Oct. 4, 1960 L. W. BRACKETT 2,955,177

CIRCUIT BREAKER

Filed July 8, 1958 2 Sheets-Sheet 1

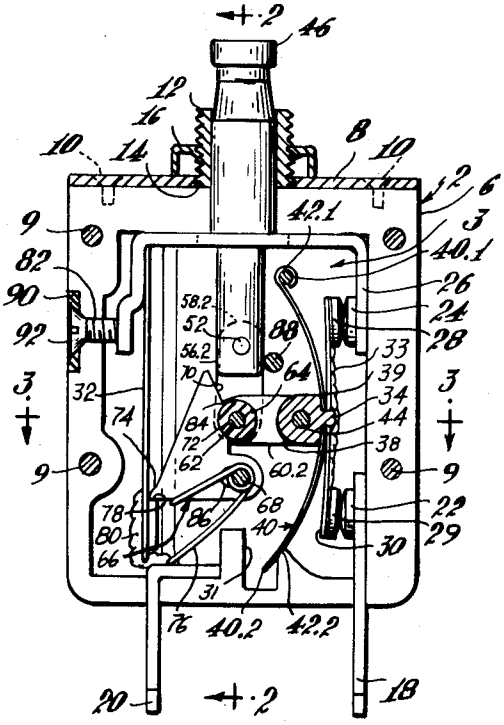


Fig. 1

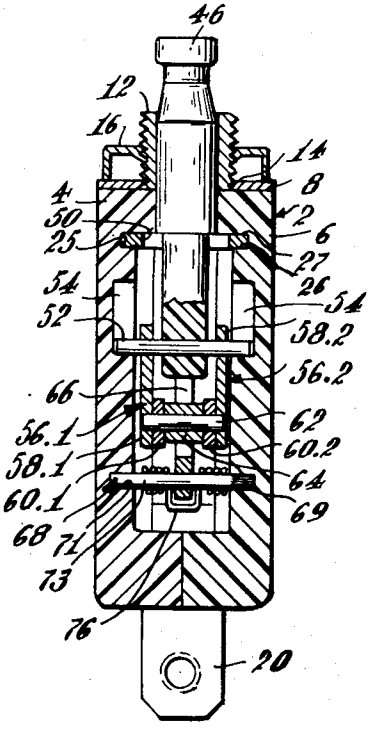


Fig. 2

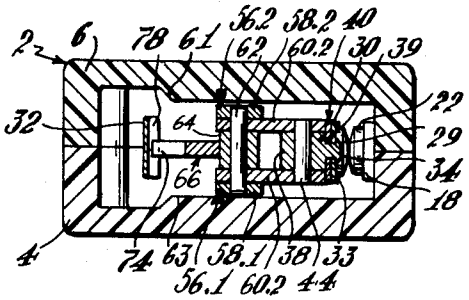


Fig. 3

Inventor
Lawrence W. Brackett
by Roberts, Cushman & Grover
Att'ys.

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CIRCUIT BREAKER

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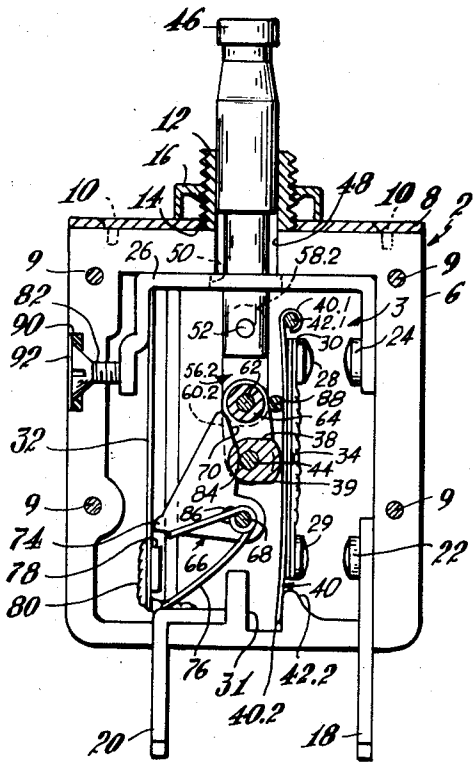


