Jan. 21, 1941. O. S. JENNINGS 2,229,412

CIRCUIT BREAKER

Original Filed Dec. 17, 1936 2 Sheets-Sheet 1

Fig. 1.

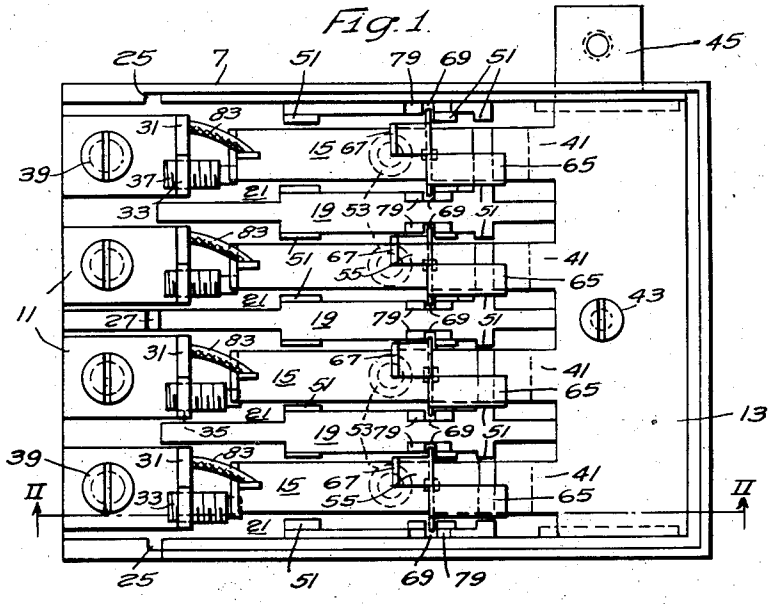


Fig. 2.

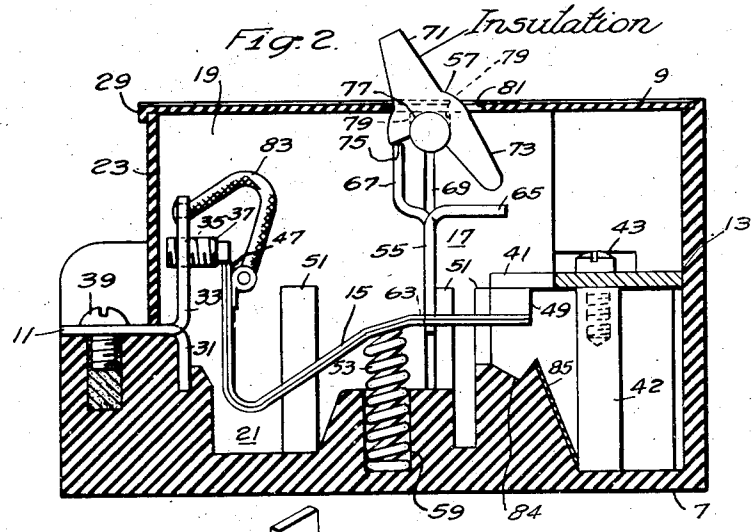
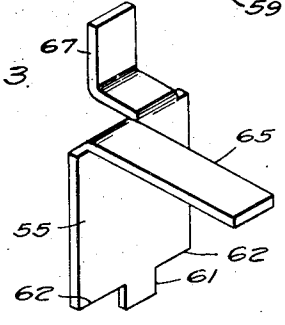


Fig. 3.



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CIRCUIT BREAKER

Original Filed Dec. 17, 1936 2 Sheets-Sheet 2

Fig. 4.

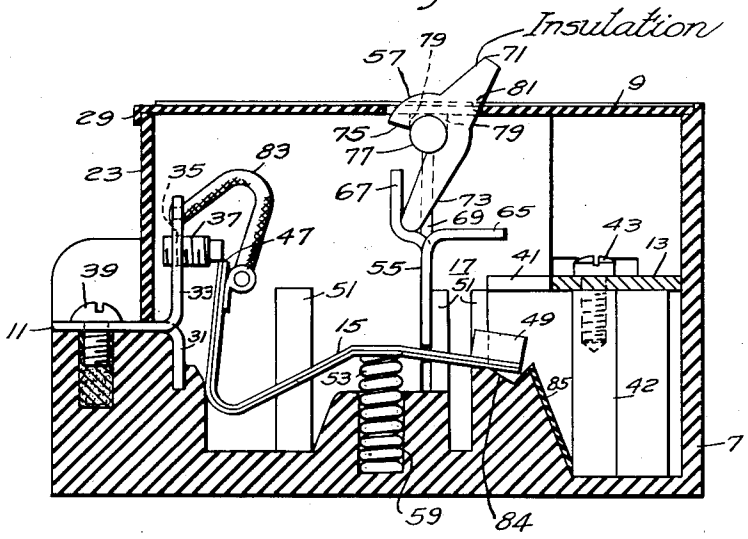
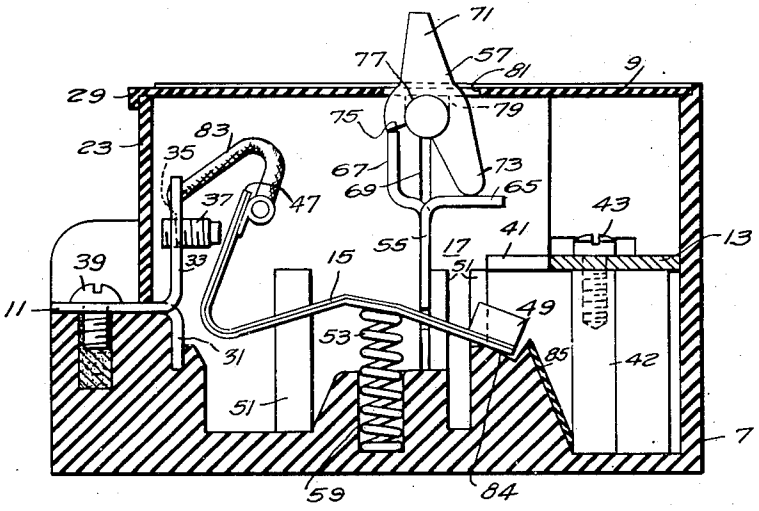


