Jan. 12, 1971 M. W. POLKINGHORN 3,555,479

CIRCUIT BREAKER CONSTRUCTION

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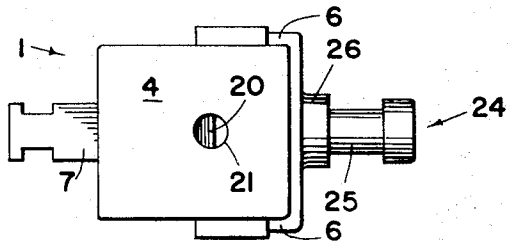



FIG.1.

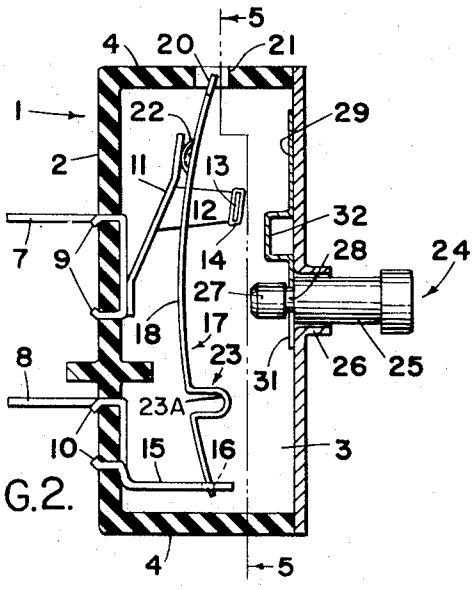



FIG.2.

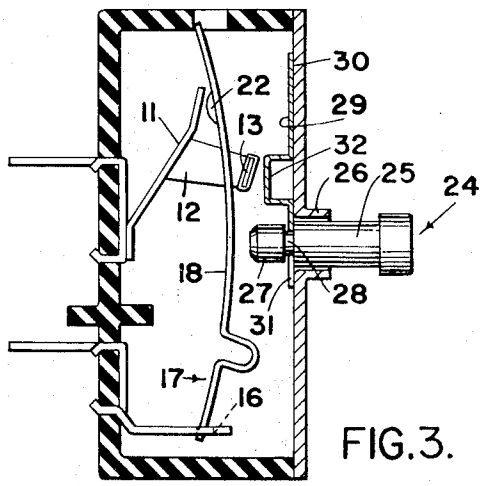



FIG.3.

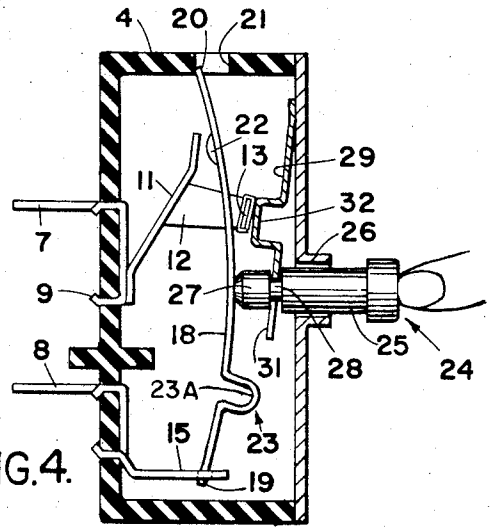



FIG.4.

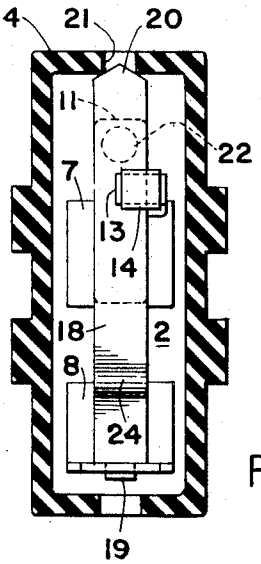



FIG.5.

INVENTOR
MELVIN W. POLKINGHORN

BY

Learman & McCulloch

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# CIRCUIT BREAKER CONSTRUCTION

Melvin W. Polkinghorn, Livonia, Mich., assignor, by mesne assignments, to Essex International, Inc., Fort Wayne, Ind., a corporation of Michigan

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## ABSTRACT OF THE DISCLOSURE

A circuit breaker having a bimetal conductor normally in bridging engagement with two spaced contacts and being responsive to the presence of a current therein in excess of a predetermined value to move out of bridging engagement with the contacts, the conductor incorporating spring means enabling such movement of the conductor and restraining return movement of the conductor into bridging engagement with the contacts. A manipulatable reset member is provided to restore the bimetal conductor to its normal position and incorporates apparatus for preventing bridging engagement between the conductor and the contacts until such time as the reset member disengages the conductor.