Fig. 4

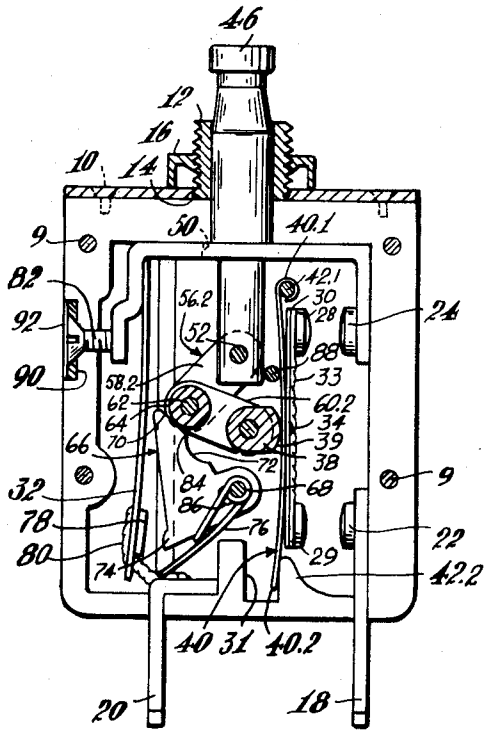


Fig. 5

Inventor
Lawrence W. Brackett
by Roberts, Cushman & Grover
Attys.

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CIRCUIT BREAKER

Lawrence W. Brackett, Georgetown, Mass., assignor to Wood Electric Co., Inc., a corporation of Massachusetts

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14 Claims. (Cl. 200—116)

The field of this invention is that of circuit breakers of the manually operable type which are also automatically operable to open a circuit at a predetermined current overload.

Objects of this invention are to provide a circuit breaker which is manually operable; which is automatically operable to open a circuit at a predetermined current overload; which may be adjusted to operate automatically to open a circuit with great rapidity under either manual or automatic operation; which suppresses arcing to a considerable degree thereby preventing sparking through casing openings such as that opening for the operating member; which automatically resets for automatic operation; which will not close the circuit so long as the automatically operable tripping means is conditioned by a current overload, even if the switch operating member is forcibly held in closing position; which is of simple, compact, sturdy and lightweight construction; which utilizes a minimum number of parts all of which are easily manufactured and assembled without requiring closely toleranced machining or selective assembly; and which compensates for wear and misalignment during extended operation.

A brief summary indicating the nature and substance of the invention in some of its principal aspects is as follows.

Circuit breakers according to the invention comprise fixed contact means; a movable contact member for closing a circuit through the fixed contact means, the movable contact being biased to an open circuit position; an operating member; a pivotally mounted cam member; actuating means pivotally engaging the operating member and movable contact and slidably engaging the cam member to urge the movable contact against said bias to closed circuit position in response to movement of the operating member, and releasable latching means retaining the cam member in slidable engagement with the actuating means.

In the preferred embodiment of the invention, the movable contact member is a bridge adapted to connect two fixed contacts, and the actuating device has toggle-joint means having a knee-pivot pin, with opposite remote ends of the toggle-joint means pivotally engaging the operating member and the bridge respectively. A rotatable roller is mounted on the knee-pivot to engage the cam member which has a recess to intercept movement of the roller in response to movement of the operating member, to urge the bridge against its bias to close the circuit, with the roller snapping into the cam recess to maintain the operating member and the bridge in closed circuit position after manually applied pressure on the operating member is released. The latching means can be controlled in various ways, but in the preferred embodiment the releasable latching means comprises, in accordance with the invention, a strip of current responsive conducting material, preferably a straight bimetallic strip which bends upon temperature change, interposed in the circuit, with one end of the strip rigidly fixed in position, and

the opposite end tangentially and releasably engaging the cam member to retain the cam in engagement with the knee-pivot without flexure of the strip. An overload current in the strip, causing flexure of the strip, releases the cam permitting the bridge biasing means to rotate the cam and to open the circuit irrespective of the position of the operating member.

Also in accordance with the invention, the pivotally mounted cam engages spring means, whereby, when the cam has been pivoted by the biasing means after overload-current tripping of the circuit, the cam will be biased to return to latched engagement with the strip and to maintain slidable engagement with the actuating means returning the operating member to open circuit position. The cam engages its pivot with a slot so that, when it is returned to latched position in response to the spring bias it can be displaced to ride into engagement over the latching strip.