Fig. 5.



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Patented Jan. 21, 1941 2,229,412

UNITED STATES PATENT OFFICE

2,229,412

CIRCUIT BREAKER

Oliver S. Jennings, Pittsburgh, Pa., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application December 17, 1936, Serial No. 116,325
Renewed April 25, 1940

40 Claims. (Cl. 200—116)

My invention relates to circuit breakers in general, and more particularly to circuit breakers of the type used for controlling lighting and moderate power industrial feeder circuits.

A commercially successful circuit breaker for this type of service must satisfactorily meet very exacting requirements. Among other things the breaker must have an efficient operating mechanism which is manually operable to open and close the contacts of the breaker and which is automatically operable to open the contacts of the breaker in response to predetermined overload conditions. The breaker must be trip free of the operating handle and should give a clearly discernible indication of its tripped condition when opened in response to overload conditions. Some means must also be provided for readily adjusting the trip characteristic of the breaker so that it can be used under varying load conditions.

As opposed to these operational requirements, a commercially successful circuit breaker must be moderate in price, both because of the large number used in even a moderately sized building or factory, and because of the fact that excessively costly breakers cannot be economically justified over the older but less desirable fuse and switch arrangements.

Heretofore the manufacturers of these devices have endeavored to effect a compromise between these conflicting requirements by manufacturing breakers as cheaply as possible consistent with good quality and ability to meet the exacting operational requirements. The best of the prior art devices, however, was more costly than would be desired.

It is accordingly the principal object of my invention to provide a simple, efficient and inexpensive circuit breaker which will satisfactorily meet the above mentioned operational requirements.

Another object of my invention is to provide an improved circuit breaker structure that is simpler and less expensive to manufacture than the previously known devices of this type.

Another object of my invention is to provide an improved circuit breaker structure that utilizes a considerably less number of parts than has heretofore been considered necessary.

Another object of my invention is to provide a simpler operating mechanism for a circuit breaker which requires fewer parts than similar devices heretofore known or used and which operates when the breaker is tripped to give a clearly discernible indication of the tripped condition of the breaker.

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

Figure 1 is a top plan view of a load center device having circuit breakers embodying the features of my invention, the cover and operating handles having been removed to illustrate certain features.

Fig. 2 is a vertical sectional view of one of the circuit breakers illustrated in Fig. 1 showing the breaker in the closed circuit position and taken on the line II—II of Fig. 1.

Fig. 3 is a perspective view of one of the operating members of the circuit breaker.

Fig. 4 is a vertical sectional view similar to Fig. 2 showing the circuit breaker in the manually opened position, and

Fig. 5 is a vertical sectional view similar to Fig. 2 showing the circuit breaker in the tripped position.

Referring to the drawings, the load center or panel-board circuit breaker illustrated comprises, in general, a casing 7, a removable cover 9, a plurality of load terminals 11, a common line terminal means 13, a plurality of floating switch arms 15 and individual operating means indicated generally at 17 for each of the switch arms.

The casing 7 is of molded insulating material and has a plurality of vertical partitions 19 formed integral therewith for dividing the casing into a plurality of longitudinal compartments 21. The casing is open at the top and at one end, and the edges of the side walls and end wall thereof are formed to provide a seat for the cover 9. A removable end wall 23 of insulating material is adapted to be slidably received in vertical grooves 25 formed in the side walls of the casing and in a recess 27 formed in the central partition 19. The cover 9 is of insulating material and is provided at one end with a depending flange portion 29 for retaining the end wall 23 in operative position. The cover 9 may be secured to the casing 7 in any suitable manner.

A load terminal 11 is provided for each of the compartments. Each load terminal is formed of a strip of conducting material preferably copper. Each terminal strip 11 is provided with a depending portion 31 adapted to seat in a recess provided

therefor in the base 7, and an upwardly projecting portion 33. The upwardly projecting portion 33 is provided with a threaded opening 35 for threadedly receiving an adjustable latch piece 37. Each of the load terminals 11 is provided with a terminal screw 39 for connecting a load conductor to the terminal.

The common line terminal 13 is disposed at the opposite end of the casing from the load terminals 11, and consists of a flat plate of conducting material provided with a plurality of spaced projections 41 constituting a plurality of stationary contacts one for each pole of the breaker. The conducting plate is secured by means of a clamping screw 43 to a boss 42 formed integral with the casing 7. One end 45 of the conducting plate 13 extends through an opening in a side wall of the casing 7 and provides a means for connecting the plate 13 to a line conductor.

