

March 23, 1954

T. M. COLE
CIRCUIT BREAKER WITH ADJUSTABLE
THERMAL AND MAGNETIC CONTROLS

2,673,264

Filed April 17, 1952

2 Sheets-Sheet 1

FIG. 1.

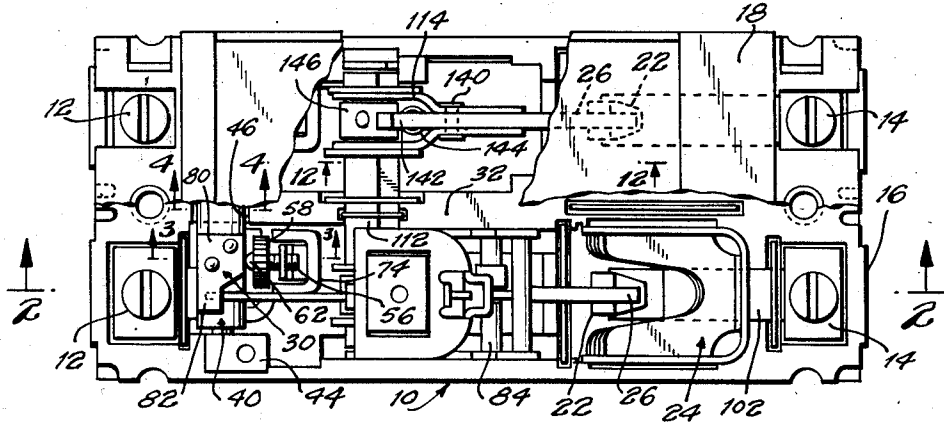


FIG. 5.

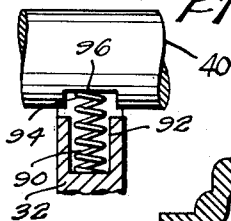


FIG. 4.

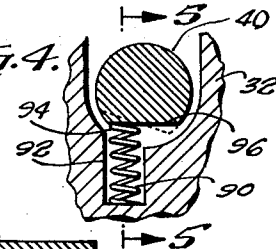


FIG. 2.

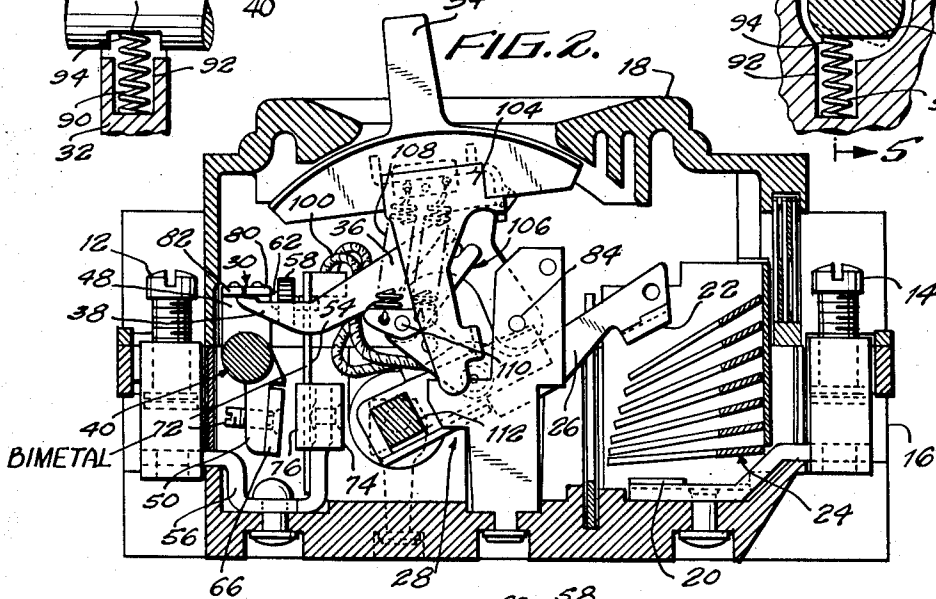


FIG. 6.

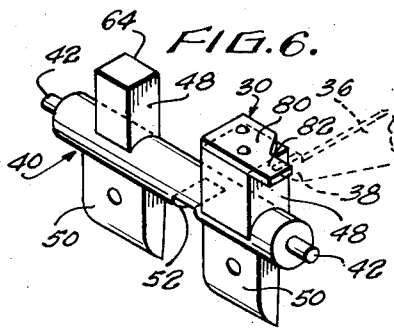
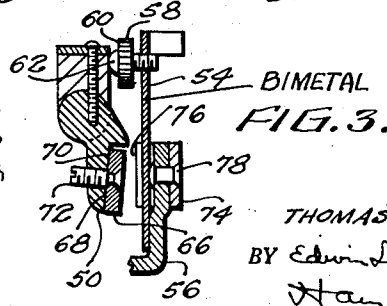


FIG. 3.