These and other aspects of the invention will appear from the herein presented outline of its mode of operation and of a practical embodiment illustrating its novel characteristics.

The description refers to a drawing in which:

Fig. 1 is a side elevation partially in section with one half of the housing removed, showing the mechanism in closed circuit position;

Fig. 2 is a section along the line 2—2 of Fig. 1 showing the mechanism in closed circuit position;

Fig. 3 is a section on lines 3—3 of Fig. 1;

Fig. 4 is an elevation similar to Fig. 1 showing the mechanism in open circuit position; and

Fig. 5 is a side elevation similar to Fig. 1 showing the mechanism in automatically tripped position before the spring means has reacted to reset the mechanism for manual operation.

Referring to the drawings, 2 indicates an insulating casing which completely encloses the breaker operating mechanism 3. The casing is formed with a front section 4, a back section 6, a cover plate 8, countersink rivets 9 which serve to connect the casing sections 4 and 6, and screws 10 which mount the cover plate 8. A bushing 12 is locked in threaded engagement with the cover plate by means of staking 14 and engages a lock nut 16 which serves for mounting the breaker on an instrument panel as desired.

The circuit breaker can be connected in series in a line to be protected from an overload current by means of the terminals 18 and 20 which extend exteriorly of the casing 2. Within the casing, fixed contacts 22 and 24, one of which is mounted on the terminal 18 and one of which is mounted on a bus bar 26, correspond to contacts 28, 29 mounted on the movable contact bridge 30 to close the line circuit and to allow line current to flow through the breaker by way of terminal 18, bridge 30, bus bar 26, and the latching strip 32 to be described below, to the terminal 20. Recesses 25 and 27 in the casing sections 4 and 6 retain the bus bar 26 in proper location. A casing barrier 31 is positioned between the spring end 40.2 and the terminal 20 assuring effective breaker operation without arcing between the said spring end and the terminal. The preferred embodiment of the circuit closing member 30 is shown here but a single-contact circuit closing member would be satisfactory under certain load conditions. Thus, if contacts 22 and 29 were eliminated and the lower end of the circuit closing member 30 were pivotally connected to the terminal 18, the breaker would operate effectively to open and close a circuit by means of contacts 24 and 28.

The movable contact bridge, composed of stiffly resilient conducting material and having a flexible-braid conductor 33 brazed thereto, is attached by the rivet neck 34 of pivot-boss 38 to the leaf spring 40. The

boss has a rounded surface 39 permitting free bending of the spring 40. The leaf spring has a loop 40.1 engaging a pivot pin 42.1 and a straight end 40.2 sliding on a casing projection 42.2. The pivot pin 42.1 is integral with the back casing section 6. This arrangement biases the bridge 30 away from the fixed contacts 22 and 24 to open circuit position. The pivot-boss 38 supports a pivot pin 44.

An operating plunger 46 extending into the casing through bushing 12, through an aperture 48 in the frame 4, and through an aperture 50 in the bus bar 26, supports a pivot pin 52 which is long enough to slidably engage slots 54 in the casing sections 4 and 6. These slots guide the movement of the operating plunger and serve as stops to prevent injury to the breaker from excessive movement of the plunger. The operating plunger should be made of an insulating material.

Twin toggle-joint members 56.1, 56.2, comprising links 58.1, 58.2 and 60.1, 60.2 made of an insulating material and the common knee-pivot pin 62, each engage the pivot-pin 44 and the pivot-pin 52 to positively connect the operating plunger and the movable contact bridge. A rotatable roller 64 is mounted on the pivot-pin 62 and rollably engages the cam member 66. Thick walled portions, 61 and 63, narrowly confine the operating mechanism 3 to prevent sidewise displacement of toggle-joint members, 56.1 and 56.2.

The cam member 66, pivotally mounted on the pivot-pin 68 which is mounted in the casing sections 4 and 6, has a cam surface 70 for slidable engagement with the roller 64, a recess 72 for retaining the roller 64 in over-center engagement to hold the bridge 30 in closed circuit position, a slot 86, and a latching lip 74 for releasable engagement with the latching strip 32. Pin 68 is knurled at one end 69 for press fitting in casing section 6, while casing section 4 is provided with a recess 71 for receiving the end 73 of the pin 68. A spring 76 biases the cam for clockwise motion about the pivot-pin 68.

