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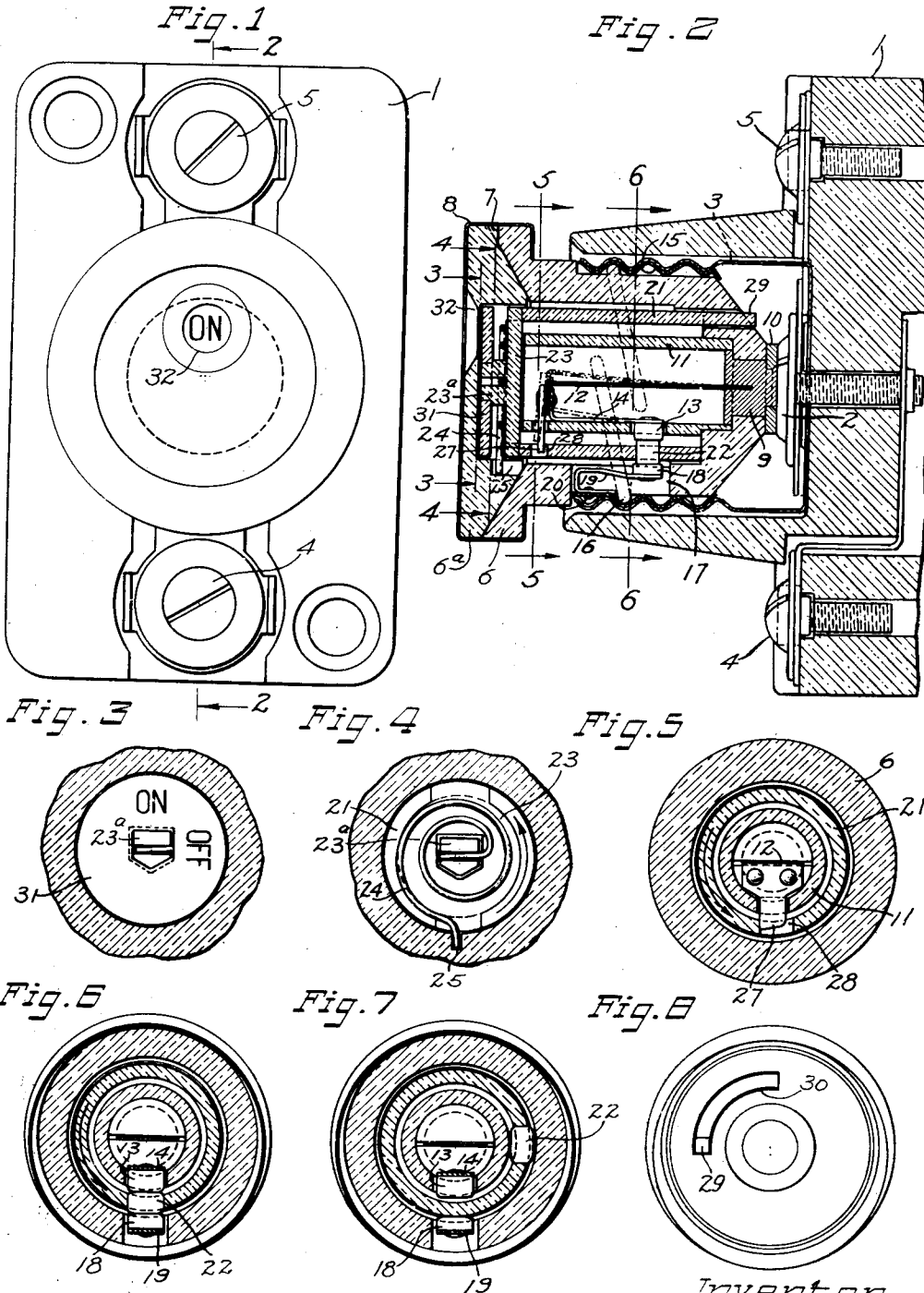
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AUTOMATIC CIRCUIT BREAKER

