Feb. 28, 1939. O. K. BECKLER 2,148,600

ELECTRIC CIRCUIT BREAKER AND CUT-OUT

Filed Feb. 17, 1936 2 Sheets-Sheet 1

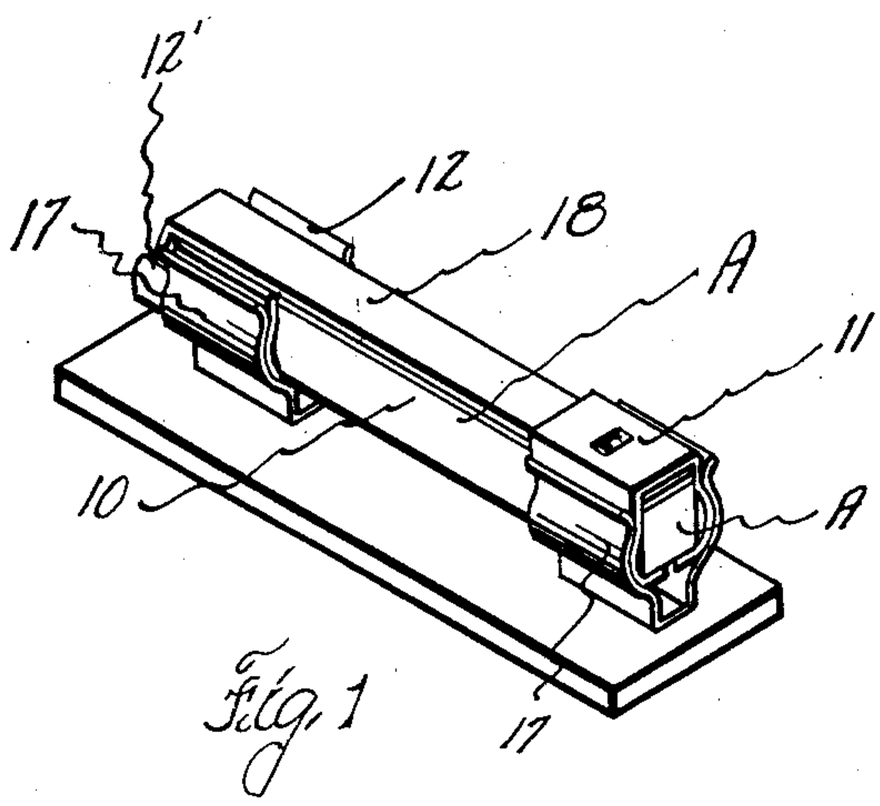

Fig. 1

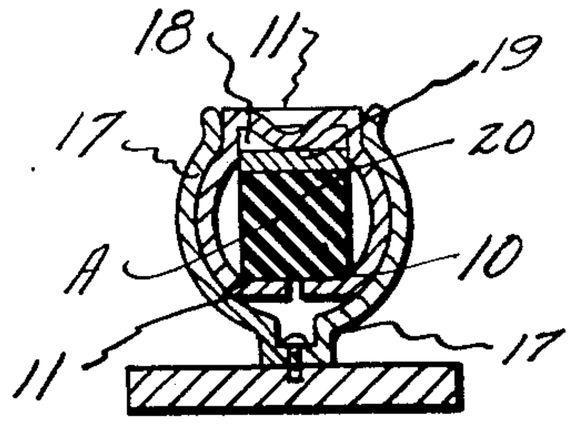

Fig. 4