The invention disclosed herein relates to a circuit breaker construction of the kind having a bimetal conductive strip which normally bridges a pair of terminals and which is automatically operable in response to a current in excess of a predetermined value to break the circuit to the terminals. More particularly, the invention pertains to a circuit breaker construction having an improved bimetal conductor which precludes its return movement to circuit making position and including manually operable reset means for restoring the conductor to its circuit making position without subjecting the engageble and disengageable contacts to arcing and without subjecting the operator to any possibility of electrical shock.

Many kinds of circuit breakers have been proposed heretofore. Some of the known circuit breakers are entirely automatic in that they interrupt a circuit when the current exceeds a predetermined value and return to circuit making condition shortly after interruption of the circuit. Others are semiautomatic in operation in that they function automatically to interrupt the circuit, but must be reset manually. The semiautomatic circuit breakers usually incorporate delicate and sometimes expensive devices for preventing automatic resetting of the circuit breakers and, so far as is known, restoration of the circuit breakers to its operative condition is effected while some part of the body of the switch operator is in contact with some part of the switch. Such a construction is objectionable for the reason that it subjects the switch operator to the risk of injury.

Some of the known circuit breakers make use of a snap-acting bimetal strip which normally engages a fixed contact and away from which the bimetal strip moves as it becomes overheated. At a point in time just prior to the snap action of the bimetal strip the engagement pressure between the strip and the fixed contact is minimal, thereby subjecting the contacts to the possibility of chatter and arcing.

An object of this invention is to provide a semiautomatic circuit breaker which overcomes or greatly minimizes the aforementioned objections.

Another object of the invention is to provide a circuit breaker construction having a thermally responsive circuit making and breaking conductor provided with self-contained means for resisting its return to circuit making position following its movement to circuit breaking position.



A further object of the invention is to provide a semiautomatic circuit breaker in which the parts are small in number and easily and quickly assembled, thereby minimizing the cost of manufacture.

Another object of the invention is to provide a semiautomatic circuit breaker construction in which resetting of the circuit making and breaking conductor to its circuit making position cannot be effected until the body of the switch operator is in a safe position with respect to the current conducting parts of the circuit breaker.

Other objects and advantages of the invention will be pointed out specifically or will become apparent from the following description when it is considered in conjunction with the appended claims and the accompanying drawings, in which:

FIG. 1 is an elevational view, on a reduced scale of a circuit breaker constructed in accordance with the invention;

FIG. 2 is a transverse sectional view, on an enlarged scale, of the apparatus shown in FIG. 1, but rotated through 90° and illustrating the conductive parts in circuit making positions;

FIG. 3 is a view similar to FIG. 2, but illustrating the conductive parts in circuit breaking positions;

FIG. 4 is a view similar to FIG. 3, and illustrating the initial phase of resetting of the conductive parts to their circuit making positions; and

FIG. 5 is a sectional view taken on the line 5—5 of FIG. 2.

The apparatus comprises a substantially cup-shaped casing or housing **1** formed of any suitable insulating material and having a base wall **2** from which extend upstanding side and end walls **3** and **4**, respectively. Secured to the end walls by means of lugs **6** is a preferably metal cover plate **5**. Mounted in the casing base **2** is a pair of electrically conductive terminals **7** and **8** which are secured in openings formed in the base **2** by means of bent over tangs **9** and **10**, respectively. Fixed to the terminal **7** within the casing is one end of a resilient contact blade **11**, the opposite end of which is free. Between the ends of the blade is a leg **12** terminating in a laterally extending foot **13** around which is positioned a rubber or other electrically insulating sleeve **14**. The terminal **8** includes a relatively stiff, conductive leg **15** which extends inwardly of the casing **1** and is provided with a slot **16** adjacent its free end.

A circuit making and breaking conductor member **17** comprises an elongated, substantially flat member **18** composed of two dissimilar, electrically conductive strips of metal secured back to back. One end of the member **18** is provided with a longitudinally projecting tang **19** which is fitted into the slot **16** in the terminal arm **15**. The opposite end of the member **18** terminates in a spade- or wedge-shaped nose **20** that is accommodated in an opening **21** formed in the end wall **4** of the casing. The members **4** and **15**, therefore, constitute the means for mounting the conductor **17**, but the distance between the members **4** and **15** is less than the overall length of the member **18**. Consequently, the member **18** assumes a bowed configuration when it is assembled with its associated parts.