Filed Nov. 25, 1935

2 Sheets-Sheet 1



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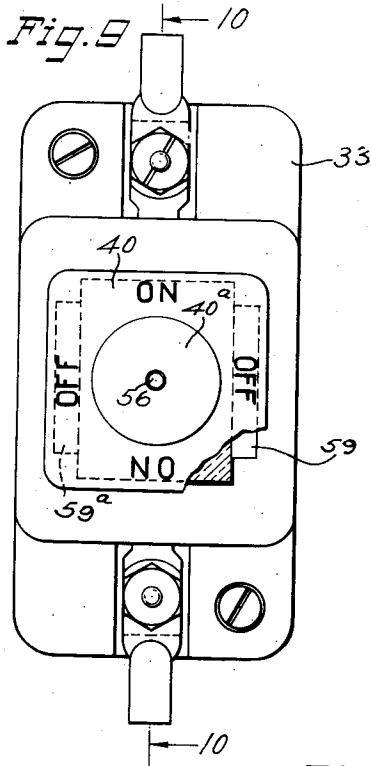
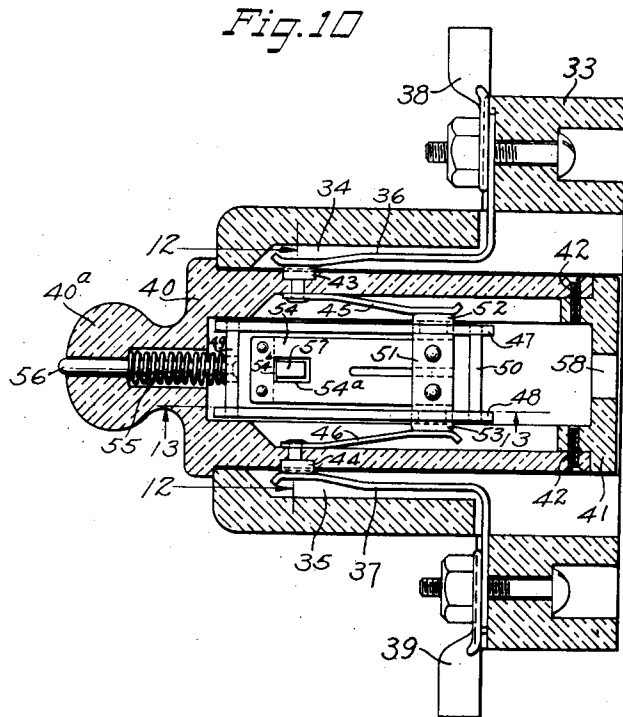
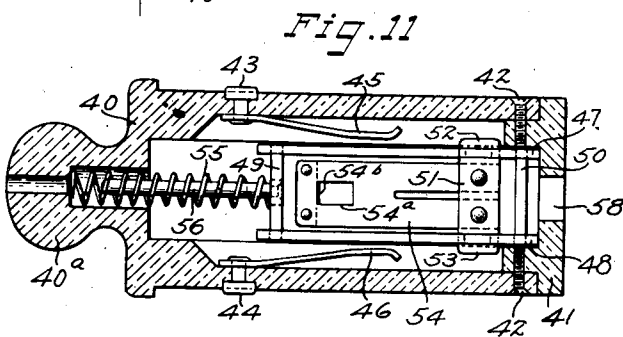
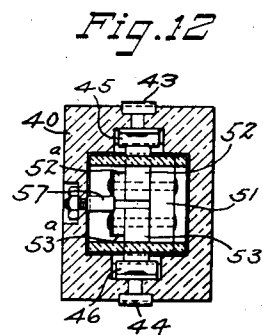
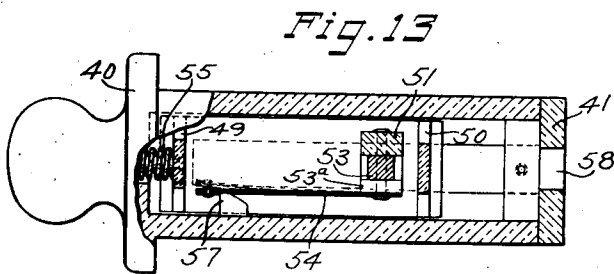
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,172,684

AUTOMATIC CIRCUIT BREAKER

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necticut

Application November 25, 1935, Serial No. 51,389

9 Claims. (Cl. 200—116)

The invention is particularly applicable to small circuit breakers, and the general object of the invention is to provide a small circuit breaker which is simple and inexpensive, and which has some of the advantages of a "handle free" circuit breaker although avoiding much of the expense which is incident to a true "handle free" circuit breaker.