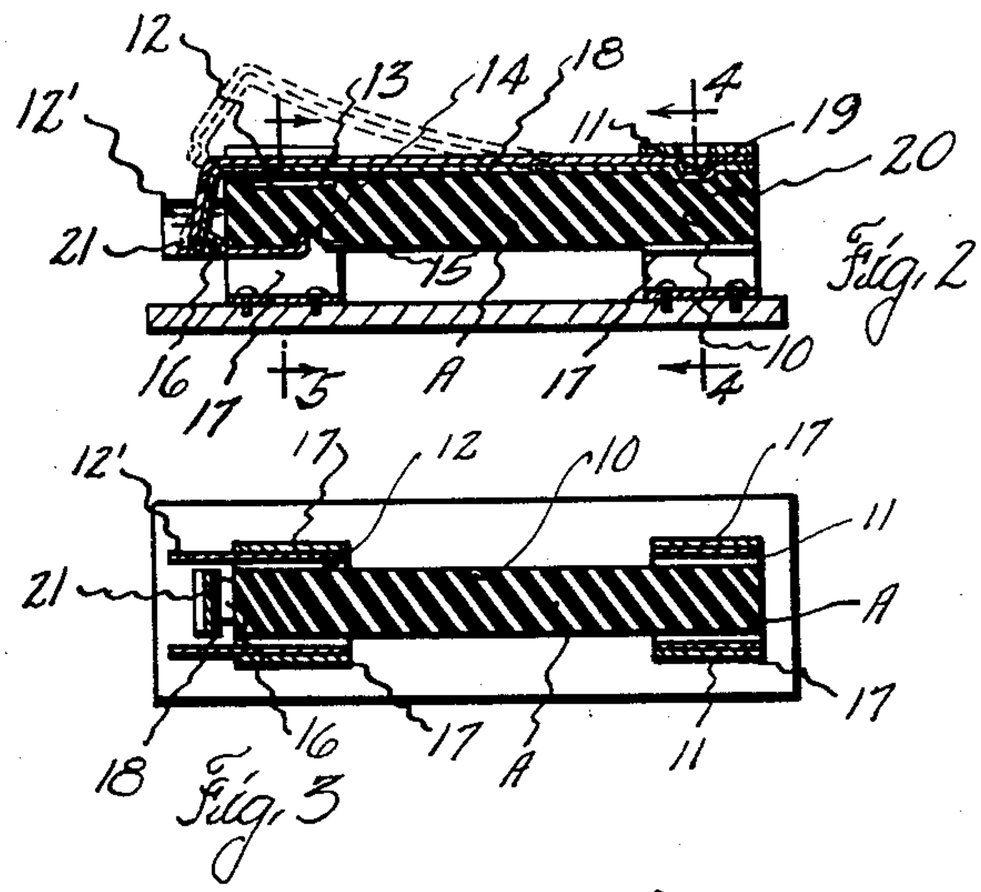

Fig. 2

Fig. 3

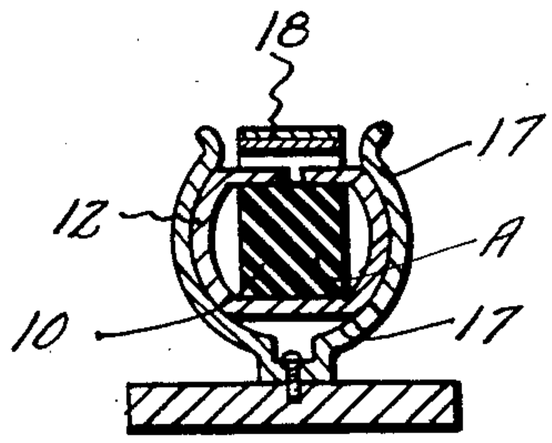

Fig. 5

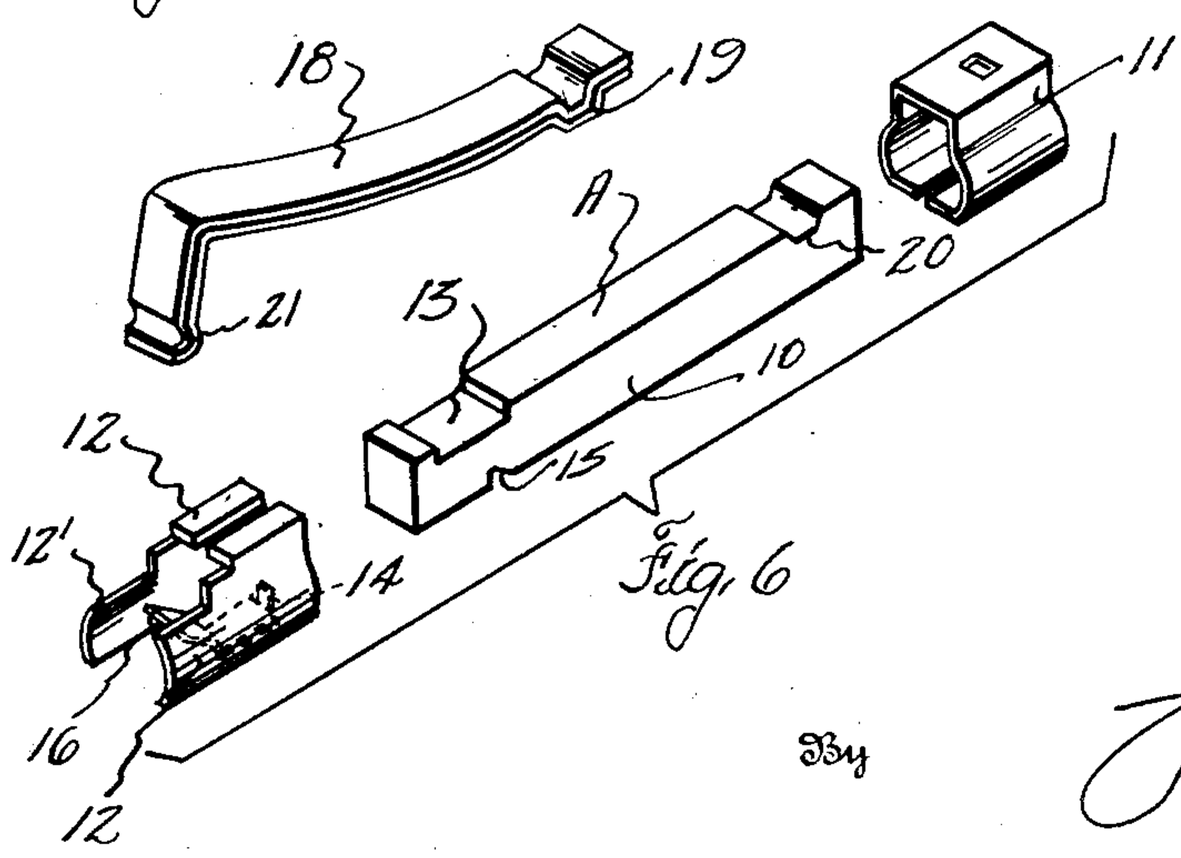

Fig. 6

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ELECTRIC CIRCUIT BREAKER AND CUT-OUT

