted on its outer end. One end of a bimetal element 47 is secured to one leg of the heater element 45 on the side adjacent the end wall of the base 11 and extends along the heater in close proximity thereto.

The terminal connectors 25 and 51 for each pole of the breaker serve to connect the circuit breaker in an electric circuit. The circuit through the breaker is the same for each pole and is traced as follows:

Terminal connector 25, conductor 23, the stationary contact 15, moving contact 17, contact arm 27, flexible conductor 37, terminal 39, conductor 43, heater 45 and conductor 49 to the terminal connector 51.

The operating mechanism 19 for the breaker is located in the center compartment of the housing and is supported on a pair of spaced frame members 53 (only one being shown) secured to the base 11. The operating mechanism comprises a forked operating lever 55, a toggle comprising toggle links 57—59, a pair of overcenter springs 61 and a releasable cradle 63 controlled by the trip device 21. The cradle 63 is pivotally supported on the frame members 53 by a pivot pin 65. The inner ends of the legs of the operating lever 55 are rounded and are pivotally seated in rounded notches in the frame member 53. An arcuate shield 67 of insulating material for substantially closing a handle opening 69 in the cover 13 is mounted on the outer end of the operating lever 55 and a manual handle 71 integral with the shield 67 projects through the opening 69 to permit manual operation of the breaker mechanism.

The toggle links 57—59 are pivotally connected together by a knee pivot pin 73. The toggle link 57 is pivotally connected by a pivot pin 75 to the cradle 63 and the toggle link 59 is pivotally connected to the switch arms 29 for the center pole of the breaker by a pivot pin 77. The overcenter springs 61 are connected under ten-

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sion between the knee pivot pin 73 of the toggles 57—59 and the outer end of the operating lever 55.

The trip device 21 includes a tripping bimetal element 47 for each pole of the breaker. The trip device also includes a series overload magnet 79 for each pole of the breaker and a trip bar 81 common to all of the poles. The trip bar 81 is constructed of one piece of molded insulating material and is pivotally supported by means of pins 83 (only one being shown) molded in the ends of the trip bar. The pins 83 pivotally support the trip bar 81 in bearing members 85 in the side walls of the base 11.

The trip bar 81 extends across all of the poles of the breaker through openings provided therefor in barriers 87 in the base 11 and matching barriers 89 in the cover. The barriers 87 and 89 extend lengthwise of the housing and divide the housing into separate compartments each of which houses one of the poles of the breaker. A plurality of flanges 91 are molded integral with the trip bar 81 and are disposed one on each side of and adjacent to each of the barriers 87—89 in order to more completely insulate the poles of the breaker from each other and reduce the danger of flashover between adjacent poles.

Each pole of the breaker is provided with a releasable stored energy device or a spring actuated trip member 93 pivotally supported by a pivot pin 97 in an inverted U-shaped frame 95, the legs of which are suitably mounted on the base 11 of the breaker. The pivot pin 97 which supports the trip member 93 is mounted in a pair of spaced ears 101 formed on a projection 103 of the frame 95. A coil spring 105 compressed between the underside of the trip member 93 and a crossbar 107 supported between the legs of the frame 95 biases the trip member about its pivot in a clockwise or tripping direction. An ambient temperature compensating bimetal element 99 has one end rigidly secured by means of a rivet 100 to the end of the trip member 93 adjacent the spring 105. To the left of the trip member 93 as viewed in Fig. 3, the compensating bimetal 99 extends downward and has a reverse bend therein. The free or movable end of the compensating bimetal element 99 extends upwardly in the same direction as the movable end of the tripping bimetal element 47 and is in latching engagement with a latch member 109 in the free end of the tripping bimetal element 47 to releasably restrain the trip member 93 in the position shown in Fig. 2.

A latch 111 secured to projections 113 on the trip bar 81 normally engages the latch end of the releasable cradle 63 and releasably restrains the cradle in operative position. The right-hand end of the trip member 93 is disposed directly above a projection 115 on the trip bar 81 which it is adapted to engage upon release of the trip member to actuate the trip bar as will be more fully described later.

The electromagnet 79 comprises a U-shaped yoke 121 and an armature 123 having a reduced portion 125 which pivotally supports the armature in an opening in one leg of the U-shaped yoke. The armature 123 is biased to unattracted position by a spring 127 and is provided with a hooked portion 129 which, upon operation of the magnet, is adapted to engage a projection 131 on the trip bar 81 to actuate the trip bar.