A floating switch arm 15 is disposed in each compartment 21. Each of the switch arms 15 is formed of bimetallic material, and one end 47 thereof is adapted to normally engage its corresponding adjustable latch piece 37. The other end of each switch arm 15 has a movable contact 49 secured thereto for engaging its corresponding stationary contact projection 41. The side walls of the casing 7 and each of the partitions 19 are provided with vertically disposed guide ribs 51 for guiding the switch arm 15 during movement of the same to open and closed circuit position.

Each of the switch arms is provided with an individual operating means comprising, in general, a spring 53, an operating member 55 and an operating handle 57. The spring 53 has its lower portion disposed in a circular recess 59 provided in the base 7 and its upper end engages the under surface of the switch arm 15. The spring 53 biases the switch arm 15 to closed circuit position as shown in Fig. 2 and presses the contact 49 against its cooperating stationary contact projection 41. The spring 53 also biases the end 47 of the switch arm against its latch piece 37. The operating member 55 is formed of any suitable material and is provided at its lower end with a reduced portion forming shoulders 62 and a projection 61 (Fig. 3) which is adapted to be received in a rectangular opening 63 provided in the switch arm 15 thus providing a pivotal coupling between the operating member 55 and the switch arm 15. The upper end of the operating member 55 is provided with a horizontally extending projection 65 and an off-set vertical projection 67. Each of the operating members 55 is mounted for vertical sliding movement by means of vertical grooves 69 formed in the side walls of the casing and in the sides of the partitions 19. The operating handle 57 for each switch arm is formed of molded insulating material and has a handle portion 71, a cam projection 73 and a shoulder portion 75. The operating member 57 also includes a pivot pin 77 secured to the handle 57 by means of its tight frictional engagement in the opening provided therefor in the handle 57. The pivot pin 77 is slightly longer than the width of the handle 57 and its projecting ends are adapted to be received in semi-circular recesses 79 formed in the side walls of the casing and sides of the partitions at the top of the vertical grooves 69. The semi-circular recesses 79 form bearings for the pins 77. The handle projection 71 of each handle is adapted to project through an opening 81 provided therefor in the cover 9. The edges of the cover 9 bounding the sides of opening 81 overlap the upper surface of the extending ends of the pivot pin 77 and thus prevent upward movement of the handle 57, since the clearance between the upper surface of the ends of the pin 77 and the cover is very small.

In assembling the breaker, the springs 53 are placed in their recesses 59 and the switch arms 15 are then dropped into their compartments. The load terminals 11 and the stationary contact plate 13 are then mounted in position with the ends 47 of the switch arms 15 engaged under their latch pieces 37 and the movable contacts 49 under their corresponding stationary contact projections 41. The operating members 55 are then slid down into the vertical grooves 69 provided therefor, and the pivot pins 77 of the operating handles 57 are dropped into the semi-circular recesses 79 provided in the casing 7 and partitions 19. The end wall 23 is then slid into the grooves 25 provided therefor, and the cover 9 placed on the top of the casing and secured thereto. It will thus be seen that the specific structure of the circuit breaker permits the parts to be readily assembled, or disassembled for repair of replacement purposes.

Each of the load terminals 11 is connected to its corresponding switch arm 15 by means of a flexible shunt conductor 83 in order to insure that no difference of potential exists between the load terminal and the switch arm, thus preventing arcing upon disengagement of the end 47 of the switch arm from the latch piece 37.

The circuit for each pole of the breaker extends from the load terminal 11 through the shunt conductor 83 to the bimetallic switch arm 15, movable contact 49 and stationary contact projection 41 of the terminal plate 13 to the line conductor.

The walls of the chambered portion of the casing adjacent the movable contacts 49 and stationary contacts 41 may be lined with steel liner plates 85, if desired, in order to attract and deionize the arcs formed at the contacts and to protect the casing against damage from the arcs.

Before describing the operation of the circuit breaker, it is well to note that the engaging surface of the latch piece 37 with the end 47 of the switch arm 15 provides a normal pivot axis for the switch arm about which it is rotated between open and closed circuit position by the operating member 55 during manual operation of the breaker. It will also be noted that the compression spring 53 engages the bimetal switch arm 15 at a point adjacent the pivotal connection of the operating member 55 and the switch arm 15 and between said pivotal connection and the end 47 of the switch arm.

The operation of the circuit breaker is as follows: With the parts in the position shown in Fig. 2, let it be assumed that it is desired to open the circuit of one of the poles of the breaker. To open the circuit, the operating handle 57 is moved from the closed circuit position shown in Fig. 2 in a clockwise direction about its pivot axis 77 to the open circuit position shown in Fig. 4 in which the handle projection 71 engages the opposite edge of the opening 81 in the cover 9. Movement of the operating handle to its open circuit position causes the cam projection 73 thereof to engage the horizontal projection 65 of the operating member 55 to move the operating member in a downward direction.

Movement of the operating member 55 downwardly causes movement of the switch arm 15 in a clockwise direction about its normal pivot axis

formed by the engagement of the end 47 thereof with the latch piece 37, to the open circuit position shown in Fig. 4. The downward movement of the switch arm 15 is limited by the engagement of the contact carrying end thereof with the bottom of a recess 84 formed in the casing 7. When the handle 57 is in the open circuit position, the force exerted by the spring 53 is transmitted through the switch member 15 and the operating member 55 to restrain the operating handle in its open circuit position. The manual open circuit position of the breaker is illustrated in Fig. 4.