Filed Feb. 17, 1936 2 Sheets-Sheet 2

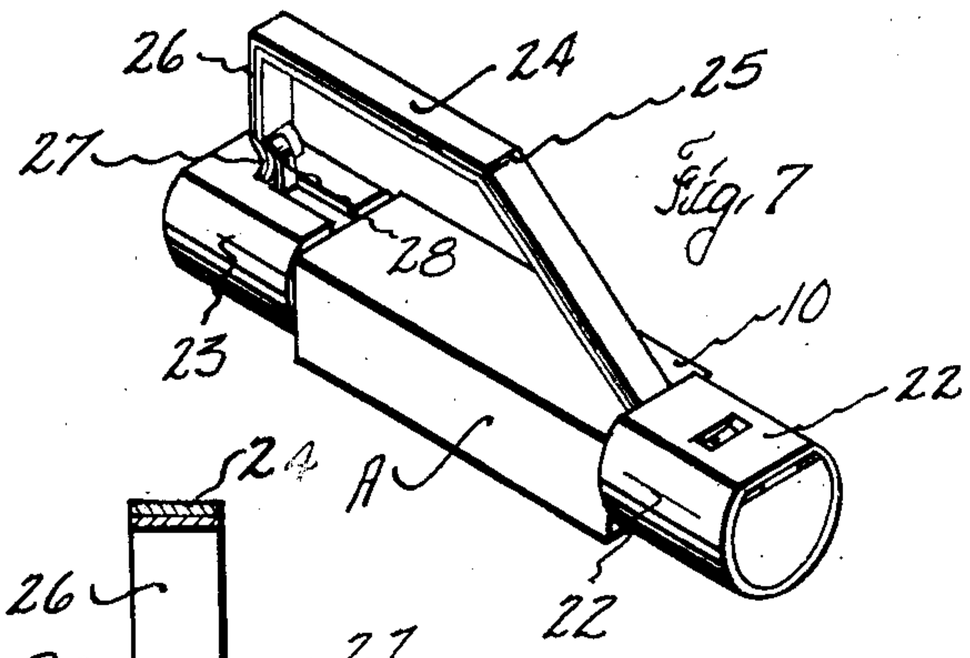

Fig. 7

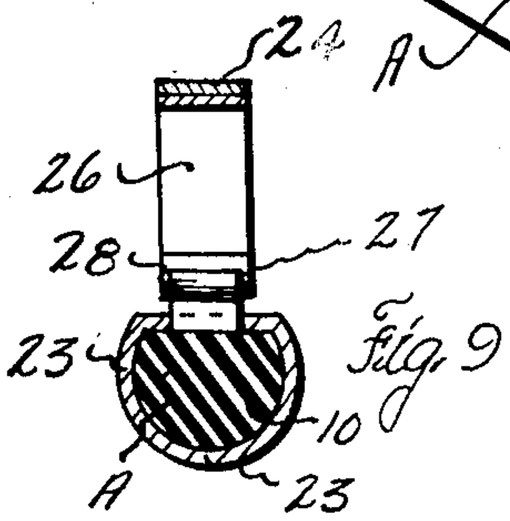

Fig. 9

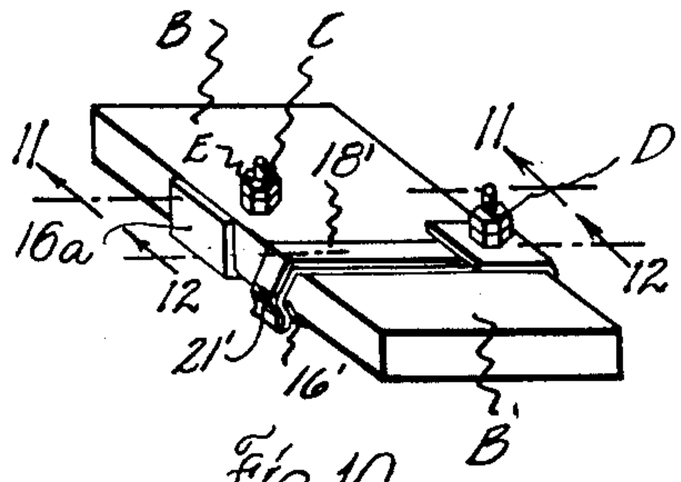

Fig. 10

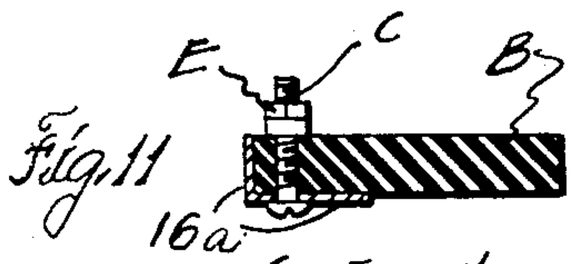

Fig. 11

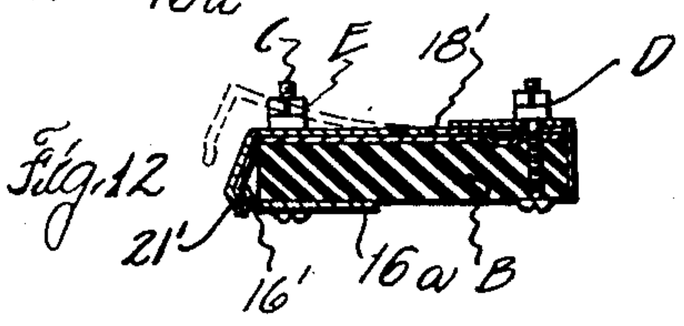

Fig. 12

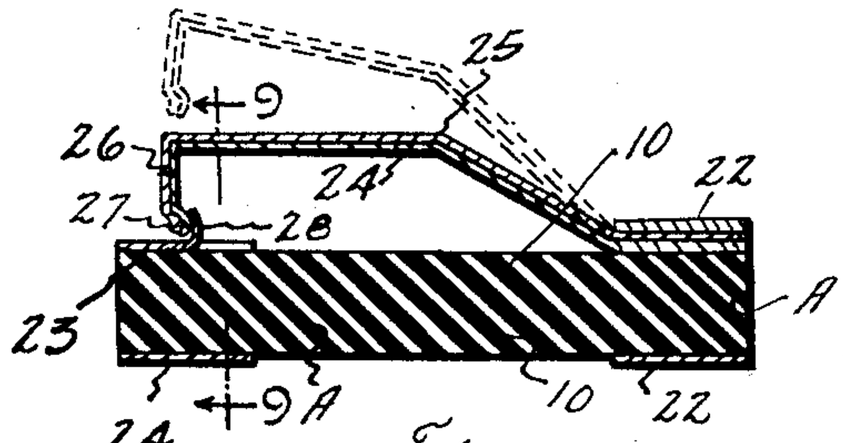

Fig. 8

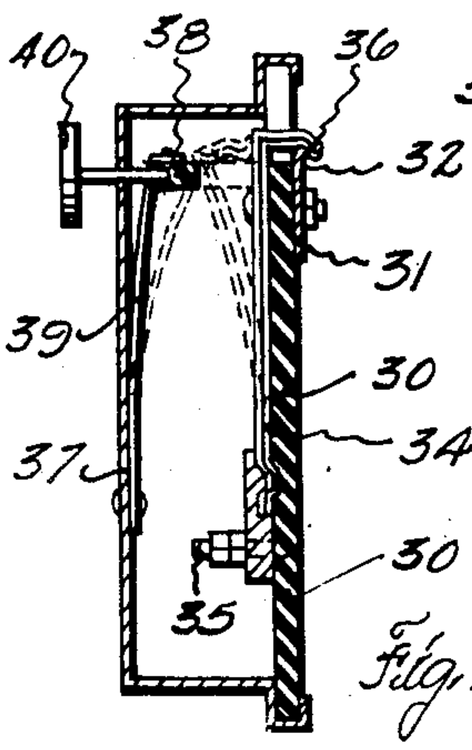

Fig. 15

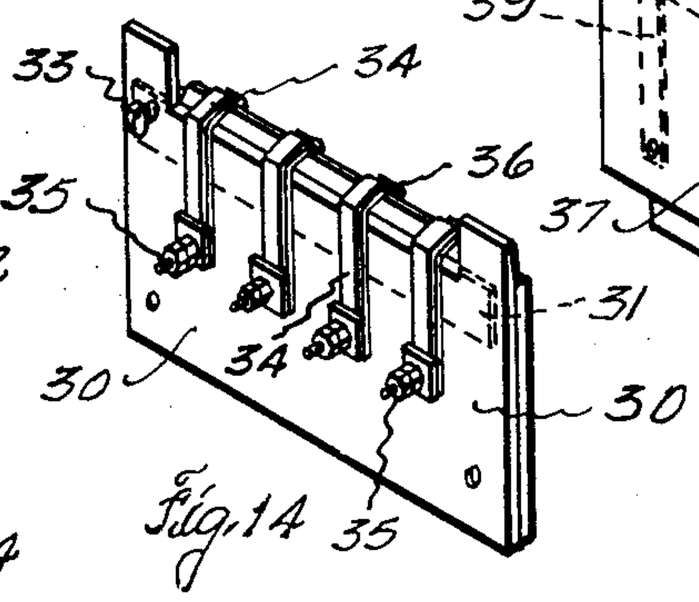

Fig. 14

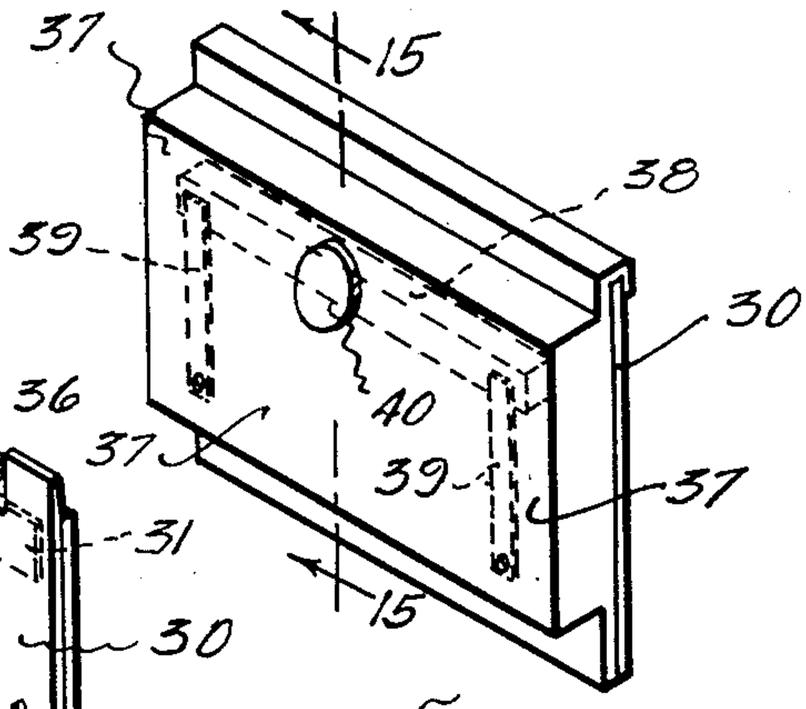

Fig. 13

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Patented Feb. 28, 1939

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UNITED STATES PATENT OFFICE

2,148,600

ELECTRIC CIRCUIT BREAKER AND CUT-OUT

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Application February 17, 1936, Serial No. 64,302

14 Claims. (Cl. 200—116)

This invention relates to new and useful improvements in electric circuit breakers and cut-outs.

One object of the invention is to provide an improved electrical device which will act as a thermostatic cut-out or circuit breaker and which will not burn out or will not be destroyed when operated, but may be restored to circuit closing position and repeatedly reused.

A particular object of the invention is to provide an improved circuit breaker or thermostatic cut-out which will operate only when the circuit becomes overloaded or is directly short circuited.

A further object of the invention is to provide a thermostatic cut-out which is arranged to produce a snap action in breaking the circuit and which requires manual resetting in order to again close the circuit.

Still another object of the invention is to provide an improved circuit breaker which breaks or opens the circuit at the same location which makes a positive calibration of amperage a certainty which does not change after repeated operation.

Still another object of the invention is to provide a thermostatic cut-out employing a resilient member sensitive to predetermined electrical circuit variations and normally restrained to complete the electric circuit, but arranged to automatically disengage itself and open said circuit upon predetermined circuit variations, the construction of the device being such that it is impossible to rupture or change the set form of said member when resetting the same to again close the circuit.

