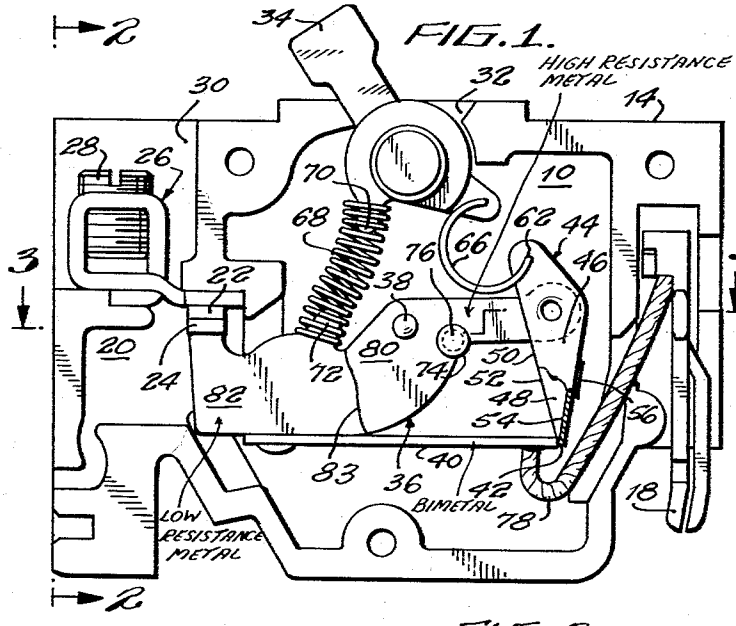
Sept. 14, 1954 T. M. COLE 2,689,286

CIRCUIT BREAKER

Filed March 8, 1952

FIG. 1.



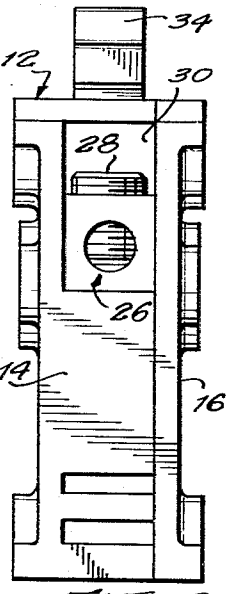


FIG. 2.

FIG. 3.

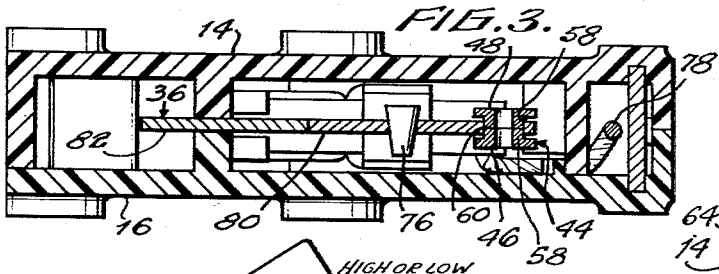
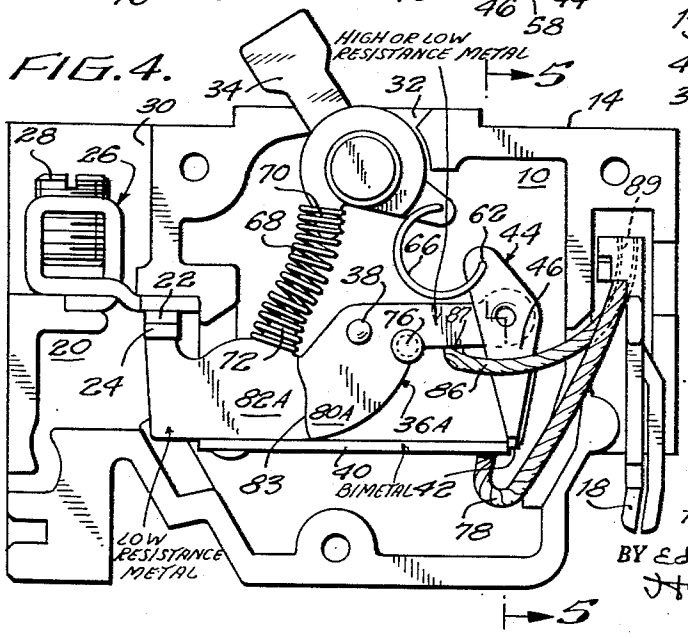


FIG. 4.