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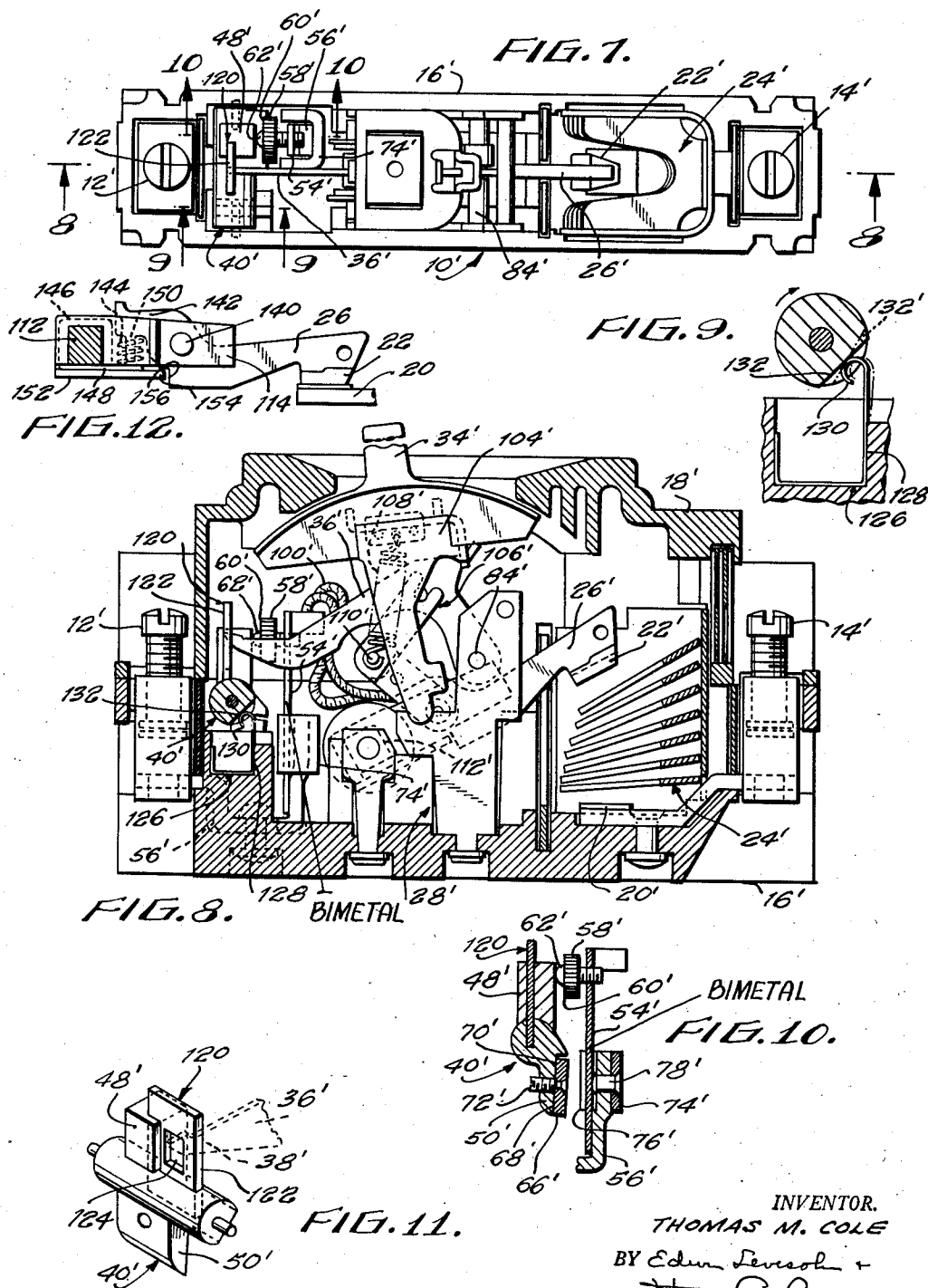
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,673,264

CIRCUIT BREAKER WITH ADJUSTABLE
THERMAL AND MAGNETIC CONTROLS

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a corporation of Delaware

Application April 17, 1952, Serial No. 282,819

15 Claims. (Cl. 200—88)

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This invention relates to circuit breakers in general and, more particularly, to circuit breakers of the type which are manually operable to open or to close the circuit and automatically operable to open the circuit upon the occurrence of an overload or short circuit condition.

One object of the present invention is the provision of a circuit breaker having independently adjustable thermal and magnetic controls whereby to provide for the accurate calibration of the circuit breaker.

Another object of the present invention is the provision of improved tripping means for an automatic circuit breaker including a current responsive bimetallic member adapted to effect opening of the circuit breaker upon moderate current overload and magnetic elements for effecting magnetic tripping of the circuit breaker on heavy current overloads and short circuits.

Another object of the present invention is the provision of tripping means of the above character which is simple and economical to manufacture and effective in operation.

The above and other objects, features and advantages of the present invention will be more fully understood from the following description considered in connection with the accompanying illustrative drawings.