A still further object of the invention is to provide an improved circuit breaker including a bimetallic resilient member which is arranged to engage a lug to close the circuit through the device, the resilient member being so constructed that the normal current flowing therethrough causes the member to positively grip the lug, which assures a positive contact and prevents disengagement of the member from the lug until such time as a short circuit or overload occurs.

A construction designed to carry out the invention will be hereinafter described, together with other features of the invention.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings, in which an example of the invention is shown, and wherein:

Figure 1 is a perspective view of a circuit breaker constructed in accordance with the invention and mounted in a fuse clip such as is used on motor vehicles,

Figure 2 is a longitudinal cross-sectional view taken through the body of the circuit breaker and showing the breaker arm closed in full lines and open in dotted lines,

Figure 3 is a horizontal cross-sectional view, taken through the body of the circuit breaker,

Figure 4 is an enlarged, transverse, vertical sectional view taken on the line 4—4 of Figure 2,

Figure 5 is a similar view taken on the line 5—5 of Figure 2,

Figure 6 is an isometric view of the various parts disassembled,

Figure 7 is a perspective view of another form of the invention,

Figure 8 is a longitudinal vertical section of the form shown in Figure 7,

Figure 9 is a transverse, vertical sectional view, taken on the line 9—9 of Figure 8,

Figure 10 is a perspective view of still another form of the invention,

Figure 11 is a transverse, vertical, sectional view taken on the line 11—11 of Figure 10,

Figure 12 is a transverse, vertical sectional view, taken on the line 12—12 of Figure 10,

Figure 13 is a perspective of still another form of the invention,

Figure 14 is a perspective view of the cut-out panel with the cover removed, and