The foregoing general object of the invention is attained by providing an arrangement of parts which is such that, after automatic opening of the circuit, the automatically-acting mechanism can be rendered accessible for resetting only by first interrupting the circuit at one or more places separate from the said automatic mechanism, and thus insuring that the said mechanism is out of circuit while being reset.

Another more specific object of the invention is to provide a circuit breaker unit which is adapted to be engaged with a suitable holder or socket, the said unit including an automatically operating circuit breaking means which is so arranged as to be capable of resetting to restore the circuit connection only when the unit is disengaged from the holder or socket.

A further object of the invention is to provide a circuit breaker unit of the character last above described which is adapted to be inserted in a socket of the type primarily intended for holding a fuse.

Other objects of the invention will be apparent from the following specification and claims.

In the accompanying drawings I have shown two embodiments of the invention in order that its character may be fully explained, but it will be understood that the drawings are intended for illustrative purposes only and are not to be construed as defining or limiting the scope of the invention, the claims forming a part of this specification being relied upon for that purpose.

Of the drawings:

Fig. 1 is a front view of a circuit breaker unit embodying the invention, the said unit being mounted in a holder or socket such as is primarily intended for holding a plug fuse.

Fig. 2 is a vertical sectional view taken along the line 2—2 of Fig. 1.

Fig. 3 is a transverse vertical sectional view taken along the line 3—3 of Fig. 2.

Fig. 4 is a transverse vertical sectional view taken along the line 4—4 of Fig. 2.

Fig. 5 is a transverse vertical sectional view taken along the line 5—5 of Fig. 2.

Fig. 6 is a transverse vertical sectional view taken along the line 6—6 of Fig. 2.

Fig. 7 is a view similar to Fig. 6 but showing the movable contact member in its "off" position.

Fig. 8 is a view showing the rear end of the circuit breaker unit.

Fig. 9 is a front view of a circuit breaker constituting an alternative embodiment of the invention.

Fig. 10 is a vertical sectional view taken along the line 10—10 of Fig. 9.

Fig. 11 is a view similar to Fig. 10, but showing the removable unit only and showing the movable contact member in its "off" position.

Fig. 12 is a transverse vertical sectional view taken along the line 12—12 of Fig. 10 and showing the removable unit only.

Fig. 13 is a combined elevational and longitudinal sectional view showing the removable unit only, the section being taken along the line 13—13 of Fig. 10.

As illustrated, a circuit breaker embodying the invention includes a stationary holder and also includes a unit which is movable with respect to the holder and which comprises a carrier and circuit connectible conducting elements on the carrier. The unit comprises a suitable connection carried entirely by the carrier and electrically connecting the said conducting elements, and it also comprises means serving to automatically break the said electrical connection between the said conducting elements upon the attainment of abnormal current conditions in the circuit. The construction is such that the circuit breaking means on the carrier can be manually reset to restore the electrical connection between the said conducting elements only when the carrier is moved out of its normal engaged relationship with the holder. Preferably circuit connectible stationary contacts are provided on the holder which normally engage with the before-mentioned conducting elements on the carrier, and the arrangement is such that at least one of these stationary contacts is disengaged when the carrier is moved. Inasmuch as the carrier must be moved before the circuit breaking means on the carrier can be reset, it will be obvious that the resetting of the said means can take place only when the circuit is broken between the contacts on the holder and the conducting elements or contacts on the carrier.

The invention may be embodied in a conventional fuse block or socket, such as is intended for holding a plug fuse. A holder of this type is shown in Figs. 1 and 2 wherein 1 represents an insulating base of conventional form. Mount-

ed on the base 1 are center and screw shell contacts of conventional form, these being electrically connected respectively with wire terminals 4 and 5 of conventional form.