The circuit breaker is manually operated to the open position by manipulation of the handle 71 and the operating lever 55 in a counterclockwise direction to the "off" position. This movement carries the line of action of the overcenter springs 61 across to the left of the pivot pin 75, whereupon the springs 61 cause collapse of the toggle 57—59 and opening movement of the switch arms 29 for all of the poles of the breaker.

The breaker is manually closed by movement of the handle 71 from the "off" to the "on" position. This moves the line of action of the overcenter springs 61 over to the right of the pivot pin 75 after which the springs 61 straighten the toggle 57—59, thereby moving the switch arms for all of the poles to the closed position.

The circuit breaker is tripped open automatically by

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operation of the trip device 21. When the tripping bimetal element 47 is heated a predetermined amount in response to a low persistent overload current below a predetermined value of, for instance, 1000% of normal rated current, it bends in a direction to move its free end toward the left (Figs. 2 and 4) or toward the right (Fig. 5). After a time delay, the tripping bimetal element 47 causes the latch member 109 to disengage the free end of the compensating bimetal 99, whereupon the spring 105 snaps the trip member 93 about its pivot 97 causing the end thereof to strike a hammer blow on the projection 115 of the trip bar 81. This rocks the trip bar 81 counterclockwise (Fig. 2) or clockwise (Fig. 5) and causes the latch 111 to release the cradle 63. The parts are shown in the tripped position in Fig. 4. Upon release of the cradle 63, the overcenter springs 61 rotate the cradle clockwise about its pivot 65 carrying the pivot 75 over to the right of the line of action of the overcenter springs 61, which thereupon causes collapse of the toggle 57—59 and opening movement of the switch arms 29 for all of the poles of the breaker.

Before the contacts can be closed following an automatic opening operation, it is necessary to reset and relatch the mechanism. This is accomplished by moving the handle 71 and the operating lever 55 counterclockwise as far as it will go during which movement a projection 133 on the operating lever 55 engages a shoulder on the cradle 63 and moves the cradle also counterclockwise. Near the end of the resetting movement of the cradle 63, the free end thereof engages a projection 135 on the trip bar 81 and rocks the trip bar clockwise to a position somewhat beyond its normal position. During this movement, the projection 115 on the trip bar 81 engages the end of the trip member 93 and moves the trip member counterclockwise to reengage the free end of the compensating bimetal element 99 with the latch member 109 on the tripping bimetal element 47. As soon as the handle 71 is released, a spring 137 (Figs. 1 and 11) disposed in a notch 139 in the barrier 87 restores the trip bar 81 to its normal position wherein the latch 111 engages and restrains the cradle 63. The contacts are then closed by movement of the handle 71 to the "on" position in the previously described manner.

The purpose of the compensating bimetal element 99 is to compensate the tripping bimetal element 47 for changes in the ambient temperature. The high expansion side of the tripping bimetal element 47 is on the right (Figs. 2 and 3) adjacent to the heater 45. Consequently, upon a rise in ambient temperature, the tripping bimetal 47 will bend toward the left or in tripping direction as shown in Fig. 3. The high expansion side of the compensating bimetal 99 is on the outside of the U, hence, upon a rise in ambient temperature, the free end of the compensating bimetal will move toward the left with the free end of the tripping bimetal, thus maintaining the normal latch overlap. The tripping time of the breaker for a given overload current will, therefore, remain the same regardless of a change in the temperature of the surrounding air.

The breaker is tripped open instantaneously by the action of the electromagnet 79. The magnet 79 is energized by the conductor 43 which extends through, but is insulated from the U of the U-shaped magnet yoke 121. When energized by overload currents of, for instance, 1000% or more of normal rated current, or a short circuit current, the magnet attracts the armature 123 which causes the hooked portion 129 to engage the projection 131 and rocks the trip bar 81 thereby instantaneously releasing the cradle 63. This effects automatic opening of the contacts in the previously described manner.