Figure 15 is a transverse, vertical, sectional view, taken on the line 15—15 of Figure 13.

In the drawings, the numeral 10 designates a body or connecting member made of some non-conductive material, over which or through which an electrical current will not pass. Some fibrous or electrical insulating material in common use, may be employed. This body may take the form of an elongated bar A substantially square, as is shown in Figures 1 to 9, inclusive, or it may be a block B, as is illustrated in Figures 10 to 12; or it may take any other form suitable for the purpose.

In the form shown in Figures 1 to 6 inclusive, a metallic ferrule 11 is arranged to fit over one end of the bar A. This ferrule has its top flattened so as to lie contiguous to the upper surface of the bar, while its sides are rounded or arcuate, as is clearly shown in Figure 6. The ferrule is clamped around the end of the bar so as to frictionally engage the same. A second ferrule 12 is clamped around the opposite end of the bar A, and this ferrule is slightly different in construction. The upper flat side of the ferrule 12 is arranged to engage in a recess 13 which is formed in the end

of the bar. The sides of the ferrule 12 are rounded or arcuate similar to the sides of the first ferrule 11. It is noted that when the ferrule 12 is clamped around the end of the bar with the top thereof engaging in the recess 13, the upper surface of the bar at this end is smooth, the recess being of a depth equal to the thickness of the top of the ferrule 12. The underside of the ferrule 12 is provided with an upwardly extending lug 14 (Figure 2) which engages in a notch 15 formed in the underside of the bar, whereby displacement of the ferrule 12 is impossible. The forward end of the bottom of the ferrule 12 is bent upwardly and outwardly to form a lug 16 and it is noted that when the ferrule is clamped around the end of the bar this lug extends outwardly beyond the end of the bar A as is clearly shown in Figure 2. Further, it is pointed out that the curved sides 12' of the ferrule 12 are extended beyond the lug 16, whereby said sides or extensions serve to encase the lug.