5 The circuit breaker unit adapted to be used in cooperation with the holder or socket 1, preferably, is of approximately the same size and shape as a conventional plug fuse, being adapted to engage in the ordinary way with the contacts 2 and 3. As shown, the main body or casing of the unit
10 consists of two pieces of porcelain or other suitable insulating material, these pieces or members being designated 6 and 6^a. The said members 6 and 6^a are connected with each other to prevent
15 relative rotative movement by means of a projection and groove at 7, and they are held together by a band of metal 8 which is crimped around them. The casing member 6 is hollow, having a substantially cylindrical opening therein, and the rear wall of the casing has a smaller
20 cylindrical opening therein into which is fitted a contact button 9. A projecting portion of the button 9 is riveted over a washer 10 and the said button and washer are adapted to engage with
25 the center contact 2 of the holder or socket.

Concentrically mounted within the opening in the casing 6 is a tube 11 of insulating material, this tube being held against rotation. A bimetallic strip 12 is centrally located within the tube
30 11 and the rear end portion thereof is rigidly held in a suitable slot in the conducting button 9. A contact 13 is fixedly mounted in a hole in one side of the tube 11, and this contact 13 is electrically connected with the front end portion
35 of the bimetallic strip 12 by means of a flexible conductor 14.

Surrounding the insulating casing member 6 is a threaded sheet metal conducting element 15 which is adapted to engage in the usual manner
40 with the threaded contact 3 in the holder or socket. The element 15 is secured to the casing member 6 in any usual or preferred manner as, for instance, by means of a thread 16 formed integrally on the said element 6. The casing member 6 is provided at one side with a slot 17 which
45 is in register with the before mentioned contact 13 on the tube 11. Positioned within the slot 17 is a contact 18, this contact 18 being electrically connected with the threaded conductor 15 by means of a resilient conductor 19. The conductor
50 19 is connected with the threaded conductor 15 in any usual way as, for instance, by riveting, as shown at 20.

Also concentrically mounted in the opening in the casing member 6 is a tube 21 of insulating material, this tube surrounding the tube 11 and being freely rotatable about its own axis. Carried by the tube 21 is a contact or conducting element 22 which is normally positioned to engage
55 the before mentioned contacts 13 and 18 to establish an electrical connection between them, as clearly shown in Figs. 2 and 6.

At the forward end of the tube 21 are opposite notches adapted to receive suitable projections on a disc 23 which is also preferably formed of insulating material. By reason of the engagement
65 of the projections on the disc 23 with the notches in the tube 21, these two elements are rotatable in unison. A spiral spring 24 is provided, having its outer end seated in a notch 25 in the casing member 6^a and having its inner end seated in a notch in a projection 23^a formed on the disc 23. The spring 24 serves to bias the disc 23
70 and the tube 21 for movement in the counter-clockwise direction, thus tending to move the

electrical contact 22 from its circuit making position as shown in Fig. 6 to its circuit breaking position as shown in Fig. 7.

The tube 21 is normally held against movement under the action of the spring 24 by means of a latch element 27 which is secured to the bimetallic strip 12 at the forward end thereof and which projects through a slot in the tube 11 into a slot 28 in the tube 21.

After the rotatable parts have moved from the position shown in Fig. 6 to the position Fig. 7, they can be reset to restore the normal circuit connection by means of an element or device 29 which is secured to or formed as a part of the tube 21 and which projects through an arcuate slot or aperture 30 formed in the rear wall of the casing element 6. By means of the device 29 the parts can be turned to permit the latch 27 to reengage the edge of the slot 28 in the tube 21.

In order to clearly indicate whether the movable parts of the circuit breaker are in their "on" position or in their "off" position, there is preferably provided a disc 31 which is at the front of the spring 24 and which is rotatable in unison with disc 23 and the tube 21. Preferably and
25 as shown the projection 23^a on the disc 23 is non-circular in contour and the disc 31 has a similarly shaped opening for receiving the projection 23^a.