To close the circuit breaker, the operating handle 57 is moved from the open circuit position illustrated in Fig. 4 to the closed circuit position shown in Fig. 2. During this movement of the operating handle, the spring 53 moves the switch arm 15 to closed circuit position and causes the operating member 55 to move in an upward direction back to the position shown in Fig. 2. It will be noted that during manual opening and closing of the circuit breaker the switch arm 15 is moved about its normal pivot point formed by the engagement of the end 47 with the latch piece 37. In the closed circuit position the spring 53 biases the switch arm 15 toward its released position, but the arm 15 is restrained from moving to its released position by reason of the engagement of the end 47 of the arm with the latch piece 37.

If an overload of predetermined magnitude and duration occurs in the circuit controlled by the pole of the breaker, the passage of the overload current through the bimetallic switch arm 15 heats the same and causes it to flex in a direction such that the end 47 disengages the latch piece 37. The switch arm 15 is then free to move to its released position irrespective of the position of the operating handle 57, and the spring 53 causes the switch arm 15 to rotate in a clockwise direction about a new pivot point, which is that formed by the point of engagement of the operating member 55 with the switch member 15. The clockwise rotation of the switch arm 15 to its released position about the new pivot point moves the contact carrying end of the switch arm to open circuit position as shown in Fig. 5. Following the release of the switch arm 15 during the tripping operation, the spring 53 also moves the operating member 55 in an upward direction which causes the off-set projection 67 thereof to engage the shoulder 75 of the operating handle 57 to move the operating handle to an intermediate indicating position as shown in Fig. 5. Any further movement of the operating handle is prevented by reason of the engagement of the horizontal projection 65 with the cam projection 73. The operating means thus moves the operating handle 57 to a clearly discernible indicating position to indicate that an overload has occurred on that particular pole of the circuit breaker and that the switch arm of said pole has been tripped to open circuit position.

To reset the switch arm after a tripping operation, the operating handle 57 is moved to the full open position during which the cam projection depresses the operating member 55 and rotates the switch arm in a counter-clockwise direction about its contact carrying end until the end 47 reengages under the latch piece 37. The breaker pole may then be reclosed by moving the operating handle to the closed circuit position shown in Fig. 2. The operation of each pole of the circuit breaker is identical and hence the above description of the operation of one pole will be sufficient.

It will be noted that the switch arm is trip free of the operating handle, that is it can move to open circuit position when tripped even though the operating handle is held in closed circuit position.

The trip characteristic of each pole of the circuit breaker may be adjusted by changing the position of the adjustable latch piece 37 to change the amount of overlap of the latch piece with respect to the end 47 of the switch arm. Increasing the amount of overlap requires a higher value of overload current for tripping the breaker, or increases the time interval on lower overloads between the occurrence of the overload and the release of the switch arm. It will be noted that the removably mounted end wall 23 permits easy access to be had to the adjustable latch pieces when adjustment of the trip characteristics of the breaker is desired.

The springs 53, in addition to biasing the switch arms 15 to closed circuit position and moving the switch arms to open circuit position, following their release from the latch pieces, also provide a definite contact pressure between the movable contacts 49 and the stationary contact projections 41.

It will thus be seen that I have provided an efficient and simple circuit breaker structure that utilizes a minimum number of parts and that can be manufactured at an extremely low cost.

While I have shown and described one embodiment of my invention, in accordance with the patent statutes, it is obvious that various changes in structure may be made in the structural details thereof without departing from the spirit of the invention. I desire, therefore, that the invention be limited only by the reasonable construction of the language of the appended claims and by the prior art.

I claim as my invention:

1. In a circuit interrupter, a switch arm including at least a portion of bimetallic material, operating means for moving said switch arm to open and to closed circuit position, a fixed support normally engaging said switch arm to hold the same during normal opening and closing operations thereof, said bimetallic portion being operable in response to predetermined conditions to disengage said switch arm from said support.

2. In a circuit interrupter, a contact controlling arm having at least a portion of bimetallic material, a fixed support normally engaging said arm to form a pivot point for said arm, operating means for moving said arm about said pivot point to the open or to the closed circuit position, said bimetallic portion being operable in response to predetermined conditions to disengage said arm from said fixed support, and spring means for moving said arm to open circuit position upon disengagement of said arm from said support.

3. In a circuit interrupter, a floating switch arm having at least a portion of bimetallic material, a fixed support engaging one end of said arm for normally providing a pivot for said arm, an operating means for moving said arm to an open and to a closed circuit position about said pivot point, said bimetallic portion being operable in response to predetermined conditions to effect disengagement of said end of said arm from said support, spring means engaging said arm for normally biasing said arm to closed circuit position, said spring means acting to move said switch arm to an open circuit position upon disengagement of said end of said arm from said support.

4. In a circuit interrupter, a floating switch arm having at least a portion of bimetallic material, an adjustable support engaging one end of said arm for normally providing a pivot for said arm, an operating means for moving said arm to an open and to a closed circuit position about said pivot point, said bimetallic portion being operable in response to predetermined conditions to effect disengagement of said end of said arm from said support, spring means engaging said arm for normally biasing said arm to closed circuit position, said spring means acting to move said switch arm to an open circuit position upon disengagement of said end of said arm from said support.