The ferrules 11 and 12 are so formed as to fit the usual terminal clips 17 found in motor vehicles' electric wiring system. By this arrangement, this form of my improved device may be substituted for the perishable fuse now in common use. It is obvious that the ferrules may be inserted or removed from the spring clips 17 in the same manner as the usual fuse.

A breaker arm 18 is employed to connect the ferrules 11 and 12 for opening and closing the circuit from one to the other. This arm is constructed of a thermostatic or bi-metallic metal which is more sensitive to the heat generated by an overloaded or short-circuited electrical circuit than the other elements of such a circuit; and which undergoes expansion when so heated. This arm is provided with an offset 19 near one end which engages in a recess 20 formed in the end of the bar around which the ferrule 11 engages. After this end of the arm is engaged within the recess, the flat top of the ferrule 11 engages over this end of the arm. A portion of the top of the ferrule is then pressed downwardly to contact the offset 19 and to rigidly secure this end of the arm 18 to the body or bar A. It is pointed out that the engagement of the pressed portion of the ferrule 11 not only holds the arm 18 rigidly in position, but also serves to more firmly attach the ferrule to the end of the bar.

The arm 18 is normally curved or bowed upwardly from its attached end and extends the full length of the bar A. The other end of the arm 18 is bent upon itself so as to extend downwardly contiguous to the end of the bar. This end of the arm is formed with a bill 21 which is adapted to engage the outwardly extending lug or keeper 16, which is carried by the ferrule 12. It is noted that normally the arm assumes the position shown in dotted lines in Figure 2, in which case there is no electrical connection through the arm between the ferrules 11 and 12. In order to make electrical connection between the ferrules, it is only necessary to depress the free end of the arm so that the downwardly turned portion thereof is swung downwardly, whereby the bill 21 will engage the keeper 16 of the ferrule 12. When the bill is in engagement with the keeper, the arm 18 lies contiguous to the upper surface of the bar A.

The width of the arm 18 is substantially the width of the bar A, although this is not essential. By arranging the arm so that it will lie flat along the top of the bar when the bill engages the keeper 16, it will be noted that the downward movement of the arm 18 is limited since the top of the bar forms a stop. With this arrangement, it is impossible to rupture or change the form of the arm 18 by forcing it downwardly too far.

The operation of the cut-out is apparent. After the ferrules 11 and 12 have been engaged in the ordinary spring clips 17, and the arm 18 depressed and the bill 21 engaged with the keeper 16, it will be seen that the current will flow from one of the spring clips 17 through the ferrule 11, arm 18, then through the ferrule 12, and other spring clip, whereby the electrical current flows through the device. When the arm 18 is heated by an overloaded circuit or a short circuit, said arm will expand and tend to elongate. This will cause the bill 21 of the arm to be moved out of engagement with the keeper 16, thus releasing or unlatching the arm 18.

Owing to the bow shape and the resiliency of the metal, the arm will immediately spring outwardly to the dotted line position shown in Figure 2. This spring pressure will cause the hook 21 to snap out of engagement with the keeper immediately when the expansion has reached the proper point. The releasing of the arm breaks the circuit and it will remain so until the arm is manually depressed to engage the bill with said keeper. The closing or restoring of the arm to the keeper is also a snap action. The arm does not deteriorate under repeated operations and, therefore, there is no change in the ampere rating. It is noted that since the arm 18 engages the top or upper surface of the bar at the same time that the bill engages the hook, the bar forms a stop for the downward movement of the arm 18, whereby rupturing of the arm or bending it out of its normal shape, due to too great a downward movement thereof, is entirely eliminated. The parts are few in number which reduces the manufacturing cost and when assembled, a very sturdy construction is had.

It is well known that all metals conduct electricity, some more readily than others and it is further well known that the amount of amperage which can be conducted by a given body of metal without heating that metal is dependent on the cross-sectional area of said metal. The bi-metallic metal of which the arm 18 is formed, is constructed so as to carry a certain predetermined amount of current without expanding due to overheating. However, every metal which conducts electrical current will heat to a certain extent when the current is passed therethrough.

Therefore, assuming the hook 21 of the arm 18 to be in engagement with the lug 16, it will be seen that when the normal flow of current passes through the arm, said arm will be heated slightly. This slight heat will act upon the bi-metal to cause said arm to tend to move upwardly. The heat is not sufficient to expand the arm to the point where the hook disengages from the lug 16, but is only sufficient to force the hook into tight engagement therewith. Thus, while the normal flow of current is flowing through the arm, the hook is held in close engagement with the lug. Of course, if there is a short circuit or overload, the arm is overheated and disengages the hook from the lug to break the circuit. Therefore, if foreign matter should get between the lug and hook, this would cause overheating because of the reduced area of metal carrying the current and the arm would be shifted to either disengage the hook from the lug entirely or to seat itself to make good contact. This improved structure of the arm and its engagement with the lug brings

about the improved results and makes the cut-out practical and efficient in operation.