According to the modification illustrated in Figs. 6, 7, 8, 9 and 10, the compensating bimetal element and the tripping bimetal element are placed edge to edge rather than face to face as shown in the Fig. 2 modification. Referring to Figs. 6 and 7, the tripping bimetal element 141 is rigidly mounted on the heater element 45 and ex-

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tends for some distance in close proximity thereto to be heated thereby. Secured to the free end of the bimetal element 141 preferably by welding is a latch carrying member 143 which extends to one side of the bimetal element 141 and has a latch member 145 mounted therein. The latch member 145 normally engages a stainless steel latch 147 secured to the free end of an ambient temperature compensating element 149 (Figs. 7, 9 and 10). The lower end of the compensating bimetal 149 is rigidly secured preferably by welding to one end of an arm 151, the upper end of which is formed substantially at right angles and is rigidly secured to the trip member 93 by means of a rivet 152. It will be seen in Figs. 6 and 7 that the tripping bimetal 141 and the compensating bimetal 149 lie in substantially the same plane but are spaced apart so that the effect of the heat from the tripping bimetal and the heater element 45 on the compensating bimetal is minimized due to the fact that the tripping bimetal and its heater have a minimum heat radiating surface facing the compensating bimetal to keep the heat transfer by radiation as small as possible.

The high expansion sides of the two bimetal elements are on the same side, that is, toward the breaker so that upon a change in ambient temperature both bimetal elements bend in the same direction and to the same extent, thus maintaining a constant latch relationship.

The operation of the thermal trip device shown in Figs. 6, 7, 8, 9 and 10 is essentially the same as that shown in Fig. 2. When the tripping bimetal 141 (Fig. 7) is heated in response to an overload current, it bends in a direction to cause the latch member 145 to disengage the steel latch 147 on the compensating bimetal 149 permitting the spring 105 to actuate the trip bar 81 and effect release of the cradle 63. This effects opening of the contacts in the previously described manner. The mechanism is reset and the contacts closed in the manner described for the device shown in Fig. 2.

Figures 12, 13 and 14 illustrate the invention as applied to a single pole circuit breaker. The breaker may be of any suitable type, the one illustrated being of the type disclosed in Patent No. 2,656,439, issued October 20, 1953, to Francis L. Gelzheiser and Joseph A. Drobney and assigned to the assignee of the present invention.

As illustrated in Fig. 12 of the drawings, the circuit breaker comprises generally, a housing including a base 211 and a cover 213 both of insulating material, a stationary contact 215, a pivoted switch member 217 carrying a movable contact 219 for cooperating with the stationary contact, operating means indicated generally at 221 and a trip device indicated generally at 223.

The stationary contact 215 is rigidly mounted on the inner end of a conducting strip 225 which has a connecting means 227 on its outer end.

The operating mechanism 221 and the pivoted switch member 217 are supported in a U-shaped frame 229 suitably secured to the base or housing 211. The switch member 217 is secured to a support member 231 pivoted on a pivot pin 233 supported in the side members of the frame 229.

The operating mechanism 221 comprises a toggle consisting of a pair of toggle links 235 and 237, a pivoted cradle 239, an overcenter spring 241 and a U-shaped operating lever 243. The toggle links 235-237 are pivotally connected by a knee pivot pin 245 and the toggle link 235 is pivotally connected to the cradle 239 by a pivot pin 247. The toggle link 237 is pivotally connected by means of a pivot pin 249 to the support member 231. The overcenter spring 241 is connected at its inner end to the knee pivot pin 245 and at its outer end to the yoke portion of the U-shaped operating lever 243. The legs of the operating lever 243 are pivoted on projections 251 formed outwardly from the sides of the frame members 229. An operating handle 255 of molded insulating material is mounted on the outer end of the operating lever 243 and projects out through an opening in the casing 211.

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The cradle 239 is pivotally mounted on a pivot pin 261 supported in the frame 229 and is normally releasably restrained in operative position by the trip device 223.

The circuit breaker is opened manually by moving the handle 255 counterclockwise, which movement carries the line of action of the overcenter spring 241 over to the left of the pivot pin 247. This action causes collapse of the toggle 235-237 and opening of the contacts with a snap action. Clockwise movement of the handle 255 back to the position shown moves the line of action of the overcenter spring 241 over to the right of the pivot pin 247 which straightens the toggle 235-237 and closes the contact with a snap action.