5. In a circuit interrupter, a switch arm of bimetallic material, a fixed support engaging one end of said arm for normally providing a pivot point for said arm, an operating member coupled to said arm for moving the same to an open and to a closed circuit position about said pivot point, spring means engaging said arm between said pivot point and said operating member for normally biasing said arm to closed circuit position, said arm being operable in response to predetermined conditions to disengage its end from said support so that said spring means moves said arm to an open circuit position.

6. In a circuit breaker, a switch arm having at least a portion of bimetallic material, a support, a latch piece adjustably mounted on said support for overlapping engagement with one end of said switch arm for providing a normal pivot point for said arm, an operating member for moving said switch arm to open and to closed circuit position, said bimetallic portion of said arm being operable in response to predetermined conditions to cause said end of said arm to disengage said latch piece.

7. In a circuit breaker, a switch arm having at least a portion of bimetallic material, a latch member engaging said arm for providing a pivot point for said arm, operating means for moving said arm about said pivot point to an open and to a closed circuit position, said bimetallic portion being operable in response to predetermined conditions to move said arm to disengage the same from said latch member, and adjusting means for predetermining the amount of movement of said arm necessary to disengage the same from said latch member.

8. In a circuit breaker, a switch arm of bimetallic material, a latch member engaging said arm to provide a pivot point for said arm, an operating means for moving said arm to an open and to a closed circuit position, said arm being operable in response to predetermined conditions to disengage said latch member to allow movement of said switch arm to an open circuit position.

9. In a circuit breaker, a switch arm having at least a portion of bimetallic material, a latch piece engaging one point of said arm to provide a pivot point for said arm, operating means for moving said arm about said pivot point to open and to closed circuit position, said bimetallic portion of said arm being operable in response to predetermined conditions to cause disengagement of said point from said latch piece, said operating means including means for automatically moving said switch arm to open circuit position following the disengagement of said point from said latch piece.

10. In a circuit breaker, a switch arm having at least a portion of bimetallic material, a latch piece engaging said arm to provide a pivot point for said arm, actuating means including an operating handle for moving said switch arm about said pivot point to an open and to a closed circuit position, said bimetallic portion being operable in response to predetermined conditions to cause said arm to disengage said latch piece, said actuating means including means for automatically moving said switch arm to open circuit position following disengagement of said arm from said latch piece independently of the position of said handle.

11. In a circuit breaker, a switch arm having at least a portion of bimetallic material, a latch member normally engaging said arm to limit its movement to rotation about a pivot point, operating means for moving said arm about said pivot point to open and to closed circuit position including a spring means acting when said arm is in closed circuit position to bias said arm to closed circuit position, said bimetallic portion being operable in response to predetermined conditions to cause said arm to disengage said latch member to allow said spring means to move said arm with its portion of bimetallic material to open circuit position.

12. In a circuit breaker, a contact operating arm having at least a portion of bimetallic material, a latch member normally engaging one point of said arm to form a pivot point for said arm, operating means including an operating member pivotally engaging a second point of said arm for moving said arm about said pivot point to open and to closed circuit position, said bimetallic portion being operable in response to predetermined conditions to effect disengagement of said arm from said latch member, said operating means including a means for moving said switch arm about said second point to open circuit position following disengagement of said arm from said latch member.

13. In a circuit breaker, a contact operating arm of bimetallic material, a latch member normally engaging one point of said arm to provide a pivot point for said arm, operating means including an operating member pivotally engaging said arm at a second point for moving said arm about said pivot point to open and to closed circuit position, said arm being operable in response to predetermined conditions to disengage said latch member, said operating means including a spring engaging said arm at a third point for normally biasing said arm to closed circuit position and for moving said arm to open circuit position following disengagement of said arm from said latch member.

14. In a circuit breaker, a contact controlling arm having a portion of bimetallic material, a latch member for engaging said arm to provide a pivot point for said arm, operating means including an operating handle movable to an open and to a closed circuit position to effect movement of said arm about said pivot point to open and to closed circuit position, said bimetallic portion being operable in response to predetermined conditions to cause the release of said arm from said latch member, said operating means including means for automatically moving said arm to open circuit position and said handle to an intermediate indicating position following the release of said arm from said latch member.

15. In a circuit breaker, a floating switch arm, latch means normally engaged at one end of said arm to provide a pivot point for said arm, oper-

ating means including an operating handle movable to an open and to a closed circuit position to effect movement of said arm about said pivot to an open and to a closed circuit position, said latch means including electro-responsive means for effecting release of said end of said arm in response to predetermined conditions, said operating means including means for automatically moving said switch arm to open circuit position and said operating handle to an indicating position between its open and closed circuit positions following the release of said arm at said latch means.

16. In a circuit breaker, a floating switch arm, latch means normally engaged at one point of said arm to provide a pivot point for said arm, operating means for moving said arm about said pivot point to open and to closed circuit position including a pivoted operating handle movable to an open and to a closed circuit position to manually control said switch arm, said latch means being operable in response to predetermined conditions to effect release of said arm, said operating means including means for automatically moving said switch arm to open circuit position and said operating handle to an indicating position between its open and closed circuit positions following release of said arm.