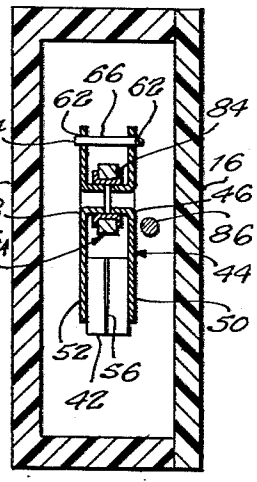


FIG. 5.

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Patented Sept. 14, 1954

2,689,286

UNITED STATES PATENT OFFICE

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CIRCUIT BREAKER

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Application March 8, 1952, Serial No. 275,580

17 Claims. (Cl. 200—116)

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This invention relates to automatic circuit breakers and more particularly, but without restriction, to circuit breakers of the general type disclosed in United States Patent Re. No. 23,188.

The present invention is a continuation-in-part of my co-pending applications Serial No. 127,433, filed November 15, 1949, now Patent No. 2,647,186, dated July 28, 1953, and Serial No. 184,749, filed September 14, 1950, both assigned to the assignee hereof.

One object of the present invention is to provide circuit breakers which are automatically tripped by the operation of a thermostatic control device and which are of such character that breakers of different ratings may be produced without requiring variations in the control device.

Another object is to enable circuit breakers of different ratings to be produced from component parts of the same size and shape. Therefore, the primary object of the present invention is the provision of means, other than thermal-current responsive members for setting the current ratings of circuit breakers.

Another object is the provision of means for calibrating a circuit breaker without the necessity of effecting any changes or variations in the movable switch arm or in the control device thereof.

A further object is the provision of an improved movable switch member for a circuit breaker, which obviates the need for insulating from said switch member, the actuator which is pivotally mounted thereon.

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 side view of a circuit breaker, pursuant to an embodiment of the present invention, one part of the casing being removed, the circuit breaker being in the closed or circuit making condition thereof;

Fig. 2 is an end view of the circuit breaker taken in the direction of the arrows 2—2 in Fig. 1;

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

Fig. 4 is a view similar to Fig. 1 illustrating another embodiment of the invention; and

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

Referring now to Figs. 1 through 3 of the drawings in detail, the circuit breaker mechanism of the present invention is disposed within a chamber 10 defined in a two-part insulation housing

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or casing 12 comprising a body part 14 and a cover or closure part 16. As herein illustrated, the circuit breaker is of the "plug-in" type, being provided with a plug-in terminal prong or stab contact 18 extending from the casing 12 for making contact with a terminal plate assembly, such as that described in the United States application Serial No. 127,432, filed November 15, 1949, by Paul M. Christensen and myself, as joint inventors, now Patent No. 2,647,225, dated July 28, 1953, and assigned to the assignee of the present application. However, it will be understood that the present invention is not limited to circuit breakers of the "plug-in" type but is applicable, as will be shown, to circuit breakers which are not provided with plug-in terminals, the stab contact, per se, not forming a part of the invention to which this application is directed.

The casing is provided with an arcing chamber 20 in which the stationary contact 22 and the companion movable contact 24 of the circuit breaker mechanism are disposed for relative movement. A terminal member 26, provided with a terminal screw 28, is mounted in a recess 30 formed in the casing, above the arcing chamber 20. Said terminal member mounts the stationary contact 22. The casing is also provided with an opening 32 through which an insulated pivoted handle 34 projects for manual operation of the circuit breaker mechanism, said handle being mounted as illustrated and described in my co-pending Patent No. 2,647,186.

Referring now to the circuit breaker mechanism disposed in chamber 10, said mechanism includes a manually operable member, here shown as the previously mentioned pivoted handle 34. A movable switch member or arm 36 is mounted in chamber 10 for pivotal movement on pivot pin 38, the opposite ends of which are received in the casing parts, as illustrated and described in my Patent No. 2,647,186. At one end thereof, switch member 36 carries the contact 24 which is engageable with and disengageable from the companion stationary contact 22. A thermal-current responsive control member 40, here shown as a thermostatic, bimetallic, flexible strip, is secured in a suitable manner to a side edge of the switch member 36. The free end of bi-metallic strip 40 is arranged to releasably engage the latch element 42 at one end of an actuating member or lever 44, pivotally mounted on the end of the movable switch member 36, opposite the end which carries the contact 24.