The trip device 223 comprises a bimetal element 263 having an armature 265 mounted thereon and a fixed magnetic member 267. The bimetal element 263 and the fixed magnetic member 267 have mounting feet thereon and are rigidly secured to the base 211 by means of a screw 269. One end of the bimetal element 263 is connected by a flexible conductor 271 to the switch member 217, and the other end of the bimetal element 263 is connected by a flexible conductor 273 to a conducting strip 275 which has a connecting means 277 on its outer end. An adjusting screw 279 threaded into the free end of the bimetal element 263 has a latch portion 281 which is engaged by a latch element 283 on the free end of a temperature compensating bimetal element 285. The compensating bimetal element 285 is rigidly mounted at its other end on the lower end of an angular support member 287 which is rigidly secured to but insulated from the free end of the releasable cradle 239. The support member 287 is mounted between pieces of insulation 289 and secured to the cradle 239 by means of rivets 291.

The high expansion sides of the bimetals 263 and 285 are on the same side, that is, on the side adjacent the operating mechanism. Consequently, the bimetal elements will bend in the same direction in response to changes in the ambient temperature, thus, maintaining a substantially constant latch overlap between the latch portion 281 and the latch element 283. In this manner, the bimetal element 285 compensates the tripping bimetal element 263 for changes in ambient temperature.

When an overload current is below a predetermined value of, for instance, ten times normal rated current, the tripping bimetal element 263 becomes heated, and when heated a predetermined amount, bends in a direction to disengage the latch 281 from the latch element 283, thereby releasing the cradle 239. This causes collapse of the toggle 235-237 and opening of the breaker contacts. The bimetal element 263 is operated to release the cradle instantaneously by the electroresponsive means 265-267 in response to overload currents above ten times normal rated current or short circuit currents.

Following an automatic opening operation, the cradle 239 is reset and relatched by movement of the handle 255 to the "off" position. During this movement, a projection 293 on the operating lever 243 engages and moves the cradle 239 clockwise about its pivot 261 causing the compensating bimetal 285 to wipe by the latch 281 slightly flexing the tripping bimetal 263 which thereafter resumes its normal latching position. The circuit breaker is thereafter closed in the previously described manner by movement of the handle 255 to the "on" position.

Having described the invention in accordance with the provisions of the patent statutes, it is to be understood that various changes and modifications may be made in the structural details and arrangement of parts thereof without departing from some of the essential features of the invention.

We claim as our invention:

1. In a circuit breaker having relatively movable contacts and releasable operating means for effecting opening of said contacts, a trip device comprising a trip member normally releasably restraining said operating means, releasable stored energy means operable when released to

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engage and actuate said trip member to effect release of said operating means, a tripping bimetal element having one end supported and the other end free, a temperature compensating bimetal element having one end mounted on said stored energy means and the other end free, the free end of said tripping bimetal element normally engaging the free end of said compensating bimetal element to releasably restrain said stored energy means in operative position, thermal bending of said tripping bimetal element releasing said compensating bimetal element to permit said stored energy device to actuate said trip member, and said compensating bimetal element bending in response to changes in ambient temperature to compensate said tripping bimetal element.

2. A circuit breaker having relatively movable contacts and releasable operating means for effecting opening of said contacts, a trip device comprising a trip member normally releasably restraining said operating means in operative position, a biased releasable member biased in tripping direction and operable when released to engage and actuate said trip member, a tripping bimetal element having one end supported and the other end free, latch means on the free end of said tripping bimetal element, a temperature compensating bimetal element having one end rigidly mounted on said releasable member and the other end engaged by said latch means to releasably restrain said releasable member, said compensating bimetal element bending in response to changes in ambient temperature to compensate said tripping bimetal element, and thermal bending of said tripping bimetal element releasing said compensating bimetal element to permit said biased member to engage and actuate said trip member.

3. In a circuit breaker having relatively movable contacts and releasably operating means for effecting opening of said contacts, a trip device comprising a trip member normally releasably restraining said operating means, releasable stored energy means operable when released to engage and actuate said trip member to effect release of said operating means, a tripping bimetal element comprising a flat strip of bimetallic material having one end supported and the other end free, a U-shaped temperature compensating bimetal element having one end mounted on said stored energy means and the other end free, the free end of said tripping bimetal element normally engaging the free end of said compensating bimetal element to releasably restrain said stored energy means in operative position, thermal bending of said tripping bimetal element releasing said compensating bimetal element to permit said stored energy device to actuate said trip member, and said compensating bimetal element bending in response to changes in ambient temperature to compensate said tripping bimetal element.