Pivotal motion of the cam 66 in a counterclockwise direction, in response to the pressure in this direction exerted by the contact bridge spring 40, is normally restrained by the bimetallic latching strip 32 which releasably engages the latching lip 74 by means of a latch plate 78 integral with the bimetallic strip. The bimetallic strip is rigidly fixed to bus bar 26 for physical support and for electrical connection in the breaker circuit. The latch plate end of the strip 32 is free to move if the strip is warped by temperature increase of the strip due to an overload current in the circuit. The flexible conductor 80 maintains the electrical connection of the strip 32 with the terminal 20 although the strip may be displaced by action of the screw 82 to adjust the strip engagement with the latching lip 74. The square metal insert 90 provides proper bearing for the screw 82 in the insulating casing 2 but is insulated after adjustment of the screw with an epoxy resin 92 as shown.

The pin 88, integral with the back casing section 6, provides an additional stop preventing the toggle-joints 56.1, 56.2 from passing overcenter on the knee-pivot pin 62 into an inoperative position and also serves as a stop for the spring 40 and the bridge 30.

The operation of the above described device is as follows:

This circuit breaker can be manually operated to close a circuit by depressing the operating plunger 46, as illustrated by Figs. 1, 2 and 3. Fig. 4 shows the breaker in open circuit position with the plunger 46 in its outer, open circuit position. When the plunger is depressed from its position according to Fig. 4, its movement forces the roller 64 against the cam surface 70 of the cam member 66. Since the latching lip 74 of the cam member is in engagement with the latch plate 78, the cam member will not rotate but will exert a reactive force on the roller 64 wedging the roller obliquely relative to the movement of the plunger. This sidewise force on the roller 64 is translated to the contact bridge 30 through the links 60.1, 60.2 to urge the bridge against the bias of the spring 40 until contacts 28, 29 bear upon contacts 22 and 24 closing the circuit. The roller 64 then snaps over the edge 84 into the cam recess 72 to retain the mechanism in closed circuit position. This closed circuit position is shown in Fig. 1.

Similarly, the circuit breaker may be manually operated to open the circuit. When the plunger 46 is pulled, the roller 64 snaps out of engagement in the recess 72 and rides up the cam surface 70 allowing the spring 40 to urge the bridge 30 away from the fixed contacts 22 and 24 to break the circuit with considerable rapidity and to seat the pivot boss 38 in said cam recess 72. This open circuit position is illustrated in Fig. 4.

Tests indicate it as probable that this breaker has its excellent arc suppression characteristics because of the arrangement of current conducting members to form a loop within the casing 2 in combination with movement of the contact bridge 30 within the loop. This loop arrangement of current conductors sets up a magnetic field transverse the movement of the contact bridge 30 and thus tends to terminate arcing upon circuit breaking with considerable rapidity.

The automatic circuit breaker operation in response to an overload current in the circuit is illustrated by a comparison of Fig. 1 with Figs. 4 and 5. When an overload current flows in the closed circuit as shown in Fig. 1, the bimetallic strip 32 will register the resulting increase in temperature by bending, moving the latch plate 78 out of engagement with the latching lip 74 as shown in Fig. 5. The cam member 66 then is free to rotate in a counterclockwise direction in response to the force exerted thereon by the spring 40 allowing the contact bridge 30 to move away from the contacts 22 and 24 to open the circuit. Since the force of the spring 40 can easily overcome the clockwise bias of the cam due to the spring 76, the contacts are easily and rapidly separated. When cam rotation begins, the roller 64 will snap out of the recess 72 and roll along the cam surface 70.

When the counterclockwise motion of the cam 66 is completed, the components will be in the position shown in Fig. 5. The spring 76 will then be under tension and will react to rotate the cam in a clockwise direction, the cam surface 70 forcing the plunger 46 into open circuit position and the cam latching lip 74 returning into engagement with the latch plate 78. This position is shown in Fig. 4. If the bimetallic strip 32 interferes with this clockwise rotation of the lip 74, the cam will move along the slot 86 until the lip has passed over the latch plate 78. The apparatus is then reset for manual closing of the circuit as described above.