As here shown, and as illustrated and described in detail in my co-pending Patent No. 2,647,186,

the actuator 44 is preferably formed in one piece of sheet metal and comprises the laterally spaced opposing walls 46 and 48 open between the marginal edges 50 and 52 thereof, and partially closed between the opposed marginal edges thereof by the integral wall 54 which is provided with the aforementioned latch element 42, depending below said opposing walls, and with the longitudinal reinforcing bead 56 offset laterally outwardly thereof. The walls 50 and 52 are provided with the confronting punched-in projections 58—58 which are mounted for pivotal movement in a bearing aperture 60 provided in the movable switch member 36.

When lever 44 is mounted on the switch member 36, the walls 50 and 52 thereof straddle said movable switch member. At their free ends, each of said walls is provided with an aperture 62. One end 64 (Fig. 5) of a resilient link 66 extends with a slight clearance through the aligned apertures 62 and the other end of said link is pivotally engaged with the handle 34. A coil compression spring 68 is operatively interposed between the movable switch member 36 and the handle 34 for biasing the movable switch member to its open position. One end of said spring engages a lug 70 carried by handle 34 and the other end of said spring engages a lug 72 integral with the movable switch member 36. The mechanism constituted by handle 34, movable with switch member 36, thermal strip 40, lever 44, and link 66 is similar to and operates in substantially the same way as corresponding mechanism in the above identified United States Patent Re. No. 23,188.

It will be understood that member 40 operates to latch the manually operable actuating mechanism 44 to the movable switch member 36 and to unlatch the actuating mechanism from the movable switch member, the unlatching taking place upon the deflection of member 40 causing the disengagement of the free end thereof from the edge of latch element 42 of lever 44 upon the occurrence of an overload, or under other abnormal predetermined conditions of the circuit controlled by the circuit breaker. When the member 40 is deflected from engagement with lever 44, spring 68 is effective to move contact member 36 to its open circuit position from the closed circuit position thereof illustrated in Figs. 1 and 4. Calibration means, such as the peripherally interrupted aperture 74 and a tapered pin 76, illustrated and described in detail in my co-pending Patent No. 2,647,186, may be provided in the movable contact member 36 for calibrating the circuit breaker.

The control element 40 is connected in series with movable contact member 36 and the circuit which is to be controlled by the circuit breaker. For this purpose a flexible metallic conductor or connector 78 is connected to said control element, preferably adjacent the free end thereof. The other end of the connector is connected to the previously mentioned stab contact 18 to complete a circuit between the terminals 26 and 18 when the breaker is closed.

Pursuant to the embodiment illustrated in Fig. 1, the movable switch member 36, formed in one piece, is provided with a portion 80 having a high resistance to the flow of current therethrough and a portion 82 in series therewith and having a low resistance to current flow therethrough. Specifically, the resistance of portion 80 is preferably of such a value as to substantially prevent the passage of current through the movable switch member 36. Said portion 80 may be formed of any suitable high resistance metal, such as, for example and without limitation, Nichrome or other similar metal, and the portion 82 is formed of a suitable low resistance metal, such as, for example and without limitation, bronze or other similar metal. Said two portions are secured to each other in edge to edge relation, as at 83, in any suitable way, for example, by welding or brazing. It will also be understood that the switch member 36 may be formed of powdered metal by a molding operation, with parts 80 and 82 formed of metal powder having high and low resistances, respectively. It will be noted that the low resistance portion 82 is provided with the movable contact 24 and with the thermal strip 40, whereby substantially all of the current which is flowing through the circuit which is controlled by the circuit breaker will flow through the thermal strip 40. Although the strip 40 is in electrical contact with the movable switch member 36 through the lever 44, in the closed condition of the circuit breaker, it will be understood that due to the high resistance characteristics of the material which forms the portion 80 of said switch member, the current will not bypass the strip 40 by flowing through the lever 44, but substantially all of the current will flow through the engaged contacts 22 and 24, the portion 82 and the strip 40. In this connection, it will be noted that since substantially no current flows through the lever 44, because of the high resistance characteristics of the portion 80, the usual insulating bushing which has heretofore been provided between the lever 44 and the movable switch member 36 may be omitted so that said lever is in direct contact with the movable switch member, as illustrated in Fig. 3.