The usual practice has been to provide a thermostatic or bimetallic arm for closing a circuit, the arrangement being such that when an overload or short circuit occurs the expansion of said arm breaks the circuit. In such case, however, as soon as the overload or short circuit is remedied, the arm is cooled to immediately and automatically again close the circuit. In my improved circuit breaker shown in the drawings, when the circuit is broken due to the expansion of the arm **18**, it remains open until such time as the arm **18** is manually depressed to again close the same. There is no automatic closing of the circuit.

In Figures 7, 8 and 9, I have shown a modified form of the invention. In this form, the ends of the bar A are partially rounded (Figures 7 and 9), whereby metallic terminal collars **22** and **23** may be snugly fastened thereon. These collars fit the usual terminal clips (not shown) found in motor vehicle electrical wiring systems.

A breaker arm **24** is employed to connect the collars for opening and closing the circuit from one to the other, and this arm is constructed of a bi-metallic, or thermostatic metal which is sensitive to the heat generated by an overloaded or short-circuited electrical circuit, whereby said arm undergoes expansion when so heated. The arm is bent into a shape to produce its intended function, and this is preferably a general bow shape. One end of the arm is clamped in the collar **22** against the bar A and the arm is inclined upwardly from said collar and then bent at **25** so as to overhang the collar **23**. A downturned hook **26** is formed on the free end of the arm and this hook terminates in a bill **27** adapted to engage in an upturned keeper **28** upset from the collar **23**. The operation of this form is the same as the first form and it is obvious that when the arm is heated by an overloaded or short-circuited circuit, the arm will expand and tend to elongate, which will cause the bill **27** to disengage the keeper **28** whereby the circuit is broken. In this form, as in the other form, the normal position of the arm **24** is disengaged, as shown in dotted lines in Figure 8. Thus when the circuit is broken due to the expansion of the arm, it will not be closed until such time as the arm is again depressed. In Figures 10, 11 and 12, the breaker arm **18'** is made similar to the arm **18** and is mounted on the block B. The arm **18'** normally is bowed upwardly from the top of the block, as shown in dotted lines in Figure 12 and is provided with a bill **21'** which is adapted to engage a keeper **16'** carried by the lower end of said block. The keeper **16'** projects from one side of an angular terminal member **16***a*. By observing Figure 12, it will be seen that when the arm **18** is depressed its bill will engage the keeper **16'**, whereby an electrical circuit is closed between the contact screw C which passes through the block B and member **16***a*, and the contact screw D which passes through the block and arm **18'** to hold said arm in place on the bar. The screws are, of course, suitably connected to electrical lead wires (not shown) by the lock nuts E which are threaded thereon. The operation of this form is exactly the same as the first form and the arm **18'** is so constructed that the top or upper surface of the block B forms a stop which limits the downward movement of the arm **18'**, whereby the danger of rupturing said arm in depressing the same, is eliminated.

In Figures 13, 14 and 15, a plurality of the circuit breakers are shown mounted on a single panel, and enclosed within a casing. In the form shown, a supporting panel **30** of electrical non-conducting material is provided with a transverse bar **31** which has its upper end bent to form a keeper **32**. The bar is suitably secured to the rear of the panel with the keeper extending above the upper edge thereof. A contact screw **33** passes through the panel and bar, whereby an electrical lead wire may be connected with the bar.

A plurality of contact arms **34**, similar to the arms **18**, are fastened to the front face of the panel by contact screws **35**, and the upper end of each arm is formed with a hook **36** adapted to engage the keeper **32**. It is noted that all the arms **34** engage the single transverse keeper **32**. Each arm may be connected in a different circuit to protect that circuit.

The contact arms **34** are covered by a suitable casing **37** which is arranged to fit thereover. The casing is fastened to the panel **30**. The operation of the arms **34** is exactly the same as the arms in the other forms. Since each arm is connected in a different circuit, it is obvious that one of said arms may be actuated to release the keeper, while the others remain in circuit closing position.

For returning any one or all of the arms into engagement with the keeper **32** after actuation, a transverse return bar **38** of electrical non-conducting material is provided. This bar is carried by a pair of flat springs **39** which normally hold the bar away from the arms **34**. An actuating button **40** on the outside of the casing **37** is fastened to the bar and it is obvious that when the button is depressed, the bar **38** is moved inwardly. Inward movement of the bar will cause the same to engage the upper end of any one of the arms **34**, which may be in a released position, to move said bar into engagement with the keeper **32**.

What I claim and desire to secure by Letters Patent, is:

1. An electric circuit breaker including, an elongated electrical insulating bar, metallic collars mounted on the ends of said bar and adapted to engage between retaining members of a support whereby the bar is detachably mounted on the support, a thermostatic spring metallic arm attached at one end to one of said collars, a keeper on the other collar, and a hook on the arm engaging said keeper.

2. An electric circuit breaker including, a connecting member of non-conducting material, spaced metallic terminals carried by said member, and a thermostatic arm overlying the member and hinged to one terminal and normally disengaged from the other terminal, said arm being adapted to be manually depressed to be hooked to the other terminal, the movement of the arm being limited by said arm engaging the member, whereby rupturing of the arm is prevented.