4. A circuit breaker having relatively movable contacts and operating means releasable to effect automatic opening of said contacts, a trip device comprising a trip bar movable to release said operating means, a biased trip member releasable to engage and move said trip bar to effect release of said operating means, a temperature compensating bimetal element having one end rigidly secured to said biased trip member and the other end free, a tripping bimetal element having one end supported and the other end free, latch means on the free end of said tripping bimetal element engaging the free end of said compensating bimetal element with a predetermined latch overlap to releasably restrain said biased trip member in operative position, said compensating bimetal element bending in response to changes in ambient temperature to maintain a constant latch overlap with said latch means, and thermal bending of said tripping bimetal element causing said latch means to disengage said compensating bimetal element and permit said biased trip member to engage and move said trip bar.

5. A circuit breaker having relatively movable contacts and operating mechanism movable to effect automatic

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opening of said contacts, a member releasable to effect opening movement of said operating mechanism, a spring biasing said releasable member in the direction to effect said opening movement, a temperature compensating bimetal element having one end supported on said biased releasable member and the other end free, a tripping bimetal element having one end supported and the other end free, said bimetal elements being spaced edgewise from each other, latch means on the free end of one of said bimetal elements disposed in latching engagement with the other of said bimetal elements to releasably restrain said biased releasable member in operative position, said compensating bimetal element bending in response to changes in ambient temperature to compensate said tripping bimetal element, and thermal bending of said tripping bimetal element disengaging said latch means to permit said biased releasable member to effect opening movement of the operating mechanism.

6. A circuit breaker having relatively movable contacts and operating mechanism movable to effect automatic opening of said contacts, a member releasable to effect opening movement of said operating mechanism, a spring biasing said releasable member in the direction to effect said opening movement, a temperature compensating bimetal element having one end supported on said biased releasable member and the other end free, a tripping bimetal element having one end supported and the other end free, latch means on the free end of one of said bimetal elements disposed in latching engagement with the other of said bimetal elements to releasably restrain said biased releasable member in operative position, said compensating bimetal element bending in response to changes in ambient temperature to compensate said tripping bimetal element, and thermal bending of said tripping bimetal element disengaging said latch means to permit said biased releasable member to effect opening movement of the operating mechanism.

7. A circuit breaker having relatively movable contacts and operating mechanism movable to effect automatic opening of said contacts, a member releasable to effect opening movement of said operating mechanism, a spring biasing said releasable member in the direction to effect said opening movement, a temperature compensating bimetal element having one end supported on said biased releasable member and the other end free, a tripping bimetal element having one end supported and the other end free, latch means on the free end of one of said bimetal elements disposed in latching engagement with the other of said bimetal elements to releasably restrain said biased releasable member in operative position, one of said bimetal elements having a substantial portion thereof extending along a substantial portion of the other bimetal element with one of said portions stressed in tension and the other in compression, said compensating bimetal element bending in response to changes in ambient temperature to compensate said tripping bimetal element, and thermal bending of said tripping bimetal element disengaging said latch means to permit said biased releasable member to effect opening movement of the operating mechanism.

8. A circuit breaker having relatively movable contacts and operating means releasable to effect automatic opening of said contacts, a trip device comprising a trip member movable to release said operating means, a trip actuator for engaging and moving said trip member, biasing means biasing said trip actuator in a direction to cause said trip actuator to engage and move said trip member, an ambient temperature responsive bimetal element having one end supported on said trip actuator and the other end free, a thermally responsive bimetal element heated by the current of the circuit and having one end supported and the other end free, the free ends of said bimetal elements being disposed in latching engagement to releasably restrain said trip actuator in operative position against the bias of said biasing means, and said thermally responsive bimetal element bending when heat-

ed a predetermined amount in response to overload currents to effect unlatching of said ambient temperature responsive bimetal element and permit said trip actuator to engage and move said trip member.

9. A circuit breaker having relatively movable contacts and operating means releasable to effect automatic opening of said contacts, a trip bar movable to release said operating means, a projection on said trip member, a spring biased trip member for engaging said projection and moving said trip bar to effect release of said operating means, a tripping bimetal element heated in response to the current of the circuit, an ambient temperature responsive bimetal element mounted on and movable with said biased trip member, latch means on said tripping bimetal element engaging said ambient temperature responsive bimetal element to releasably restrain said spring biased trip member, thermal bending of said tripping bimetal element causing said latch means to release said biased trip member to permit said biased trip member to engage said projection and move said trip bar.