In the drawings:

Fig. 1 is a top plan view of a multi-pole circuit breaker according to the present invention, with the cover shown removed;

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 1;

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 1;

Fig. 5 is a sectional view taken on the line 5—5 of Fig. 4;

Fig. 6 is a perspective view of the trip bar;

Fig. 7 is a view similar to Fig. 1 of a single pole circuit breaker according to the present invention;

Fig. 8 is a sectional view taken on the line 8—8 of Fig. 7;

Fig. 9 is a sectional view taken on the line 9—9 of Fig. 7;

Fig. 10 is a sectional view taken on the line 10—10 of Fig. 7;

Fig. 11 is a perspective view of the trip bar of the circuit breaker shown in Figs. 7—10; and

Fig. 12 is a sectional view taken on the line 12—12 of Fig. 1.

Referring to the drawings and, more particu-

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larly, to Figs. 1 through 6 thereof, there is shown a circuit breaker of the multipole type, each pole comprising a pair of terminals 12 and 14, one disposed at each end of the breaker. The circuit breaker 10 includes a base 16 preferably of molded insulating material on which the several elements of the breaker mechanism are mounted. A cover 18 also preferably of molded insulating material is removably secured to the base 16 and cooperates therewith to form an enclosing housing for the breaker mechanism. The circuit breaker 10 is also provided with associated pairs of stationary contacts 20 and movable contacts 22, and an arc extinguisher 24 of conventional construction. Each of the movable contacts 22 is mounted on a movable contact member 26, said movable contact members being movable to "open" and "closed" positions by the operating mechanism indicated generally at 28. Thus the common operating mechanism 28 is provided for simultaneously actuating the movable contacts 22 to "open" and to "closed" positions, there being provided a trip device indicated generally at 30 for effecting the automatic opening of all of the movable contacts 22 in response to predetermined overload conditions in the circuit through any pole of the breaker. Each of the poles of the breaker is contained in a separate compartment formed by barriers 32 which extend for the length of the breaker. It will be understood that the barriers 32 are in alignment with similar barriers in the cover 18 so that when the cover is in place the barriers serve to insulate each compartment from an adjacent compartment. Each of the movable contact members is pivotally mounted intermediate its ends for movement by the common operating mechanism indicated generally at 28. Said common operating mechanism may be of any of the well known types, for example, of the type shown in Patent No. 2,419,125, issued April 15, 1947, to Heeler D. Dorfman and Gerald J. Freese, for Circuit Breaker.

The circuit breaker 10 is provided with an externally accessible operating handle 34 which is movable to "open" and "closed" positions for moving the contact members 26 to corresponding positions. Operatively associated with the operating mechanism 28 is a cradle 36 having an end portion 38 which is operatively associated with the trip device 30 in a manner to be described in detail hereinafter. The trip device 30 comprises a trip bar 40 having end shaft portions 42 which are mounted for rotation in the bearing portions 44 of the breaker. Thus the trip bar 40 is mounted for rotation about its longitudinal axis and is

transversely mounted in the breaker. It will be seen that the trip bar 40 extends across the barrier 32, the latter being suitably recessed at 46 for the reception of a central portion of the trip bar. The trip bar 40 is provided with a laterally projecting portion 48 and a laterally depending portion 50 for each compartment, said projecting and depending portions being preferably formed integral with the trip bar. The trip bar 40 is notched centrally at 52, said notch being adapted to be positioned on adjacent portions of barrier 32 at recess 46, the rotation of the trip bar in a counter-clockwise direction as viewed in Figs. 2 and 3 being effective to release the cradle 36 for moving the contact members 26 to an "open" position. Positioned in each compartment is a thermally responsive bimetallic element 54, said element being secured at one end to the conductor 56 in any well known manner. At the free end of the element 54 there is threadedly received screw member 58 having at one face portion 60 a protuberance 62, the latter being adapted to cooperate with the laterally projecting portion 48 of the trip bar 40. It will be seen that the rotation of the screw member 58 will be effective to axially move the latter whereby to vary the space between the protuberance 62 and adjacent portions of the face 64 of its associated projecting portion 48. As previously noted, each compartment is structurally and electrically similar and the operating mechanism disposed in each compartment is similarly structurally similar, except that one compartment will be provided with operating mechanism 28 for simultaneously actuating the contact members 26, one of which is disposed in each compartment. From the above, it will be seen that each compartment is provided with an element 54 and the space between the protuberance 62 and the associated projecting portion 48 may readily be adjusted by rotating the screw 58. Thus the positioning of the adjusting screw 58 will be effective to calibrate the position at which bar 40 will be tripped in response to a predetermined current in the associated circuit. It will be understood that a predetermined current in the circuit will be effective to flex the free end of element 54 towards the trip bar 40 and that the degree of flexing required for tripping bar 40 is adjusted by means of the axial positioning of the screw member 58. The element 54 is connected in series into its associated circuit whereby said element will be current responsive on a predetermined overload to rotate the trip bar in a counter-clockwise position as viewed in Figs. 2 and 3 to thereby release all of the contact members 26 simultaneously to an "open" position. The thermally responsive bimetallic element is adapted to trip the bar 40 after a time delay on predetermined overload conditions.