The disc 31 is marked with suitable indicating data as, for instance the words "on" and "off", and an aperture is provided at 32 in the front casing member 6^a through which one or the other of the said words can be seen according to the position of the rotatable parts.

In normal use, the circuit breaker unit is mounted in a holder or socket such as 1, and it serves to establish an electrical connection between the center contact 2 and the screw shell contact 3. This circuit connection extends through the button 9, the bimetallic strip 12, the conductor 14, the contact 13, the contact 22, the contact 18, the conductor 19 and the threaded conductor 15. This normal circuit connection is maintained so long as the current conditions therein are within a normal predetermined range. However, upon the attainment of abnormal current conditions in the circuit, ordinarily current in excess of a predetermined maximum, the bimetallic strip 12 becomes heated, and in accordance with the well known characteristic of such a strip, is deflected to the position shown by dot-and-dash lines in Fig. 2. This movement of the bimetallic strip withdraws the latch 27 from the notch 28 in the tube 21 and thus permits the tube to move in the counter-clockwise direction under the influence of the spring 24. This carries the contact 22 to the position shown in Fig. 7, thus breaking the circuit at two places. It will be observed that in the open circuit position, a portion of the insulating tube 11 is interposed between the two contacts 13 and 18. This movement to circuit breaking position brings the word "off" into register with the opening 32, thus clearly indicating that the circuit breaker has automatically
65 operated.

The movable contact 22 and the parts movable therewith can be restored to their circuit making position by manually moving the projecting device 29, but this device and its slot or aperture 30 are entirely inaccessible when the circuit breaker unit is in its normal engaged relationship with the holder or socket 1. In order to obtain access to the device 29, it is necessary to first disengage the unit from the socket by unscrewing

it. Then the device 29 can be manually engaged and rotated so as to restore the movable parts to the positions shown in Figs. 2 and 6, the latch 27 then reengaging the wall of the notch 28 as shown in Fig. 5. This movement also brings the word "on" into register with the opening 32, thus indicating that the circuit breaker is in its circuit making position. After being thus reset, the unit can be again engaged with the contacts in the holder or socket, and the circuit can be reestablished.

In view of the fact that the resetting device 29 and its aperture are normally inaccessible, the circuit breaker has some of the advantages of a "handle free" circuit breaker, and is acceptable for service in installations wherein low cost is essential and wherein frequent manual opening and closing of the circuit is not required. The fact that the device 29 is inaccessible when the current is on makes it impossible for anyone to manually hold it in the "on" position under excess current conditions.

In Figs. 9 to 13, I have shown a circuit breaker embodying the same general principles as are embodied in the circuit breaker already described, but the details of construction are quite different. Instead of providing a unit which must be screwed into engagement with the stationary contacts, I have provided a unit which can be engaged or disengaged with its stationary contacts by being moved inward or outward in straight lines.

An insulating base 33 is provided which constitutes the main body of the holder or socket. This base has an opening therein which extends from front to rear thereof. At the top and bottom of this opening are grooves 34 and 35 in which are located resilient contact members 36 and 37 which are connected with suitable wire terminals 38 and 39 rigidly secured in the main body of the base 33.

A carrier or casing is provided which is adapted to fit the hole in the base 33 so as to be free for rearward or forward movement therein along straight lines. As shown the carrier is entirely removable from the base or holder. The carrier or casing comprises a main body 40 of insulating material having a handle or knob 40^a at the front. This body 40 is hollow and it has an approximately rectangular opening therein, the said opening being substantially closed at the rear by a member 41 which is secured in place by means of screws 42, 42. Fixedly secured in opposite side walls of the casing 40 and projecting slightly therefrom are contacts 43 and 44 which are adapted to normally engage the before mentioned contacts 36 and 37 carried by the base or holder 33. Electrically connected with the said contacts 43 and 44 and positioned in grooves at opposite sides of the interior recess in the casing 40 are resilient contacts 45 and 46.