It will be noted that, if the latching strip does not reengage the cam member, as where the strip 32 has not sufficiently cooled to return to its normal straight disposition, the attempted manual closing of the circuit by the depression of plunger 46 will be ineffective. If the cam 66 is not latched, the cam will exert no reactive force on the roller 64 but will rotate freely in a counterclockwise direction. Thus, the circuit cannot be manually closed when the automatic-overload protection means is not set to operate.

The overload current which will be sufficient to break the circuit automatically may be selectively predetermined by adjustment of the screw 82. Adjustment of the screw inwardly of the casing will decrease the bearing of the strip 32 on the latching lip 74. Therefore, the strip will require a smaller distortive force in order to overcome this bearing pressure. Thus, unlatching will require a lower temperature and so the strip may be subjected to a lower current, and still create sufficient distortive force within the strip to disengage the lip 74.

It will be noted that this circuit breaker serves all the

functions of circuit breakers of this general type and that it accomplishes these results with a greatly reduced number and complexity of working parts as compared to existing switching devices used for similar purposes. In addition, the components of this device are readily and interchangeably assembled and are freely operable without requiring closely toleranced machining. Further, the working members may be subjected to a greater degree of wear and disalignment during operation without detracting from the freely working character of the apparatus. It will be noted that errors in machining or defects due to wear or disalignment which are not compensated for by complementary errors of defects elsewhere in the device, are absorbed by the resilience of the bridge **30**, or by slight folding of the toggle-joints **56**, or will be manifested in poor engagement of the lip **74** and the latch plate **78**. As was noted above, this engagement may be adjusted by means of the screw **82**.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications which fall within the scope of the appended claims.

I claim:

1. A circuit breaker comprising: fixed contact means; a movable contact member cooperable with said fixed contact means to close a circuit; means for biasing said movable contact member to an open circuit position; an operating member; a pivotally mounted cam member; actuating means pivotally connected to the operating member and to the movable contact member and slidably engaging the cam member, for urging the movable contact member against said bias to closed circuit position in response to movement of the operating member, and for permitting normal opening and closing of the circuit by movement of the operating member while actuating means and cam member are engaged; and releasable latching means adapted normally to retain said slidable engagement between said actuating means and said cam member and, upon release, disengaging the actuating means from said cam member allowing said biasing means to move said movable contact member to open the circuit and to keep it open regardless of the position of the operating member.

2. A circuit breaker comprising: fixed contacts; a movable contact bridge cooperable with said fixed contacts to close a circuit; means for biasing said contact bridge to an open circuit position; an operating member; a pivotally mounted cam member; a toggle-joint member pivotally connected to the operating member and to the contact bridge at opposite remote ends of said toggle-joint member, said toggle-joint member slidably engaging the cam member at the common pivot of said toggle linkage for urging the bridge against said bias to closed circuit position in response to movement of the operating member and for permitting normal opening and closing of the circuit by movement of the operating member while the common pivot of said toggle-joint member and the cam member are engaged; and releasable latching means adapted normally to retain said slidable engagement between said common pivot and said cam member, and, upon release, disengaging said common pivot from said cam member allowing said biasing means to move said bridge to open the circuit and to keep it open regardless of the position of the operating member.

3. A circuit breaker according to claim 2, wherein the movable contact bridge comprises a resilient strip of conducting material having contact surfaces raised thereon at either end.

4. A circuit breaker comprising: fixed contacts; a movable contact bridge cooperable with said fixed contacts to close a circuit; a leaf spring for biasing said contact bridge to an open circuit position; an operating member; a toggle-joint member pivotally connected to the operating member and to the bridge at opposite remote ends of said toggle-joint member; a pivotally mounted cam member disposed in axial extension of said operating member to slidably engage the common pivot of said toggle linkage for urging the bridge perpendicular to the axis of the operating member to closed circuit position against said bias in response to axial movement of the operating member, thereby stressing said leaf spring, and for permitting normal opening and closing of the circuit by movement of the operating member while said common pivot and said cam member are engaged; and releasable latching means adapted normally to retain said slidable engagement between said common pivot and said cam member, and, upon release, disengaging said common pivot from said cam member allowing said stressed leaf spring rapidly to move said bridge to open the circuit and to keep it open regardless of the position of the operating member.