The embodiment illustrated in Fig. 1 is preferably calibrated through the use of the tapering pin 76 in the peripherally interrupted aperture 74 whereby to vary the extent of overlap of the latch 42 and the free end of the strip 40, as described in detail in my Patent No. 2,647,186.

Referring now to the embodiment illustrated in Figs. 4 and 5, the circuit breaker thereof is substantially similar in construction to that illustrated in Fig. 1. However, pursuant to the present embodiment, an insulated bushing 84 (Fig. 5) is interposed between the actuator 44 and the movable switch member 36A so as to prevent the flow of current between the actuator and the terminal strip 40. Also in the present embodiment, although the movable switch member 36A is formed of the separate portions 80A and 82A, it will be understood that the portion 80A is not of such high resistance as to prevent the passage of current therethrough. More specifically, the portion 82A which carries the movable contact 24 and the terminal strip 40, may be formed from a metal of one resistance and the portion 80A may be formed of a metal of higher or lower resistance to provide a predetermined overall resistance for the switch member 36A. By varying the resistance of either of these portions, for example, but not by way of limitation, by changing the relative dimensions thereof or by changing the respective metals of either or both portions, the current flow through the switch member 36A may be varied in order to vary the amount of current flow through the bi-metallic strip 40 whereby to vary the response of the circuit breaker. In this connection, it

will be noted that since the insulation bushing 84 is interposed between the actuator 44 and the movable switch member 36A, a flexible connector or coupling 86 interconnects the portion 80A of the switch member 36A, as at 87, and the stab contact 18, as at 89, to complete a path for current flow through the engaged contacts, the portions 82A and 80A and the flexible connector 86, which path is in parallel with a second current flow circuit which extends through the engaged contacts, the portion 82A, the strip 40 and the flexible connector 78. Therefore, it will be apparent that by varying the overall current conductive characteristic of the switch member 36A, by varying the resistance of either or both of the portions 80A and 82A thereof, the overall response of the circuit breaker may be varied, as desired, in order to provide a desired calibration or current rating for the circuit breaker.

In addition to calibrating the circuit breaker illustrated in Fig. 4 by varying the resistance of either or both portions of the movable switch member 36A, whereby to vary the overall current conductive characteristics thereof, the calibration may also be changed by changing the resistance of the connector 86. More specifically, the resistance of said connector may be varied by varying the wire gauge or material thereof. It will be apparent that any change in the current conductivity of the connector 86 will affect the magnitude of the current flow through the strip 40 and thereby serve to calibrate the circuit breaker.

While I have shown and described the preferred embodiments of my invention, it will be 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. A movable switch member for a circuit breaker, said member being unitary and having integral serially related portions which differ, respectively, in current-conductive characteristics.

2. A movable switch member for a circuit breaker, said member being unitary and having portions which differ, respectively, in current conductive characteristics, said portions being joined to each other in edge to edge relation.

3. A movable switch member for a circuit breaker, said member being a planar part and having portions disposed in series therein and which differ, respectively, in current-conductive characteristics, at least one of said portions being of such resistance value as to substantially prevent the flow of current through said member.

4. A movable switch member for a circuit breaker, said member being unitary and having integral serially related portions which differ, respectively, in current-conductive characteristics, the conductivity of said portions being related to provide a predetermined overall current-conductive characteristic for said switch member.

5. A movable switch member for a circuit breaker, said member being unitary and having integral serially related portions which differ, respectively, in current conductive characteristics, one of said portions being of substantially low current-conductivity and another of said portions being of substantially high current-conductivity.

6. In a circuit breaker having relatively movable companion contacts engageable with and disengageable from each other, actuating means for operatively effecting said engagement and disengagement thereof, and control means of predetermined current-conductive characteristic for effecting the disengagement of said contacts in response to predetermined current in the circuit; a movable switch member of predetermined current-conductive characteristic, said switch member being provided with one of said contacts, said switch member mounting said control means and said actuating means for normal engagement of said control means with said actuating means to releasably latch said switch member to said actuating means for operation by the latter, a terminal element electrically connected to said control means to form a first circuit in said breaker in the closed condition thereof, said circuit extending from the engaged contacts to said element and including said control means, and connector means having a predetermined resistance and electrically connecting said element and said switch member to form a second circuit between said element and said engaged contacts which by-passes said control means whereby the current rating of the breaker is a function of the current-conductive characteristic of said connector means.