Slidably mounted in the rectangular opening in the casing 40 is a contact carrying member. This contact carrying member comprises two main insulating side plates 47 and 48 which are guided for rectilinear movement by the walls of the recess in the casing. These side plates are connected near their ends by transverse insulating plates 49 and 50 and they are also connected by means of a transverse insulating bar 51 which is between the plates 49 and 50, being somewhat nearer the latter. Carried by the insulating bar 51 and projecting through suitable apertures in the insulating plates 47 and 48 are movable contacts 52 and 53 which are adapted to engage

respectively with the resilient contacts 45 and 46, as clearly shown in Fig. 10. Electrically connected with the two contacts 52 and 53 is a U-shaped bimetallic strip 54, this strip preferably being spaced laterally from the contacts by means of spacing washers 52^a and 53^a.

The contact carrying member is biased toward the rear by means of a coil spring 55 at the front, which is positioned in part in a suitable recess in the front handle portion 40^a of the casing 40. Preferably, a guide pin 56 is provided for the spring 55 and this pin is made long enough so that when the parts are in circuit making position, as shown in Fig. 10, the front end of the pin 56 projects slightly at the front of the knob 40^a.

For holding the contact carrying member and the contacts in a circuit making position, as shown in Fig. 10, there is provided a metallic finger 57 which is secured to one side wall of the casing 40 and projects inward therefrom. This finger 57 normally extends into an opening 54^a formed in the bimetallic strip 54 and engages the outer edge of the said opening to hold the strip and also the contacting carrying member and the contacts in their circuit closing positions, thus resisting the bias of the spring 55. The bimetallic strip 54 may be provided with a separate wear piece 54^b, as shown, for engagement with the finger 57. The insulating plate 49 has a notch therein to provide clearance for the finger 57, when the contact carrying member is moved by the spring 55.

After the movable parts have moved from the position shown in Fig. 10 to the position shown in Fig. 11 they can be reset to restore the normal circuit connection by inserting a suitable tool through an opening or aperture 58 in the rear member 41. This tool will engage the transverse insulating plate 50, which thus serves as a resetting device, and in this way the movable parts can be restored to the position shown in Fig. 10 with the bimetallic strip 54 engaged with the finger 57.

In normal use, the circuit breaker unit is mounted in a holder or socket such as shown in Figs. 9 and 10, and it serves to establish an electrical connection between the two stationary contacts on the holder or socket. This circuit is established through the contact 43, the contact 45, the contact 52, the U-shaped bimetallic strip 54, the contact 53, the contact 46 and the contact 44. This normal circuit connection is maintained so long as the current conditions therein are within a normal predetermined range. However, upon the attainment of abnormal current conditions in the circuit, ordinarily current in excess of a predetermined maximum, the bimetallic strip 54 becomes heated and is deflected to the position shown by dot-and-dash lines in Fig. 13. This movement of the bimetallic strip disengages the strip from the finger 57 and thus permits the contact carrying member to move toward the rear under the influence of the spring 55. In this way the contacts 52 and 53 are moved to the positions shown in Fig. 11, thus breaking the circuit at two places.

It will be observed that when the parts are in circuit making position, as shown in Fig. 10, the front end of the pin 56 projects slightly at the front of the knob 40^a, and that when the parts are in the circuit breaking position, as shown in Fig. 11, the said pin 56 is withdrawn into the interior of the knob. This pin thus constitutes a convenient indicator to show whether the circuit

breaker parts are in their "on" or in their "off" position.

The circuit can be manually broken at any time by withdrawing the circuit breaker unit from its holder or socket, thus disengaging the contacts 43 and 44 from the stationary contacts 36 and 37. After the circuit has been opened automatically as the result of abnormal current conditions, the movable parts can be restored only by inserting a tool through the aperture 58 into engagement with the resetting device 50, as already described, but the aperture 58 is accessible for the insertion of the tool only after the unit has been removed from the holder or socket. Thus, the circuit breaker unit can be reset to restore the normal electric connection there-through only by first removing it from the socket or holder, thus assuring that the unit will be out of circuit while being reset.