5. A circuit breaker comprising: fixed contacts; a movable contact bridge cooperable with said fixed contacts to close a circuit; a leaf spring for biasing said contact bridge to an open circuit position; an operating member; a pair of toggle-joint members having a common knee-pivot pin, said toggle-joint members being disposed in parallel relation and each pivotally connected to the operating member and to the bridge at opposite remote ends of said toggle-joint members; a rotatable roller mounted on said common knee-pivot pin for holding the toggle-joint members in spaced relation; a pivotally mounted cam member obliquely engaging the rotatable roller for urging the bridge against said bias to closed circuit position in response to movement of the operating member, thereby stressing said leaf spring, and for permitting normal opening and closing of the circuit by movement of the operating member while said rotatable roller and said cam member are engaged; and releasable latching means adapted normally to retain said engagement between said rotatable roller and said cam member, and, upon release, disengaging said rotatable roller from said cam member allowing said stressed leaf spring rapidly to move said bridge to open the circuit and to keep it open regardless of the position of the operating member.

6. A circuit breaker comprising: fixed contacts; a movable contact bridge cooperable with said fixed contacts to close a circuit; a leaf spring for biasing said contact bridge to an open circuit position; and operating member; a toggle-joint member pivotally connected to the operating member and to the bridge at opposite remote ends of said toggle-joint member; a pivotally mounted cam member disposed in axial extension of said operating member, said cam member having a cam surface for slidably engaging the common pivot of said toggle linkage for urging the bridge normal to the axis of the operating member to closed circuit position against said bias in response to axial movement of the operating member, thereby stressing said leaf spring said cam surface having a recess for engaging the common pivot for retaining the bridge in closed circuit position, said engagement between said common pivot and said cam surface permitting normal opening and closing of the circuit by movement of the operating member; and releasable latching means adapted normally to retain said engagement between said common pivot and said cam member, and, upon release, disengaging said common pivot from said cam member allowing said stressed leaf spring rapidly to move said bridge to open the circuit and to keep it open regardless of the position of the operating member.

7. A circuit breaker comprising: a hollow insulating casing; an operating member extending exteriorly of the casing; a bus bar conforming to three, rectangularly disposed, internal sides of the casing and having both ends extending from the casing through the fourth rectangularly disposed side, said bar ends serving as terminals for connecting the circuit breaker into a circuit; said bar being interrupted along one side to form a circuit break, said bar having interposed therein a current-responsive strip on the side opposite the circuit break, and said bar

being apertured on the third side to receive the operating member; a movable contact bridge cooperable with said bar to close said circuit break; means for biasing said contact bridge to open circuit position; a toggle-joint member pivotally engaging the operating member and the bridge at opposite remote ends of said toggle-joint member; and a pivotally mounted cam member disposed in axial extension of the operating member for slidably engaging the knee-pivot of the toggle-joint for urging the bridge normal to the axis of the operating member to closed position against said bias and for permitting normal opening and closing of the circuit by movement of the operating member while said knee-pivot and said cam member are engaged, said cam being adapted normally to engage the current-responsive strip so that such strip engagement normally retains the cam in slidable engagement with the knee-pivot and so that, when an overload current flows in the circuit, the cam will be released from strip engagement and will rotate under stress of the bridge bias to allow the bridge to move to open circuit position irrespective of the position of said operating member.

8. A circuit breaker according to claim 7, wherein a screw engages said casing and said bus bar adjacent said current-responsive strip so that adjustment of the screw will displace the strip within the casing thereby adjusting the strip engagement with said cam.

9. A circuit breaker according to claim 7, wherein said pivotally mounted cam engages a spring means so that, when the cam has been pivoted by the contact bridge biasing means after automatic overload tripping of the circuit, said spring means will bias the cam to return to latched engagement with said strip and to maintain slidable engagement with said knee-pivot forcing the operating member to open circuit position.