Adjustably secured to each of the depending portions 50 or trip bar 40 is an armature 66 which comprises a plate of magnetic material which has a face portion 68 in confronting position with the face 70 of the depending portion 50. The armature 66 is adapted for lateral movement relative to the depending portion 50 by means of the adjusting screw element 72, the rotation of the latter being effective to move armature 66 inwardly and outwardly of the face 70 of the depending portion 50 to adjust the air gap in the instant apparatus, as will become apparent from the description which follows. Associated with each of the bimetallic elements 54, adjacent to the secured end thereof is a magnetic yoke 74

having pole faces 76 in confronting relation relative to the armature 66. The magnetic yoke 74 is secured to the conductor 56 in any conventional manner, as by means of the rivets 78. Thus the element 54 and the magnetic yoke 74 are secured to the conductor 56 and said yoke 74 is positioned so as to be magnetically energized in accordance with the current in element 54. As previously pointed out, the element 54 is connected in series in its associated circuit whereby the magnetic yoke is similarly connected into said associated circuit. The air gap between the pole faces 76 of the magnetic yoke 74 and the armature 66 is adjusted by rotating the screw element 72, it being apparent that said rotation of the screw element will be effective to vary the distance between the armature 66 and the magnetic yoke 74. The armature 66 is adapted to be attracted to the magnetic yoke 74, instantaneously on overload currents of predetermined magnitude, said attraction being effective to rotate the trip bar 40 in a counter-clockwise direction as viewed in Figs. 2 and 3, to thereby release cradle 36 for simultaneously opening the contact members 26. The trip bar 40 is provided with a latch member 80 having a latch portion 82 which is adapted to cooperate with the portion 38 of cradle 36. With the cradle 36 in the latching position, as shown in Figs. 1, 2 and 6, the portion 38 will abut and be restrained against the underside of the latch portions 82. On overload conditions in the circuit breaker the trip bar 40 will be rotated in a counter-clockwise direction, as aforescribed, whereby the portion 38 of the cradle 36 will be released for clockwise rotation about its pivot 84 whereby the operating mechanism 28 will simultaneously open all of the companion contacts 20 and 22. More specifically, overload currents of a predetermined magnitude will instantly cause armature 66 to be attracted to the yoke 74 to thereby rotate the trip bar 40 in a counter-clockwise direction, the rotation of said trip bar being effective to unlatch the cradle 36. Similarly, lesser overloads after a time delay will cause the element 54 to flex towards the trip bar 40, said flexing movement causing the member 58 to move the projecting portion 48 whereby to rotate the trip bar 40 in a counterclockwise direction, as aforescribed, to thereby unlatch the latch portion 82 from the cradle 36. From the above, it will be seen that the screw member 58 for calibrating the thermal overload is independent of the adjustment element 72 for calibrating the magnetic overload whereby the circuit breaker 10 may be accurately calibrated.

The trip bar 40 is biased in a clockwise direction, as viewed in Figs. 2 and 3, by means of the spring 90 which is positioned in the recess 92 of partition 32, said spring having its end 94 operatively associated with the face portion 96 of the trip bar 40 whereby said spring will produce a biasing component which will urge the trip bar 40 in the clockwise direction aforescribed. It will be noted that the biasing of the trip bar 40 in a clockwise direction will tend to urge the latch member 80 into a latched position whereby a positive overload condition is necessary for rotating the trip bar in a counterclockwise direction to unlatch the cradle 36.

The electrical circuit for each of the poles is essentially the same and extends from the terminal 12 through the conductor 56 and the bimetallic element 54, through the flexible wire 100 and through the contact member 26 having contact