17. In a circuit breaker, a floating switch arm, a latch member normally engaging a first point of said arm to provide a pivot point for said arm, an operating member having one end engaging a second point of said arm, spring means engaging said arm between said first and second points for normally biasing said arm and member to closed circuit position, a pivoted operating handle movable to an open circuit position to move said operating member and, through said operating member, said arm to open circuit position, said operating handle being movable to a closed circuit position to allow said spring means to move said operating member and arm to closed circuit position, electro-responsive means operable in response to predetermined conditions for effecting release of said arm from said latch member to allow said spring means to move said arm about said second point to open circuit position, and means carried by said operating member for engaging and moving said handle to an intermediate indicating position between its open and closed circuit position following release of said arm from said latch member.

18. In a circuit breaker, a floating switch arm having at least a portion of bimetallic material, a latch member normally engaging a first point of said arm to provide a pivot for said arm, an operating member pivotally engaging a second point of said arm, a spring engaging said arm between said first and second points for biasing said arm and operating member to closed circuit position as long as said latch member engages said first point of said arm, a pivoted operating handle having a shoulder and a cam portion, said operating handle being movable to an open circuit position to cause said cam portion to engage and move said operating member to open circuit position to move said switch arm to open circuit position, and being movable to closed circuit position to allow said spring means to move said arm and operating member to closed circuit position, said bimetallic portion being operable in response to predetermined condition for effecting release of said arm from said latch member to allow said spring to rotate said arm about said second point to open circuit position and to move said operating member toward said handle, and a projection carried by said operating member for engaging the shoulder of said handle to move said handle to an indicating position between its open and closed circuit positions following the release of said arm.

19. In a circuit breaker, a floating switch arm of bimetallic material, a latch member normally engaging one point of said arm to provide a pivot for said arm, operating means including an operating member engaging said arm at a second point and movable to an open and to a closed circuit position to effect movement of said arm to open and to closed circuit position, said arm being operable in response to predetermined conditions to disengage said latch member, said operating means including means for automatically moving said arm to open circuit position and said operating member to an indicating position following disengagement of said arm from said latch member.

20. In a circuit interrupter, a circuit controlling member having at least a portion of bimetallic material, a fixed support normally engaging said member to form a pivot point for said member, operating means for moving said member to open and to closed circuit position to open and to close the circuit, said bimetallic portion being operable in response to predetermined conditions to disengage said member from said support to permit movement of the member to open circuit position.

21. In a circuit breaker, a switch member having at least a portion of bimetallic material, a fixed member engaging said switch member to provide a pivot for said switch member, operating means including an operating member for moving said switch member about said pivot to open and to closed circuit position, said switch member being operable in response to predetermined conditions to disengage said fixed member and move to an open circuit position, said operating member being operable to reset said switch member in engagement with said fixed member.

22. In a circuit breaker, a switch member having at least a portion of bimetallic material, a fixed support normally engaging one part of said member to provide a pivot therefor, operating means including an operating member pivotally engaging a second part of said member for moving said member about said first mentioned pivot to open and to closed circuit position, said switch member being operable in response to predetermined conditions to disengage said fixed support, said operating means including means for moving said switch member about the pivot formed by the engagement of the switch member with the operating member to an open circuit position following disengagement of the switch member from said support, said operating member being operable to reset said switch member in engagement with the fixed support.

23. In a circuit breaker, a switch member having at least a portion of bimetallic material, a fixed support normally engaging said switch member to form a pivot therefor, operating means including an operating member for moving said member about said pivot to open and to closed circuit position, said switch member being operable in response to predetermined conditions to disengage said fixed support and move to an open circuit position irrespective of the position of said operating member.

24. In a circuit breaker, a contact operating

arm having at least a portion of bimetallic material, a latch piece normally engaging one point of said arm to provide for rotation of said arm about a pivot axis, operating means including an operating member pivotally engaging a second point of said arm for moving said arm about said pivot axis to open and to closed circuit position, said bimetallic portion being operable in response to predetermined conditions to effect disengagement of said arm from said latch piece, said operating means including a means for moving said switch arm with its portion of bimetallic material about said second point to open circuit position following disengagement of said arm from said latch piece, irrespective of the position of said operating member.

25. In a circuit breaker, a floating switch arm, latch means normally engaged at one end of said arm to provide a pivot point for said arm, operating means including an operating handle movable to an open and to a closed position to effect movement of said switch arm about said pivot to an open and to a closed circuit position, said latch means including electro-responsive means for effecting release of said arm in response to predetermined conditions, said operating means including means for automatically moving said switch arm to an open circuit position irrespective of the position of said operating handle and for causing movement of said operating handle to an indicating position between its open and closed positions following the release of said switch arm.

26. In a circuit breaker, a floating switch arm, releasable and resettable latch means normally engaged at one point of said arm to provide a pivot point for said arm, operating means including a pivoted operating handle movable to an open and to a closed circuit position for moving said switch arm about said pivot to an open and to a closed circuit position, said latch means being operable in response to predetermined conditions to effect release of said switch arm, said operating means being operable upon release of said switch arm to automatically move said switch arm to an open circuit position irrespective of the position of said operating handle and to cause movement of said operating handle to an indicating position between its open and closed circuit positions, and said operating means being operable to reset said latch means upon movement of said operating handle to open circuit position.