10. A circuit breaker comprising: an insulating casing; fixed contacts; a movable contact bridge cooperable with the fixed contacts to close a circuit; means for biasing said contact bridge to open circuit position; an operating member extending exteriorly of the casing; a pair of toggle-joint members having a common knee-pivot pin, said toggle-joint members being disposed in parallel relation and each pivotally engaging the operating member and the bridge at opposite remote ends of said toggle-joint members; a rotatable roller mounted on the knee-pivot pin holding the toggle-joint members in spaced relation; a pivotally mounted cam member disposed in axial extension of said operating member, said cam member having a cam surface for obliquely engaging the rotatable roller for urging the bridge normal to the axis of the operating member to closed circuit position against said bridge bias in response to axial movement of the operating member, said cam surface having a recess for receiving the roller for retaining the bridge in closed circuit position, said engagement between said rotatable roller and said cam surface permitting normal opening and closing of the circuit by movement of the operating member; a current-responsive strip interposed in said circuit, said strip being adapted to engage the cam member for retaining the cam in engagement with the roller, such that an overload current in the circuit will release the strip engagement with the cam and will allow the bridge biasing means to rotate the cam and to open the circuit irrespective of the position of the operating member; and spring means engaging the cam whereby, when the cam has been pivoted by the bridge-biasing means after overload-current tripping of the circuit, the cam will be biased to return to latched engagement with the strip and to maintain slidable engagement with the roller forcing the operating member to open circuit position.

11. A circuit breaker according to claim 10, wherein the cam member is slotted to engage its pivot so that in returning to normal latched position in response to the bias of said spring means, the cam may displace to ride into engagement over said current-responsive strip.

12. A circuit breaker according to claim 10, wherein the operating member pivotally engages the toggle-joint members by means of a pivot pin which extends into slots in said casing, said slots limiting the axial movement of the operating member.

13. A circuit breaker comprising: an insulating casing; current conducting means disposed within said casing to form a substantially loop shaped circuit, and having a break in said circuit; a fixed contact member and a movable contact member associated with said conducting means at said break for opening and closing said circuit; means for biasing said movable contact member to open circuit position within a magnetic field of said loop shaped circuit; an operating member; a pivotally mounted cam member; actuating means pivotally connected to the operating member and to the movable contact member and slidably engaging the cam member, for urging the movable contact member against said bias to closed circuit position in response to movement of the operating member, and for permitting normal opening and closing of the circuit by movement of the operating member while actuating means and cam member are engaged; and releasable latching means adapted normally to retain said slidable engagement between said actuating means and said cam member, and upon release, disengaging the actuating means from said cam member allowing said biasing means to move said movable contact member to open the circuit and to keep it open regardless of the position of the operating member.

14. A circuit breaker comprising: a hollow insulating casing; an operating member extending exteriorly of the casing; a bus bar conforming to three, rectangularly disposed, internal sides of the casing and having both ends extending from the casing through the fourth rectangularly disposed side, said bar ends serving as terminals for connecting the circuit breaker into a circuit; said bar being interrupted along one side to form a circuit break, said bar having interposed therein a current-responsive strip on the side opposite the circuit break, and said bar being apertured on the third side to receive the operating member; a movable contact bridge cooperable with said bar to close said circuit break; means for biasing said contact bridge to open circuit position; an insulating barrier extending from said casing between said bar end terminals for preventing arcing between said contact bridge biasing means and said bus bar; a toggle-joint member pivotally engaging the operating member and the bridge at opposite remote ends of said toggle-joint member; and a pivotally mounted cam member disposed in axial extension of the operating member for slidably engaging the knee-pivot of the toggle-joint for urging the bridge normal to the axis of the operating member to closed position against said bias and for permitting normal opening and closing of the circuit by movement of the operating member while said knee-pivot and said cam member are engaged, said cam being adapted normally to engage the current-responsive strip so that such strip engagement normally retains the cam in slidable engagement with the knee-pivot and so that, when an overload current flows in the circuit, the cam will be released from strip engagement and will rotate under stress of the bridge bias to allow the bridge to move to open circuit position irrespective of the position of said operating member.

References Cited in the file of this patent

UNITED STATES PATENTS

2,195,016	Swingle	Mar. 26, 1940
2,325,650	Baxter	Aug. 3, 1943
2,343,323	Pierce	Mar. 7, 1944
2,449,486	Killian et al.	Sept. 14, 1948
2,496,072	Taylor	Jan. 31, 1950
2,613,296	Wood	Oct. 7, 1952
2,813,168	Mascioli	Nov. 12, 1957
2,833,888	Bessiere	May 6, 1958