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22 secured thereto. When the contact member 26 is in a closed condition the electrical circuit will extend through the stationary contact 20, the conductor 102, and then to the terminal 14. It will be noted that the flexible wire 103 will have one end secured to the free end of element 54 and will have its other end secured to one end portion of the movable contact member 26. As previously noted the operating mechanism 28 may be of any conventional construction as disclosed in the afore-referred to patent and said operating mechanism may be disposed in any one of a plurality of compartments defined by the barrier 32. The operating mechanism 28 includes a forked operating lever 104, a toggle 106 comprising a pair of links, over centering springs 108 and a releasable cradle 36 controlled by the trip device 30 as described. The toggle links are pivotally connected together by the knee pin 110 and said toggle links operate in a conventional manner whereby the operating mechanism 28 is of the quick make and break type. It is here to be noted that the operating mechanism 28 forms no part of the present invention and accordingly only a general description of said operating mechanism is herein made. The tie bar 112 which extends across all of the poles of the breaker extends through a suitable aperture in the barrier 32, it being noted that each of the movable contact members 26 is connected to the tie bar 112 whereby the rotation of said tie bar will be effective to simultaneously actuate all of the movable contact members 26. The transversely extending tie bar 112 is mounted for rotation in the breaker 10 in any desired manner and each of the contact members 26 is secured thereto at spaced points through the intermediation of the links 114, each of said links straddling its associated movable contact member 26. The movement of the operating handle or lever 34 is effective to correspondingly actuate each of the movable contact members 26 simultaneously and the unlatching of the trip bar 40 in response to a current overload in any pole of the trip devices 30 will be effective to open all of the circuits of the breaker as will be readily apparent. When the trip bar 40 is unlatched in response to a current overload the cradle 36 will snap to an unlatched position being rotated in a clockwise direction about its pivot 84, due to the action of the springs 108. Thus on the release of the cradle 36 it will be rotated in a clockwise direction as viewed in Fig. 2 by the spring 108 which will be tensioned with the cradle 36 in a latching position. The release of said cradle will also result in the rotation of tie bar 112 in a counter-clockwise direction viewing Fig. 2 whereby each of the contact members 26 secured to said tie bar will be moved to an open-circuit position.

Following each automatic operation of the breaker due to the operation of the trip devices 30 in response to an overload current, it is necessary to reset the mechanism to operative condition before the contacts can be re-closed. In the tripped position of the circuit breaker the lever 34 will be at a position intermediate the "on" and "off" positions and to reset the trip device 30 the lever 34 is rotated from its tripped position to its extreme counter-clockwise or "on" position. This movement of the lever 34 is transmitted to the cradle to rotate said cradle in a counter-clockwise direction, the end portion 38 of said cradle passing the latch portion 82 of the latch member 80 to inter-engage with said

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portion 82. Thus the movement of the cradle 36 will be effective to rock the trip bar 40 counter-clockwise against the biasing of spring 90 slightly past its normal position to thereby relatch the cradle 36. After the cradle is so relatched the contacts can be closed manually by moving the lever 34 clockwise to its closed circuit position. As previously mentioned the operating mechanism 28 is preferably of the quick make and break type in which the springs 108 actuate the toggle mechanism to make and break the circuit with a positive snap action. The aforescribed circuit breaker is trip-free so that it is operative automatically in response to predetermined abnormal circuit conditions in any one of the poles thereof irrespective of the position of the operating lever 34. Thus if an overload condition takes place in any of the poles of the circuit breaker 10 the trip bar 40 will release the cradle 36 whereby each of the contact members 26 will be opened with a snap action. An arc extinguisher 24 is provided for each pole of the breaker and is generally of the spaced plate type. Although the circuit breaker 10 is of the two-pole type it will be understood that the trip device 30 of the present invention is equally applicable to a single-pole circuit breaker as well as to a multi-pole circuit breaker having any number of poles positioned in side-by-side arranged compartments. Thus the trip bar 40 as described is equally applicable to a circuit breaker having any number of poles. With reference to Figs. 7 through 11 there is shown a single-pole circuit breaker 10' which is structurally similar to circuit breaker 10 except that circuit breaker 10' is of a single-pole type. The circuit breaker 10' is provided with internal structure which is substantially identical with the structure disposed in breaker 10 except for the trip bar 40' now to be described. The trip bar 40' is provided with a laterally projecting portion 48' which is operatively associated with the cradle 36' in the manner described in reference to breaker 10. The latch member 120 is adapted to perform the same function as latch member 80 of breaker 10 and comprises a plate 122 which is apertured at 124 for the reception of the portion 38' of the cradle 36'. Thus trip bar 40' is structurally similar to trip bar 40 except for the latch member 120 which is provided with aperture 124 through which extends the portion 38' of cradle 36' in the latched position of the latter. It will be apparent from the above that the rotation of trip bar 40' in response to an overload current condition will be effective to release the cradle 36' for clockwise rotation in the manner described above. Thus trip bar 40' differs from trip bar 40 in the latch member which is operatively associated with the cradle 36. It will be seen from the above that the trip bar 40' is integrated with the remainder of the mechanism of breaker 10' in the same manner that trip bar 40 is structurally integrated in circuit breaker 10. The trip bar 40' is biased in a clockwise direction by means of the spring 126 which is secured in the recess 128 in any conventional manner. The spring 126 is provided with a curved portion 130 at one end which is operatively associated with a face portion 132 of the trip bar 40'. Thus the curved end portion 130 of spring 126 will coact with the face 132 of trip bar 40' to spring-urge said trip bar in a clockwise direction as best shown in Fig. 9. An overload condition in breaker 10' will cause the trip bar 40' to rotate in a counter-clockwise direction whereby the face 132 will assume the

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position 132' shown in Fig. 9. It is to be noted that the component of force produced by the curved end portion 130 of spring 123 is to the left of a line drawn from the center of the trip bar to the point of contact of the spring and face 132 whereby the trip bar will be normally spring-urged in a clockwise direction. Thus, except for the specific structural details afore-described circuit breaker 10' operates in a similar manner to the circuit breaker 10 whereby it will be seen that trip device 30 according to the present invention is applicable to a single pole breaker as well as to a multi-pole circuit breaker.