27. In a circuit interrupter, a switch arm having thereon a contact portion and a latch portion movable relative to the contact portion in response to electrical conditions in the circuit, two pivot axes about which said switch arm is rotatable, manually engageable means operable to cause movement of said switch arm about one of said pivot axes with said contact portion and said latch portion moving as a unit between open and closed circuit positions, and resilient means acting on said switch arm to move it to open circuit position about the other of said pivot axes upon electrically responsive movement of said latch portion.

28. In a circuit interrupter, a switch arm having thereon a contact portion and a latch portion movable relative to the contact portion in response to electrical conditions in the circuit, two pivot axes about which said switch arm is rotatable, manually engageable means operable to cause movement of said switch arm about one of said pivot axes with said contact portion and said latch portion moving as a unit between open and closed circuit positions, resilient means acting on said switch arm to move it to open circuit position about the other of said pivot axes upon electrically responsive movement of said latch portion, and said manually engageable means being inoperative to prevent said movement of the switch arm to open circuit position upon electrically responsive movement of the latch portion.

29. In a circuit interrupter, a first contact portion, a switch arm having thereon a second contact portion and a latch portion movable relative to the second contact portion in response to electrical conditions in the circuit, two pivot axes about which said switch arm is rotatable, manually engageable means operable to cause movement of said switch arm about one of said pivot axes with said second contact portion and said latch portion moving as a unit between open and closed circuit positions, and resilient means applying a biasing force acting on said switch arm when in the closed circuit position to bias said first and second contact portions into engagement and acting at the same time to bias said switch arm to move it to open circuit position about the other of said pivot axes upon electrically responsive movement of said latch portion.

30. In a circuit interrupter, a relatively fixed contact, a movable switch member including a movable contact and a current responsive bimetallic member secured for movement together, two pivot axes about which said switch member is rotatable, manually engageable means operable to cause normal movement of the switch member about one of said pivot axes between open and closed circuit positions, a spring applying a force to said switch member when in the closed circuit position with the line of action of the force lying between said one pivot axis and said contacts so as to bias said contacts into engagement and also lying on the side of said other pivot axis opposite the contacts so as to bias said switch member to move with its bimetallic member and contact rotating about said other pivot axis to open circuit position upon deflection of said bimetallic member due to the occurrence of an abnormal condition in the circuit, and said movement to open circuit position about said other pivot axis taking place irrespective of the position in which said manually engageable means may be held.

31. In a circuit breaker, a movable switch member comprising a contact member and a current carrying bimetal latch secured for movement therewith and electrically connected thereto, a cooperating latch portion normally engaged by said bimetal latch, operating means including a manually engageable portion having means associated therewith providing a pivotal connection to said switch member and operable to cause movement of said switch member about a fixed pivot to open or to closed circuit position as long as said bimetal latch is in latching engagement with said latch portion, and a spring engaging said switch member and operable upon release of said bimetal latch to cause movement of said switch member about its pivotal connection with said operating means to a tripped open circuit position.

32. A manually and automatically operable circuit breaker comprising a first contact, a movable contact cooperating with said first contact, a current responsive element movable with said movable contact during manual operation of said

breaker and having a latch portion controlled thereby, operating means comprising an operating member manually operable to cause rotation of said movable contact and said current responsive element about a fixed pivot into and out of engagement with said first contact, an actuating spring operable upon movement of said latch portion by the current responsive element to a tripping position to cause rotation of said movable contact and said current responsive element to a tripped open circuit position about an axis which is movable upon each movement of said manually operable member.

33. In a circuit breaker, a movable switch member comprising a contact and a current responsive bimetal latch secured for movement together, a cooperating latch portion normally engaged by said bimetal latch, operating means including a movable actuating member pivotally engaged with said switch member and operable to cause rotation of said switch member with its contact and bimetal latch moving about a fixed pivot to open or to closed circuit position when said bimetal latch is in latching engagement with said cooperating latch portion, and an actuating spring acting on said switch member and operable upon release of said bimetal latch due to a predetermined abnormal condition to cause movement of said switch member with its contact and bimetal latch rotating about its point of pivotal engagement with said actuating member to a tripped open circuit position.

34. In a circuit breaker, a movable switch member comprising a contact and a current responsive bimetal latch secured for movement together, a cooperating latch portion normally engaged by said bimetal latch, operating means including a movable actuating member pivotally engaged with said switch member and operable to cause rotation of said switch member with its contact and bimetal latch moving about a fixed pivot to open or to closed circuit position when said bimetal latch is in latching engagement with said cooperating latch portion, an actuating spring acting on said switch member and operable upon release of said bimetal latch due to a predetermined abnormal condition to cause movement of said switch member with its contact and bimetal latch rotating about its point of pivotal engagement with said actuating member to a tripped open circuit position, and a stop engageable by said switch member upon movement of said actuating member after said movement of the switch member to tripped open position for causing said movement of the actuating member to return the switch member to a position where its bimetal latch reengages said cooperating latch portion.