The assembly of the conductor **17** within the casing is such that the member **18** is interposed between the contact blade **11** and the foot **13** so as to position a silver or other conductive button **22** carried by the member **18** adjacent the free end of the blade **11**. In its normal or circuit making position the member **18** is bowed in a direction toward the base wall **2** so as to bridge and electrically connect the conductive terminal parts **11** and **15**. In these positions of the parts the blade **11** is stressed somewhat by its engagement with the conductor **18** so

as to assure good electrical contact between the parts **11** and **22**.

An important characteristic of the conductor **17** is that it incorporates self-contained, conductive spring means **23** which enables the overall length of the conductor to be varied. In the disclosed embodiment of the invention the spring **23** comprises a substantially U-shaped bend or loop **23A** in the member **18** which is located between the ends of the member and preferably closer to the mounting member **15** than to the mounting wall **4**. The purpose and function of the spring means **23** will be pointed out hereinafter.

Although the conductive member **18** normally is bowed in a direction toward the base wall **2**, it may be bowed in the opposite direction, as is shown in FIG. 3. In this position of the member **18** the contacts **11** and **22** are disengaged, and the disengagement of those contacts enables the resilience of the contact **11** to position the latter at a somewhat steeper incline inwardly of the casing.

Reciprocable reset means **24** is provided to return the member **18** from the position shown in FIG. 3 to the position shown in FIG. 2 and comprises a plunger **25** formed of insulating material mounted in a tubular boss **26** formed in the cover plate **5**. The inner end of the plunger **25** terminates in a head **27** that is spaced from the shank of the plunger **25** by a reduced neck **28**. The plunger **25** is constantly biased to the outwardly projected position shown in FIGS. 2 and 3 by a leaf spring **29**, one end of which is welded or otherwise suitably fixed as at **30** to the inner surface of the wall **5** and the other end of which is slotted as at **31** to accommodate the plunger neck **28**. Between its opposite ends, the spring **29** is provided with an offset operating part **32** that is adapted to engage the foot **13** of the contact **11**.

To condition the apparatus for operation, the casing **1** is supported in any convenient location and the terminals **7** and **8** connected in an electric circuit. In its normal position the conductor **17** is stable and is bowed toward the base wall **2** so as to bridge and electrically connect the terminals **7** and **8** to complete a circuit therebetween. The conductor **17** is maintained in its circuit making position by the action of two separate and distinct forces: first, the bowing force exerted on the member **18** because of its being of greater length than the spacing between its two supporting members **4** and **15** and second, the resistance to deformation of the spring loop **23**. In this connection, it should be observed that the thickness of the bimetal member **18** is less than the thickness of the terminal leg **15**, thereby enabling the spring **23** to yield prior to yielding of the leg **15**.

When an electric current is caused to pass between the terminals **7** and **8** via the conductor **17**, the presence of current in the conductor in excess of a predetermined value will cause unequal heating of the dissimilar metal strips, resulting in sufficient force being applied on the member **18** as to cause it to be deflected from the circuit making position shown in FIG. 2 toward the circuit breaking position shown in FIG. 3 in which the contacts **11** and **22** are spaced from one another.

As the member **18** moves from the position shown in FIG. 1 toward an intermediate position, the resilience of the spring blade **11** will cause the latter to follow the member, thereby maintaining good electrical contact between the parts **11** and **22**, and incidentally effecting a wiping action between them. As the member **18** deflects, the spring **23** is bowed or collapsed as the member moves toward a nonbowed or planar condition. As soon as the member **18** passes through the planar condition, the resilience of the spring **23** and of the member itself will snap the member **18** to the bowed condition shown in FIG. 3 in which the current path is broken. As soon as the circuit is broken, current no longer will pass through the member **18**, whereupon the dissimilar metal strips will cool. Upon cooling of the metal strips, the member **18** will have a natural tendency to resume its unbowed condition, but the bowing force exerted on the conductor by the mounting devices **4** and **15**, coupled with the resistance of the spring **23** to deformation, is sufficient to maintain the member **18** in its bowed, circuit breaking position. The conductor **17**, therefore, is stable in its open circuit position and is not capable of returning automatically to its circuit making position.