It will be seen from the above that the trip device 30 according to the present invention provides for thermal and magnetic overload controls which are each individually adjustable to actuate a common trip bar whereby to provide a circuit breaker which may be readily calibrated with a high degree of accuracy.

In order to apply contact pressure to the movable contact member 26 when the latter is closed, there is provided means for biasing said contact member in a clockwise direction, as viewed in Fig. 12. More particularly, the link member 114, which straddles the contact member 26, has an intermediate portion of said contact member pivotally mounted thereon by means of the pivot pin 140. As previously pointed out, link member 114 is secured to the tie bar 112 in any conventional manner, as by having said tie bar passed through a complementary aperture in said link member. The tie bar 112 is also provided with a strap element 146 which is secured to the bottom plate 148 of the link member 114 in any suitable manner, said element being effective to rigidly secure together the tie bar and said link member. Secured to the bottom plate 148 in any suitable manner is a plate member 152, said plate member having an end portion 154 which is operatively associated with portion 156 of member 26 to limit the pivotal movement of the latter member in a clockwise direction when the member 26 is in an open circuit condition. It is to be noted that the link member 114 adjacent to its securement to the tie bar 112 is U-shaped in cross section and is provided with a base plate 148 which is adapted to receive spring 144 positioned between said base plate and the end portion 142 of the contact member 26. The contact member 26 is further provided with an integral extension 150 which is received in spring 144 for restraining said spring in position. The spring 144 is positioned as aforedescribed under tension whereby the contact member 26 will be spring urged in a circuit closing direction about its pivotal mounting 140. Thus when the tie bar 112 is rotated in a circuit closing direction by the operating mechanism aforedescribed, the link member 114 will be concomitantly rotated to thereby move the movable contact member 26 in a circuit closing direction with the spring 144, applying contact pressure to said movable contact member when the latter is in a circuit closed condition. Thus the compression spring 144, which is associated with the contact member 26 in the manner aforedescribed, will apply a contact pressure between the companion contacts 20 and 22 when the latter are in a circuit closed condition. It will be understood that each of the movable contact members 26 is structurally similar and is integrated with its tie bar 112 in a structurally similar manner.

While I have shown and described the preferred embodiments of my invention, it will be

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understood that various changes may be made in the present invention without departing from the underlying idea or principles of the invention within the scope of the appended claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In a circuit breaker having stationary and movable contact members, mechanism for actuating said movable contact member to open and close the circuit breaker, and a trip device including a movable latching member for releasably holding said mechanism in contact-closing condition, control means for said trip device, comprising a bimetallic strip responsive to the current in the circuit, an adjustable member carried by said strip and operable to move with said latching member to a mechanism-releasing position in response to flexing of said strip when the current reaches a predetermined value for opening the circuit breaker, electro-magnetic means operable to move said latching member to a mechanism-releasing position when the current reaches a predetermined value, said electro-magnetic means including a magnetic yoke disposed relative to said strip for energization by the current therein and an armature operatively connected to said latching member, and means operable independently of the strip for adjusting the air gap between said yoke and said armature.

2. In a circuit breaker having stationary and movable contact members, mechanism for actuating said movable contact member to open and close the circuit breaker, and a trip device including a movable latching member for releasably holding said mechanism in contact-closing condition, control means for said trip device, comprising a bimetallic strip responsive to the current in the circuit, an adjustable member carried by said strip and operable to move with said latching member to a mechanism-releasing position in response to flexing of said strip when the current reaches a predetermined value for opening the circuit breaker, electro-magnetic means operable to move said latching member to a mechanism-releasing position when the current reaches a predetermined value, said electro-magnetic means including a magnetic yoke disposed relative to said strip and energized by the current therein and an armature carried by said latching member and adjustably movable thereon in relation to said magnetic yoke for adjusting the air gap between said yoke and armature.

3. In a circuit breaker having stationary and movable contact members, mechanism for actuating said movable contact member to open and close the circuit breaker, and a trip device including a movable latching member for releasably holding said mechanism in contact-closing condition, control means for said trip device, comprising a bimetallic strip responsive to the current in the circuit, a member actuated by said strip and operable to move said latching member for moving the latter to a mechanism-releasing position in response to flexing of said strip when the current reaches a predetermined value for opening the circuit breaker, electro-magnetic means operable to move said latching member to a mechanism-releasing position when the current reaches a predetermined value, said electro-magnetic means including a magnetic yoke disposed relative to said strip and for energization by the current therein and an armature carried by said latching member and adjustably movable there-

on in relation to said magnetic yoke for adjusting the air gap between said yoke and armature.