7. In a circuit breaker having relatively movable companion contacts engageable with and disengageable from each other, actuating means for operatively effecting said engagement and disengagement thereof, and control means of predetermined current-conductive characteristic for effecting the disengagement of said contacts in response to predetermined current in the circuit; a movable switch member of predetermined current-conductive characteristic, said switch member being provided with one of said contacts, said switch member mounting said control means and said actuating means for normal engagement of said control means with said actuating means to releasably latch said switch member to said actuating means for operation by the latter, a terminal element electrically connected to said control means to form a first circuit in said breaker in the closed condition thereof, said circuit extending from the engaged contacts to said element and including said control means, and connector means having a predetermined resistance and electrically connecting said element and said switch member to form a second circuit between said element and said engaged contacts which by-passes said control means whereby the current rating of the breaker is a function of the current-conductive characteristic of said connector means, and insulation means between said switch member and said actuating means.

8. In a circuit breaker having a stationary contact and a companion movable contact for engagement and disengagement therewith, a movable switch member for said movable contact, actuating means provided on said switch member, a current-responsive control device provided on said switch member, said control-device releasably latching said actuating means to said switch member and operable upon overload to release said actuating means for opening the circuit, and a terminal element in circuit with said control device, said switch member having a portion of predetermined resistance and a portion of different resistance, said latter portion being in circuit between said movable contact and said actuating means, and said first mentioned portion being in circuit between said movable contact and said control device for predetermining the rela-

tive control-current flow through said control device between said terminal and said stationary contact when the breaker is closed, whereby to predetermine the current rating of the breaker.

9. In a circuit breaker having a stationary contact and a companion movable contact for engagement and disengagement therewith, a movable switch member for said movable contact, actuating means provided on said switch member, a current-responsive control device provided on said switch member, said control-device releasably latching said actuating means to said switch member and operable upon overload to release said actuating means for opening the circuit, and a terminal element in circuit with said control device, said switch member having a portion of predetermined resistance and a portion of different resistance, said latter portion being in circuit between said movable contact and said actuating means, and said first mentioned portion being in circuit between said movable contact and said control device for predetermining the relative control-current flow through said control device between said terminal and said stationary contact when the breaker is closed, whereby to predetermine the current rating of the breaker, said first mentioned portion having a resistance lower than that of said latter portion.

10. In a circuit breaker having a stationary contact and a companion movable contact for engagement and disengagement therewith, a movable switch member for said movable contact, actuating means provided on said switch member, a current-responsive control device provided on said switch member, said control device releasably latching said actuating means to said switch member and operable upon overload to release said actuating means for opening the circuit, and a terminal element in circuit with said control device, said switch member having a portion of predetermined resistance and a portion of different resistance, said latter portion being in circuit between said movable contact and said actuating means, and said first mentioned portion being in circuit between said movable contact and said control device for predetermining the relative control-current flow through said control device between said terminal and said stationary contact when the breaker is closed, whereby to predetermine the current rating of the breaker, said first mentioned portion having a resistance lower than that of said latter portion, said portions being joined in edge-to-edge relation in said switch member.

11. In a circuit breaker having a stationary contact and a companion movable contact for engagement and disengagement therewith, a movable switch member for said movable contact, actuating means provided on said switch member, a current-responsive control device provided on said switch member, said control-device releasably latching said actuating means to said switch member and operable upon overload to release said actuating means for opening the circuit, and a terminal element in circuit with said control device, said switch member having a portion of predetermined resistance and a portion of different resistance, said latter portion being in circuit between said movable contact and said actuating means, and said first mentioned portion being in circuit between said movable contact and said control device for predetermining the relative control-current flow through said control device between said terminal and said stationary contact when the breaker is closed, whereby to predetermine the current rating of the breaker, said latter portion being of such a resistance value as to substantially prevent the passage of current between said movable contact and said actuating means, whereby to obviate the need for insulation between said switch member and said actuating means.