In view of the fact that the means permitting resetting of the circuit breaker is normally inaccessible, the circuit breaker has some of the advantages of a "handle free" circuit breaker, and is acceptable for service in installations wherein low cost is essential. The fact that the resetting aperture is inaccessible when the current is on, makes it impossible for any one to manually hold the circuit breaker in the "on" position under excess current conditions.

The circuit breaker unit is normally put in position as shown so that the contacts 43 and 44 engage the resilient contacts 36 and 37 to establish the electrical connection through the circuit breaker as already described. If it is desired to manually break the circuit, this is done by withdrawing the unit, thus breaking the circuit at two places. The circuit can be reestablished by restoring the unit to its normal position. It is sometimes desired to leave the circuit interrupted for an indefinite period of time and, in order that this may be accomplished without leaving the circuit breaker unit detached from its socket or holder, I preferably provide the central recess in the holder with extensions 59 and 59^a at the sides thereof which are of such size as to permit the circuit breaker unit to be inserted in the opening after being turned through an angle of 90 degrees. When the circuit breaker unit is thus turned and reinserted in the socket or holder, the contacts 43 and 44 do not engage the contacts 36 and 37, and the circuit through the device remains broken. Preferably, in order that the user may conveniently know whether the circuit breaker unit is inserted in its "on" position or in its "off" position, the words "on" and "off" are marked on the front face of the casing 40, as clearly shown in Fig. 9.

What I claim is:

1. An automatic circuit breaker unit of the screw plug type adapted to be engaged with a holder having an internally threaded contact and a center contact both located in a socket, the said unit comprising in combination, an insulating casing having a portion adapted to enter the socket in the holder, an externally threaded contact and a center contact on the last said portion of the casing and adapted to engage the said contacts in the socket of the holder, a connection carried entirely by the casing and electrically connecting the said contacts thereon, and means within the casing serving to automatically break the said electrical connection between the contacts on the casing upon the attainment of abnormal current conditions in the circuit, the last said means including a device manually mov-

able to restore the said electrical connection which device is accessible only from a position at the inner end of the casing between the threaded contact and the center contact.

2. An automatic circuit breaker unit adapted to be engaged with a holder having two circuit connectible contacts thereon, the said unit comprising in combination, an insulating casing, two spaced external contacts on the casing adapted to engage the contacts on the holder, two contacts within the casing electrically connected respectively with the said external contacts, a movable contact member within the casing having a movable conducting element normally in circuit making engagement with the last said contacts but movable out of engagement with both of them to break the circuit, the said contact member being inaccessible for manual movement in the circuit making direction when the unit is normally engaged with the holder but otherwise accessible for such movement, and an electro-responsive means within the casing automatically serving upon the attainment of abnormal circuit conditions in the circuit to cause circuit breaking movement of the contact member.

3. An automatic circuit breaker unit adapted to be engaged with a holder having two circuit connectible contacts thereon, the said unit comprising in combination, an insulating casing, two spaced external contacts on the casing adapted to engage the contacts on the holder, two contacts within the casing electrically connected respectively with the said external contacts, a movable contact member within the casing having movable contact means normally engageable with the last said contacts in the casing, the said member being biased for movement to the circuit breaking direction and being manually resettable after such movement but being inaccessible for resetting except when the unit is disengaged from the holder, and a bimetallic strip connected in the circuit within the casing and normally serving to hold the contact member in its circuit making position, the said strip being automatically deflectible upon the attainment of abnormal circuit conditions to release the contact member for circuit breaking movement.

4. An automatic circuit breaker unit adapted to be engaged with a holder having two circuit connectible contacts thereon, the said unit comprising in combination, an insulating casing, two spaced external contacts on the casing adapted to engage the contacts on the holder, a contact within the casing electrically connected with one of the said external contacts, a tubular contact member within the casing rotatable about its own axis and having a movable circuit connected conducting element normally in circuit making engagement with the last said contact in the casing but movable out of such engagement to break the circuit, the said contact member being prevented from being manually rotated from its circuit breaking position to its circuit making position when the unit is normally engaged with the holder but otherwise being manually so rotatable, and an electro-responsive means within the tubular contact member automatically serving upon the attainment of abnormal circuit conditions in the circuit to cause circuit breaking rotation of the said contact member.