4. In a circuit breaker having stationary and movable contact members, mechanism for actuating said movable contact member to open and close the circuit breaker, a trip device including a movable latching member for releasably holding said mechanism in contact-closing condition, control means for said trip device, comprising a bimetallic strip responsive to the current in the circuit, said strip being fixed at one end thereof and free to flex at its opposite end, said latching member being mounted independently of said strip, an adjustable screw member carried by said free end of the strip and operable upon said latching member for moving the latter to a mechanism-releasing position in response to flexing of said strip when the current reaches a predetermined value for opening the circuit breaker, electro-magnetic means operable to move said latching member to a mechanism-releasing position when the current reaches a predetermined value, said electro-magnetic means including a magnetic yoke disposed relative to said strip for energization by the current therein and an armature carried by said latching member and adjustably movable thereon in relation to said magnetic yoke for adjusting the air gap between said yoke and armature.

5. In a circuit breaker having stationary and movable contact members, mechanism for actuating said movable contact member to open and close the circuit breaker, and a trip device including a movable latching member for releasably holding said mechanism in contact-closing condition, control means for said trip device, comprising thermal-current means and magnetic means individually responsive to the current in the circuit for individually actuating said latching member to mechanism-releasing position, in response to different current values, respectively, and including individually adjustable members operable individually by said thermal current means and by said magnetic means, respectively, for adjusting the response of said latching member in relation to the current values.

6. In a circuit breaker having stationary and movable contact members, mechanism for actuating said movable contact member to open and close the circuit breaker, and a trip device including a movable latching member for releasably holding said mechanism in contact-closing condition, control means for said trip device, comprising thermal-current means and magnetic means individually responsive to the current in the circuit for individually actuating said latching member to mechanism-releasing position, in response to different current values, respectively, and including individually adjustable members operable individually by said thermal current means and by said magnetic means, respectively, for adjusting the response of said latching member in relation to the current values, said latching member including a trip bar mounted for pivotal movement about its own axis and having actuating arms disposed at opposite sides of said axis for turning the bar, one of said individually adjustable members being mounted on one of said arms and the other of said adjustable members being operable to move the other of said arms.

7. In a circuit breaker having stationary and movable contact members, mechanism for actuating said movable contact member to open and close the circuit breaker, and a trip device

including a movable latching member for releasably holding said mechanism in contact-closing condition, control means for said trip device, comprising thermal-current means and magnetic means individually responsive to the current in the circuit for individually actuating said latching member to mechanism-releasing position, in response to different current values, respectively, and including individually adjustable members operable individually by said thermal current means and by said magnetic means, respectively, for adjusting the response of said latching member in relation to the current values, said latching member including a trip bar mounted for pivotal movement about its own axis and having actuating arms disposed at opposite sides of said axis for turning the bar, one of said individually adjustable members being mounted on one of said arms and the other of said adjustable members being operable to move the other of said arms, said thermal-current means including a bimetallic strip on which said other of the adjustable members is mounted and which flexes toward said other arm, in response to a predetermined current value, for operating said arm to move said latching member to mechanism-releasing position.

8. In a circuit breaker having stationary and movable contact members, mechanism for actuating said movable contact member to open and close the circuit breaker, and a trip device including a movable latching member for releasably holding said mechanism in contact-closing condition, control means for said trip device, comprising thermal-current means and magnetic means individually responsive to the current in the circuit for individually actuating said latching member to mechanism-releasing position, in response to different current values, respectively, and including individually adjustable members operable individually by said thermal current means and by said magnetic means, respectively, for adjusting the response of said latching member in relation to the current values, said latching member including a trip bar mounted for pivotal movement about its own axis and having actuating arms disposed at opposite sides of said axis for turning the bar, one of said individually adjustable members being operable to move one of said arms and the other of said adjustable members being operable to move the other of said arms, said individually adjustable members being positioned in relation to said arms, respectively, so that both arms move in the same rotary direction when operated by said individual members, respectively.

9. In a circuit breaker having stationary and movable contact members, mechanism for actuating said movable contact member to open and close the circuit breaker, and a trip device including a movable latching member for releasably holding said mechanism in contact-closing condition, control means for said trip device, comprising thermal-current means and magnetic means individually responsive to the current in the circuit for individually actuating said latching member to mechanism-releasing position, in response to different current values, respectively, and including individually adjustable members operable individually by said thermal current means and by said magnetic means, respectively, for adjusting the response of said latching member in relation to the current values, said latching member including a trip bar mounted for pivotal movement about its own axis and having actuating

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arms disposed at opposite sides of said axis for turning the bar, one of said individually adjustable members being operable to move one of said arms and the other of said adjustable members being operable to move the other of said arms, said individually adjustable members being positioned in relation to said arms, respectively, so that both arms move in the same rotary direction when operated by said individual members, respectively, said thermal-current means including a bimetallic strip arranged to be responsive to the current in the circuit controlled by the circuit breaker, and said magnetic means including a magnetic yoke energized by the current in said strip.