12. In a circuit breaker having a stationary contact and a companion movable contact for engagement and disengagement therewith, a movable switch member for said movable contact, actuating means, a current-responsive control device for releasably latching said actuating means to said switch member and operable upon overload to release said actuating means for opening the circuit, and a terminal element in circuit with said switch member and said control device to form shunt current paths through said switch member and said control device, respectively, between said movable contact and said terminal element, said switch member having a plurality of serially related portions of different resistances, respectively, one of said portions being in series with said control device, and the resistances of said portions being related to provide a predetermined overall current-conductive characteristic for said switch member, whereby to predetermine the current-rating of said circuit breaker.

13. In a circuit breaker having a stationary contact and a companion movable contact for engagement and disengagement therewith, a movable switch member for said movable contact, actuating means, a current-responsive control device for releasably latching said actuating means to said switch member and operable upon overload to release said actuating means for opening the circuit, and a terminal element in circuit with said switch member and said control device to form shunt current paths through said switch member and said control device, respectively, between said movable contact and said terminal element, said switch member having a plurality of serially related portions of different resistances, respectively, one of said portions being in series with said control device, and the resistances of said portions being related to provide a predetermined overall current-conductive characteristic for said switch member, whereby to predetermine the current-rating of said circuit breaker, said one portion being of low resistance value and another portion having a high resistance value.

14. In a circuit breaker having a stationary contact and a companion movable contact for engagement and disengagement therewith, a movable switch member for said movable contact, actuating means provided on said switch member, a current-responsive control device provided on said switch member, said control-device releasably latching said actuating means to said switch member and operable upon overload to release said actuating means for opening the circuit, and a terminal element in circuit with said control device, said switch member having a portion of predetermined resistance and a portion of different resistance, said latter portion being in circuit between said movable contact and said actuating means, and said first mentioned portion being in circuit between said movable contact and said control device for predetermining the relative control-current flow through said control device between said terminal and said stationary contact when the breaker is closed, whereby to predetermine the

current rating of the breaker, and an electrical connector of predetermined resistance between said terminal element and said switch member, whereby said current-rating is a function of the current-conductive characteristic of said connector.

15. In a circuit breaker having a stationary contact and a companion movable contact for engagement and disengagement therewith, a movable switch member for said movable contact, actuating means provided on said switch member, a current-responsive control device provided on said switch member, said control-device releasably latching said actuating means to said switch member and operable upon overload to release said actuating means for opening the circuit, and a terminal element in circuit with said control device, said switch member having a portion of predetermined resistance and a portion of different resistance, said latter portion being in circuit between said movable contact and said actuating means, and said first mentioned portion being in circuit between said movable contact and said control device for predetermining the relative control-current flow through said control device between said terminal and said stationary contact when the breaker is closed, whereby to predetermine the current rating of the breaker, and an electrical connector of predetermined resistance between said terminal element and said switch member, whereby said current-rating is a function of the current conductive characteristic of said connector, said first mentioned portion having a resistance lower than that of said latter portion.

16. A system for calibrating circuit breakers of the type having an input terminal and an output terminal and means for providing parallel current paths through the breaker between said terminals in the closed condition of the breaker, a pair of engageable and disengageable contacts common to said paths, one of said paths including a movable current conductive switch member operable upon overload to disengage said contacts for interrupting said parallel paths to break the circuit through the breaker and the other path including a current-conductive control element operable in response to predetermined current flow therethrough to effect said operation of said switch member; said system comprising the establishment of a basic current-rating for each circuit breaker as a function of the current-conductive characteristic of the switch member thereof for predetermining the relative division of the current flow through said parallel paths.

17. A system for calibrating circuit breakers of the type having an input terminal and an output terminal and means for providing parallel current paths through the breaker between said terminals in the closed condition of the breaker, a pair of engageable and disengageable contacts common to said paths, one of said paths including a movable current conductive switch member operable upon overload to disengage said contacts for interrupting said parallel paths to break the circuit through the breaker and the other path including a current-conductive control element operable in response to predetermined current flow therethrough to effect said operation of said switch member; said system comprising the establishment of a basic current-rating for each circuit breaker as a function of the current-conductive characteristic of the switch member thereof for predetermining the relative division of the current flow through said parallel paths, and then varying said basic current rating by including in the current path which includes said movable switch member an electrical connector of predetermined resistance value between said switch member and one of said terminals.

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