When the condition resulting in the excessive current is remedied, the conductor **17** may be restored to its circuit making position by an operator's depressing the reset plunger **25**, as is indicated in FIG. 4. As the plunger is depressed, the spring **29** simultaneously is displaced. The length of the leg **12** is such that the operating portion **32** of the spring will engage the foot element **13** prior to the engagement of the plunger head **27** with the conductive member **18**. Thus, as the plunger is depressed the contact blade **11** is displaced prior to deflection of the member **18** so as to prevent engagement between the contacts **11** and **22** until such time as the plunger **25** is released by the operator. When the plunger is released, the spring **29** will restore the latter to its projected position and disengage the foot **13**, whereupon the contacts **11** and **22** may engage one another and reestablish a circuit between the terminals **7** and **8**. Consequently, no part of the operator's body need engage any part of the circuit breaker at the time the circuit is reestablished.

The disclosed embodiment is representative of a presently preferred form of the invention, but is intended to be illustrative rather than definitive thereof. The invention is defined in the claims.

I claim:

**1.** A circuit breaker construction comprising spaced apart terminal means; thermally sensitive, flexible means; means mounting said flexible means for deflection in response to a predetermined change in temperature of said flexible means from a first stable position effecting electrical connection of said terminal means to a second stable position effecting electrical disconnection of said terminal means; and yieldable means integral with and between the ends of said flexible means acting on the latter in each of said positions to restrain deflection of said flexible means from either of said positions to the other, said yieldable means being operable to prevent deflection of said flexible means from said second position to said first position in the absence of the application of an external deflecting force to said flexible member.

**2.** The construction set forth in claim **1** including manipulatable means; and means mounting said manipulatable means for movement into engagement with said flexible means for applying to the latter an external force of such magnitude as to overcome said yieldable means and deflect said flexible means from said second position to said first position.

**3.** The construction set forth in claim **1** wherein said mounting means comprises spaced supports and wherein said flexible means is supported at its opposite ends by said supports.

**4.** The construction set forth in claim **3** wherein the length of said flexible means is greater than the spacing between said supports.

**5.** The construction set forth in claim **1** wherein said part of said flexible means is a substantially U-shaped loop formed in said flexible means.

**6.** The construction set forth in claim **1** wherein said yieldable means includes said mounting means.

**7.** The construction set forth in claim **6** wherein said mounting means comprises at least one resilient member.

**8.** The construction set forth in claim **1** wherein said flexible means is electrically conductive and wherein the temperature of said flexible means is affected by current flowing therein.

**9.** The construction set forth in claim **1** wherein said flexible means is bi-metallic.

10. A circuit breaker construction comprising spaced terminal means at least one of which is resilient; a thermally responsive, flexible conductor deflectable from a first stable position to a second stable position in response to a current therein in excess of a predetermined value; means mounting said conductor for bridging engagement with said terminal means when said conductor is in its first position; yieldable means acting on said conductor and forming a conductive part of the latter for restraining deflection of said conductor from either of said positions to the other; manipulatable means; means mounting said manipulatable means for movements toward and away from said conductor and operable to restore the latter to its first position; and means responsive to movement of said manipulatable means toward said conductor to displace said resilient conductive member and prevent bridging engagement between said conductor and said terminal means.

11. The construction set forth in claim **10** including spring means acting on said manipulatable means and biasing the latter away from said conductor.

12. The construction set forth in claim **11** wherein the means for displacing said resilient conductive member is carried by said spring means.

13. A circuit breaker construction comprising a casing; a pair of spaced apart terminals carried by said casing; an elongated, flexible, bi-metal conductor; means mounting said conductor in a bowed position such that it has a first stable position in bridging engagement with said termianls, said conductor being deflectable in response to a current therein in excess of a predetermined value to a second stable, bowed position out of bridging engagement with said terminals; spring means incorporated in said conductor for yieldably resisting movement of the latter from either of said positions to the other; reset means carried by said casing for movement toward said conductor for restoring the latter from said second bowed position to said first position, one of said terminals including a resilient contact engaged by said conductor when the latter is in said first position; and operating



means operable in response to movement of said reset means toward said conductor to displace said resilient contact and prevent engagement of the latter by said conductor.

14. The construction set forth in claim **13** wherein said conductor is supported at its opposite ends by said mounting means and wherein said conductor has an unbowed length greater than the distance between said mounting means.

15. The construction set forth in claim **13** wherein yieldable means acting on said reset means and biasing the latter in a direction away from said conductor.

16. The construction set forth in claim **13** wherein said operating means forms a part of said reset means.


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BERNARD A. GILHEANY, Primary Examiner

D. M. MORGAN, Assistant Examiner

U.S. Cl. X.R.

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