10. In a circuit breaker having stationary and movable contact members, mechanism for actuating said movable contact member to open and close the circuit breaker, and a trip device including a movable latching member for releasably holding said mechanism in contact-closing condition, control means for said trip device, comprising thermal-current means and magnetic means individually responsive to the current in the circuit for individually actuating said latching member to mechanism-releasing position, in response to different current values, respectively, and including individually adjustable members operable individually by said thermal current means and by said magnetic means, respectively, for adjusting the response of said latching member in relation to the current values, said latching member including a trip bar mounted for pivotal movement about its own axis and having actuating arms disposed at opposite sides of said axis for turning the bar, one of said individually adjustable members being operable to move one of said arms and the other of said adjustable members being operable to move the other of said arms, said individually adjustable members being positioned in relation to said arms, respectively, so that both arms move in the same direction when operated by said individual members, respectively, said thermal-current means including a bimetallic strip arranged to be responsive to the current in the circuit controlled by the circuit breaker, and said magnetic means including a magnetic yoke energized by the current in said strip, one of said adjustable members having an armature carried thereby in position to be attracted by said magnetic yoke when the current in the strip reaches a predetermined value.

11. In a circuit breaker having stationary and movable contact members, mechanism for actuating said movable contact member to open and close the circuit breaker, and a trip device including a movable latching member for releasably holding said mechanism in contact-closing condition, control means for said trip device, comprising thermal-current means and magnetic means individually responsive to the current in the circuit for individually actuating said latching member to mechanism-releasing position, in response to different current values, respectively, and including individually adjustable members operable individually by said thermal current means and by said magnetic means, respectively, for adjusting the response of said latching member in relation to the current values, said latching member including a trip bar mounted for pivotal movement about its own axis and having actuating arms disposed at opposite sides of said axis for turning the bar, one of said individually adjustable members being operable to move one of said arms and the other of said adjustable members

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being operable to move the other of said arms, said individually adjustable members being positioned in relation to said arms, respectively, so that both arms move in the same rotary direction when operated by said individual members, respectively, said thermal-current means including a bimetallic strip having its low expansion side facing said trip bar so as to flex toward the latter when heated for actuating one of said individually adjustable members for operating one of said arms, and said magnetic means including a magnetic yoke facing toward the other of said individually adjustable members for attracting the latter when the current reaches a predetermined value.

12. In a circuit breaker having stationary and movable contact members, manually operable trip-free mechanism for effecting engagement and disengagement of said contacts, automatically operable means associated with said mechanism for actuating the latter to disengage said contacts, comprising a trip device including a latching member normally releasably connected operatively with a part of said mechanism and releasable from said part upon actuation of said trip device to disengage said contacts, thermal control means for actuating said latching member directly to release said part of said mechanism, and magnetic control means for actuating said latching member directly to release said part of said mechanism, said thermal control means and said magnetic control means being individually adjustable independently of each other for calibrating the circuit breaker for automatic operations in response to different current values under the control of said thermal means and said magnetic means, respectively.

13. In a circuit breaker, a stationary contact member, a movable contact member engageable with and disengageable from said stationary contact member, mechanism for operating said movable contact member to engage and disengage said stationary contact member, said mechanism including a link member, means mounting said movable contact member directly on said link in pivotal relation thereto whereby said movable contact member is bodily movable directly with said link member when said mechanism is actuated for said operation of said movable contact member and spring means engaging directly said link and said movable contact member for resiliently moving said movable contact member directly in relation to said link for providing contact pressure when said movable contact member engages said stationary contact member.

14. In a circuit breaker, a stationary contact member, a movable contact member engageable with and disengageable from said stationary contact member, mechanism for operating said movable contact member to engage and disengage said stationary contact member, said mechanism including a link member, means mounting said movable contact member directly on said link in pivotal relation thereto whereby said movable contact member is bodily movable directly with said link member when said mechanism is actuated for said operation of said movable contact member, and spring means engaging directly said link and said movable contact member for resiliently moving said movable contact member directly in relation to said link for providing contact pressure when said movable contact member engages said stationary contact member, said link member having laterally spaced side arms between which said movable contact member is

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positioned, spring means being disposed between said side arms and said movable contact member having an end portion against which said spring means exerts pressure for said resilient movement of said movable contact member in relation to said link.

15. In a circuit breaker having stationary and movable contact members, mechanism for actuating said movable contact member to open and close the circuit breaker, and a trip device including a pivoted trip bar having an arm provided with a latching member for releasably holding said mechanism in contact-closing condition, said bar having a second arm for pivotally moving said trip bar to move said latching member to mechanism-releasing position, and electromagnetic means for moving said second arm to effect said movement of the trip bar, said mag-

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netic means comprising a magnetic yoke and a companion armature, means mounting said armature on said second arm for attraction by said yoke when the latter is energized, said mounting means having provision for adjusting said armature in relation to said yoke for adjustably varying the air gap between said yoke and said armature.

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