35. In a circuit breaker, a movable switch member including a contact adjacent one end thereof and a current responsive bimetal element secured for movement with said contact and having a latch portion adjacent the other end of the switch member, a cooperating latch element normally engaged by said latch portion on the switch member, operating means comprising a movable actuating member pivotally engaged with said switch member between the contact end and the latch end thereof, said actuating member being operable to cause movement of said switch member with its contact and bimetal element rotating about a fixed pivot to open or to closed circuit position when said latch portion on the switch member is in latching engagement with said latch element, and an actuating spring engaging said switch member between the latch end and the point of pivotal engagement of the actuating member with said switch member, said spring being operable upon release of the latch portion on the switch member from said latch element to cause movement of said switch member with its contact and bimetal element rotating about the point of pivotal engagement of the actuating member and switch member to a tripped open circuit position irrespective of the position in which said actuating member may be held.

36. In a circuit breaker, a movable switch member including a contact adjacent one end thereof and a current responsive bimetal element secured for movement with said contact and having a latch portion adjacent the other end of the switch member, a cooperating latch element normally engaged by said latch portion on the switch member, operating means comprising a movable actuating member pivotally engaged with said switch member between the contact end and the latch end thereof, said actuating member being operable to cause movement of said switch member with its contact and bimetal element rotating about a fixed pivot to open or to closed circuit position when said latch portion on the switch member is in latching engagement with said latch element, and an actuating spring engaging said switch member between the latch end and the point of pivotal engagement of the actuating member with said switch member, said spring being operable upon release of the latch portion on the switch member from said latch element to cause movement of said switch member with its contact and bimetal element rotating about the point of pivotal engagement of the actuating member and switch member to a tripped open circuit position irrespective of the position in which said actuating member may be held, and a stop for engaging said switch member adjacent its contact end upon movement of said actuating member when said switch member is in tripped open circuit position and thereby causing movement of said switch member to a position where its latch portion reengages said cooperating latch element.

37. In a circuit breaker, a pair of spaced terminals, a stationary contact secured to one of said terminals, a movable switch member comprising a movable contact member and a current responsive bimetal latch secured for movement together and electrically connected to each other, a flexible conductor electrically connecting the latch end of said bimetal latch to the other terminal of said breaker, a latch element normally engaged by said bimetal latch, operating means comprising a movable actuating member above said switch member and having pivotal engagement with said switch member between the contact and the latch end thereof, said actuating member being operable to cause movement of said switch member about a fixed pivot to open or to closed circuit position when said bimetal latch is in latching engagement with said latch element, and a spring below said switch member engaging said switch member between the latch end thereof and the point of pivotal engagement of the actuating member with the switch member, said spring being operable upon release of said bimetal latch to cause movement of said switch member about the point of pivotal engagement thereof with said actuating member to a tripped open circuit position.

38. In a circuit breaker, a movable switch member comprising a contact member and a current responsive bimetal latch, a cooperating latch element normally engaged by said bimetal latch in the latching position thereof, operating means comprising a movable operating handle operable to cause movement of said switch member about one pivot axis to open or to closed circuit position as long as said bimetal latch is in latching engagement with said latch element, and an actuating spring operable upon release of said bimetal latch to cause movement of said switch member about a different axis to a tripped open position independently of the position of said handle, said bimetal latch being resettable in engagement with said latch element, after cooling, by movement of said operating handle in a switch opening direction.

39. In a circuit interrupter, a base of insulating material, a terminal member having a stationary contact portion thereon mounted on said base, an assembly unit including a movable contact and a current responsive bimetallic member having one end electrically connected to said movable contact and permanently connected to move with said movable contact, said bimetallic member having a latch portion adjacent the other end thereof, a second terminal member and a flexible conductor electrically connected at one end to said second terminal member and at its other end to said bimetallic member at a point adjacent its latch portion, said assembly unit including the aforesaid parts being positioned on the base with said movable contact and said bimetallic member free to move together about either of two axes, an operating member movable in opposite directions to cause movement of said movable contact and said bimetallic member together about one of said axes to alternately make and break connection with said stationary contact portion, and a spring supported at one end on said base and acting at its other end to bias said movable contact and said bimetallic member to move together about the other of said pivot axes to break connection with said stationary contact portion upon current responsive movement of the latch portion of said bimetallic member irrespective of the position in which said operating member may be held.

40. In a circuit interrupter, a base of insulating material, a terminal member having a stationary contact portion thereon mounted on said base, an assembly unit including a movable contact and a current responsive bimetallic member having one end electrically connected to said movable contact and permanently connected to move with said movable contact, said bimetallic member having a latch portion adjacent the other end thereof, a second terminal member and a flexible conductor electrically connected at one end to said second terminal member and at its other end to said bimetallic member at a point adjacent its latch portion, said assembly unit including the aforesaid parts being positioned on the base with said movable contact and said bimetallic member free to move together about either of two axes, an operating member movable in opposite directions to cause movement of said movable contact and said bimetallic member together about one of said axes to alternately make and break connection with said stationary contact portion, a spring supported at one end on said base and acting at its other end to bias said movable contact and said bimetallic member to move together about the other of said pivot axes to break connection with said stationary contact portion upon current responsive movement of the latch portion of said bimetallic member irrespective of the position in which said operating member may be held, and a stop portion on said base cooperating with said movable contact and said bimetallic member for moving them together upon movement of said operating member in one direction after said current responsive movement and returning them to a reset position from which they are movable together to make connection with said stationary contact portion upon movement of said operating member in the other direction.

OLIVER S. JENNINGS.