3. A quickly replaceable electric circuit breaker including, a connecting member of non-conducting material, spaced metallic terminals carried by said member, a stationary latch keeper projected from one of the terminals, a thermostatic arm having one end secured to one of the terminals, and a hook on the opposite end of said arm arranged to engage the keeper on the opposite terminal, whereby said arm may unlatch from said keeper and open the circuit when said arm is heated said terminals being free for insertion in the clips of a circuit breaker mounting.

4. A quickly replaceable electric circuit breaker including, a connecting member of non-conducting material, spaced metallic terminals carried by said member, a stationary latch keeper projected from one of the terminals, a spring thermostatic arm having one end secured to one of the terminals, and a hook on the opposite end of said arm arranged to engage the keeper on the opposite terminal, whereby said arm may unlatch and spring away from the keeper and connecting member to open the circuit when said arm is heated said terminals being free for insertion in the clips of a circuit breaker mounting.

5. A quickly replaceable electric circuit breaker including, a connecting member of non-conducting material, spaced metallic terminals secured to said member, a stationary latch keeper projected from one of the terminals, a resilient thermostatic arm having one end held stationary by one of the terminals, the remainder of the arm overlying the exterior of the connecting member, and a hook at the opposite end of said arm arranged to engage the keeper, whereby said arm may unlatch from said keeper and move away from said member to open the circuit when heated said terminals being free for insertion in the clips of a circuit breaker mounting.

6. An electric circuit breaker including, an elongate connecting bar of non-conducting material, metallic terminals mounted on the ends of the bar and shaped to engage retaining clips, a stationary latch keeper projected from one of the terminals, a spring thermostatic arm having one end secured in the opposite terminal, and a hook directed inwardly from the opposite end of the arm so as to overhang the bar and engaging with the keeper, whereby said arm may unlatch and spring away from said keeper to open the circuit when the arm is heated.

7. An electric circuit breaker including, an elongate bar of non-conducting material, spaced metallic terminals mounted on the ends of said bar, a stationary latch keeper projected from one of the terminals beyond the end of the bar, projections extending from the keeper terminal on each side of said keeper, and a spring thermostatic arm having one end secured to one of the terminals and provided with a hook at its opposite end engaging the keeper between the projections, whereby said arm may unlatch from said keeper to open the circuit when the arm is heated.

8. An electric circuit breaker including, an elongate electrical insulating bar, metallic terminals mounted on the ends of the bar and having portions shaped to prevent rotation of said bar when placed in terminal clips, whereby said bar is held in a predetermined non-rotatable position, a stationary latch keeper projected from one of the terminals, and a spring thermostatic arm having one end clamped to the bar by one of the terminals and provided with an inwardly directed hook at its opposite end latching on the keeper, whereby said arm may unlatch from said keeper to open the circuit when the arm is heated.

9. An electric circuit breaker including, an electrical insulating member, a stationary metallic electric terminal secured to one extremity of said member and having a projecting keeper in close proximity to said member, a thermostatic resilient metal arm mounted on said support at a terminal point spaced from the keeper and provided with a terminal at its mounting, and a hook on the free end of the arm overhanging and engaging on the projecting keeper, whereby said arm when overloaded by an electrical current elongates and releases the hook from said keeper projection and springs away therefrom.

10. A removable electric circuit breaker including, an elongate electrical insulating bar, metallic terminals mounted on the ends of said bar and insulated thereby from each other, said terminals being arranged to engage in the clips of a circuit breaker mounting, a thermostatic spring metallic arm mounted at one end of the bar in connection with the terminal thereat, a keeper on the other terminal, and a hook on the free end of said arm overhanging and engaging on the projecting keeper, whereby said arm when overloaded by an electrical current elongates and releases the hook from said keeper projection and springs away therefrom.

11. An electric circuit breaker including, a relatively thin panel member of electrical non-conducting material, spaced metallic terminals carried by the member, and a thermostatic arm overlying the member and having hinged connection with one of the terminals and normally disengaged from the other terminal, said arm being adapted to be manually depressed so as to be engaged and connected with the other terminal, the movement of the arm being limited by the engagement of said arm with the surface of the panel member.

12. An electric circuit breaker including, a base member of electrical non-conducting material, a metallic terminal carried by the member, a thermostatic arm connected to said terminal and having its free end arranged to be swung with relation to the base member and normally spaced therefrom, a second metallic terminal carried by the base member and located on the side opposite to which the arm is connected, said panel having an opening through which the free end of the arm may pass so that when the arm is depressed it will engage said second terminal to establish an electrical connection therebetween.

13. An electric circuit breaker including, a base member of electrical non-conducting material, a metallic terminal carried by the member, a thermostatic arm connected to said terminal and having its free end arranged to be swung with relation to the base member and normally spaced therefrom, a second metallic terminal carried by the base member and located on the side opposite the side to which the arm is connected, said panel having an opening through which the free end of the arm may pass so that when the arm is depressed it will engage said second terminal to establish an electrical connection therebetween, the depressing of the arm being limited by the engagement of said arm with the base panel, whereby rupturing of said arm is prevented.

14. An electric circuit breaker including, an electrical insulating member, a stationary metallic terminal carried by the member, a thermostatic resilient metal arm mounted on said member at a point spaced from the metallic terminal and provided with a terminal at its mounting, and a hook on the free end of the arm overhanging and adapted to be engaged with the first mentioned stationary terminal, whereby said arm when overloaded by an electrical current elongates and releases the hook from said terminal and springs away from said terminal.

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