10. In a multi-pole circuit breaker, relatively movable contact means and operating means releasable to effect automatic opening of said contact means, trip means comprising a trip bar common to all of the poles of the breaker movable to effect release of said operating means, a plurality of projections on said trip bar, a spring biased trip member for each pole, an ambient temperature responsive bimetal element on each of said trip members, a current responsive bimetal element for each pole engaging said ambient temperature responsive bimetal elements to releasably restrain said spring biased trip members in operative position, each of said current responsive bimetal elements being heated in response to the current of the circuit of its associated pole and operable when heated a predetermined amount to release the associated trip member, each of said trip members when released engaging the associated projection on said trip bar to move said trip bar and effect release of said operating means.

11. In a multi-pole circuit breaker having relatively movable contact means in each pole and a common operating mechanism releasable to effect automatic opening of said contact means, a trip device comprising a trip bar common to all of the poles and movable to release said operating mechanism, a plurality of projections on said trip bar, a normally restrained spring biased trip member for each pole, said spring biased trip members being operable when released to engage the associated projection on said trip bar and move said trip bar, an ambient temperature responsive bimetal element rigidly supported on each of said spring biased trip members, a current responsive bimetal element for each pole, latch means on each of said current responsive bimetal elements normally engaging the associated ambient temperature responsive bimetal element to releasably restrain the associated spring biased trip member in operative position, said current responsive bimetal elements deflecting in response to overload currents to release the associated spring biased trip member.

12. In a multi-pole circuit breaker having relatively movable contact means in each pole and a common operating mechanism releasable to effect automatic opening of said contact means, a trip device comprising a trip bar common to all of the poles and movable to release said operating mechanism, a plurality of projections on said trip bar, a normally restrained spring biased trip member for each pole, said spring biased trip members being operable when released to engage the associated projection on said trip bar and move said trip bar, an ambient temperature responsive bimetal element rigidly supported on each of said spring biased trip members, a current responsive bimetal element for each pole, latch means on each of said current responsive bimetal elements normally engaging the associated ambient temperature responsive bimetal element to releasably restrain the associated spring biased trip member in operative position,

said current responsive bimetal elements deflecting in response to overload currents to release the associated spring biased trip member, and electroresponsive means including an armature for each pole of the breaker operable in response to overloads of predetermined value to engage another projection on said trip bar to instantaneously move said trip bar independently of any operation of said current responsive bimetal element.

13. A circuit interrupter having relatively movable contacts; a movable trip member; a spring biasing said movable trip member to move in a direction to effect movement of the contacts; a pair of bimetal elements, one of which is responsive to current and the other to ambient temperature; one of said bimetal elements being rigidly mounted on a fixed portion adjacent one end and having its other end portion movable, and the other bimetal element being mounted on said movable trip member and also having a movable end portion; said movable end portions of the two bimetal elements extending in the same direction and along each other, with the high expansion side of the bimetal in each end portion facing in the same direction; latching means at the movable ends of the bimetal elements normally holding said movable trip member and the bimetal element mounted thereon against movement by said biasing spring and release of said latching means permitting movement of said movable trip member and the bimetal mounted thereon by said biasing spring to effect movement of the contacts.

14. A circuit interrupter having relatively movable contacts; a movable member; a spring biasing said movable member to move in a direction to effect movement of the contacts; a pair of bimetal elements, one of which is responsive to current and the other to ambient temperature; one of said bimetal elements being mounted adjacent one end and having its other end portion movable, and the other bimetal element being mounted on said movable member and also having a movable end portion; said movable end portions of the two bimetal elements extending in the same direction and along each other, with the high expansion side of the bimetal in each end portion facing in the same direction; said two bimetal elements having their movable end portions positioned with the side edge of one bimetal element facing the side edge of the other bimetal element to minimize transfer of heat from one bimetal element to the other by radiation; latching means at the movable ends of the bimetal elements normally holding said movable member and the bimetal element mounted thereon against movement by said biasing spring and release of said latching means permitting movement of said movable member and the bimetal mounted thereon by said biasing spring to effect movement of the contacts.

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