5. An automatic circuit breaker unit adapted to be engaged with a holder having two circuit connectible contacts thereon, the said unit comprising in combination, an insulating casing, two spaced external contacts on the casing adapted

to engage the contacts on the holder, two contacts within the casing electrically connected respectively with the said external contacts, a rotatably movable tubular contact member within the casing having movable contact means engageable with the last said contacts in the casing, the said member being biased for rotation to the circuit breaking direction and being manually resettable after such rotation but being inaccessible for resetting except when the unit is disengaged from the holder, and a bimetallic strip positioned within the tubular contact member and connected in the circuit and normally serving to hold the said contact member in its circuit making position, the said strip being automatically deflectible upon the attainment of abnormal circuit conditions to release the contact member for circuit breaking rotation.

6. An automatic circuit breaker unit adapted to be engaged with a holder having two circuit connectible contacts thereon, the said unit comprising in combination, an insulating casing, two spaced external contacts on the casing adapted to engage the contacts on the holder, a contact within the casing electrically connected with one of the said external contacts, a movable contact member within the casing having a movable circuit connected conducting element normally in circuit making engagement with the last said contact in the casing but movable out of such engagement to break the circuit, the said contact member being prevented from being manually moved from its circuit breaking position to its circuit making position when the unit is normally engaged with the holder but otherwise being manually so movable, means normally biasing the contact member for circuit breaking movement, and a bi-metallic strip bodily movable with the contact member and normally serving to prevent circuit breaking movement thereof, the said strip being responsive to abnormal circuit conditions in the circuit and thereupon releasing the contact member for automatic circuit breaking movement.

7. An automatic circuit breaker unit adapted to be engaged with a holder having two circuit connectible contacts thereon, the said unit comprising in combination, an insulating casing, two spaced external contacts on the casing adapted to engage the contacts on the holder, a contact within the casing electrically connected with one of the said external contacts, a rectilinearly movable contact member within the casing having a movable circuit connected conducting element normally in circuit making engagement with the last said contact in the casing but movable out of such engagement to break the circuit, the said contact member being prevented from being man-

ually moved rectilinearly from its circuit breaking position to its circuit making position when the unit is normally engaged with the holder but otherwise being manually so movable, means normally biasing the contact member for circuit breaking movement, and a bi-metallic strip bodily movable with the contact member and normally serving to prevent circuit breaking movement thereof, the said strip being responsive to abnormal circuit conditions in the circuit and thereupon releasing the contact member for automatic circuit breaking movement.

8. An automatic circuit breaker unit adapted to be engaged with a holder having two circuit connectible contacts thereon, the said unit comprising in combination, an insulating casing, two spaced external contacts on the casing normally electrically connected with each other and adapted to engage the contacts on the holder, two contacts within the casing electrically connected respectively with the said external contacts, a movable contact member within the casing having two movable contacts engageable respectively with the last said contacts in the casing, the said member being biased for movement to the circuit breaking direction and being manually resettable after such movement but being inaccessible for resetting except when the unit is disengaged from the holder, and a bimetallic strip connected in the circuit between the last said contacts and movable therewith and normally serving to hold the contact member in its circuit making position, the said strip being automatically deflectible upon the attainment of abnormal circuit conditions to release the contact member for circuit breaking movement.

9. The combination of a holder having a socket therein, two stationary circuit connectible contacts in the socket, and an automatic circuit breaker unit comprising a carrier or casing adapted to be inserted in the socket in either of two different positions, two contacts on the casing located to engage the contacts in the socket in one position of the casing and not to engage them in the other position of the casing, a connection carried entirely by the casing and electrically connecting the contacts thereon, means within the casing serving to automatically break the said electrical connection between the contacts on the casing upon the attainment of abnormal current conditions in the circuit, and a manually operable device carried by the casing for resetting the automatic circuit breaking means to restore the said electrical connection which device is inaccessible when the unit is in normal engagement with the holder and is accessible when the unit is out of normal engagement with the holder.

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