July 8, 1958 R. G. PAGE 2,842,641

CIRCUIT BREAKER

Filed Feb. 16, 1956 2 Sheets-Sheet 1

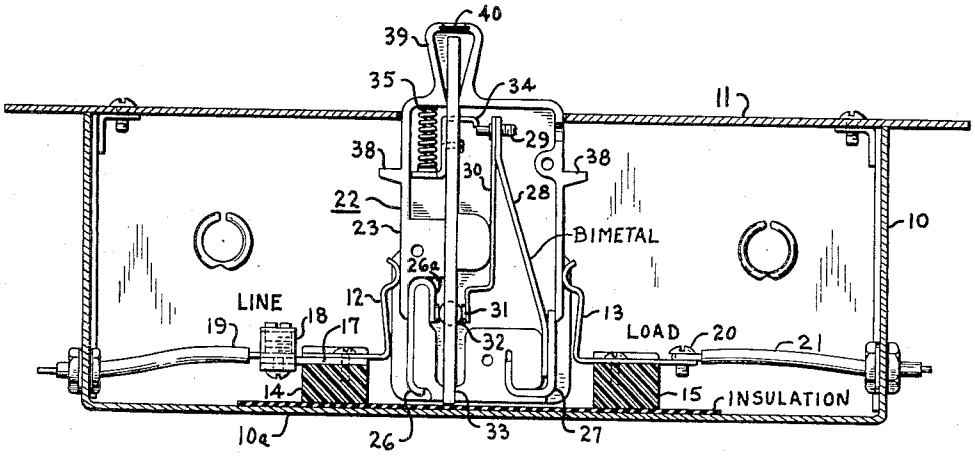


Fig. 1

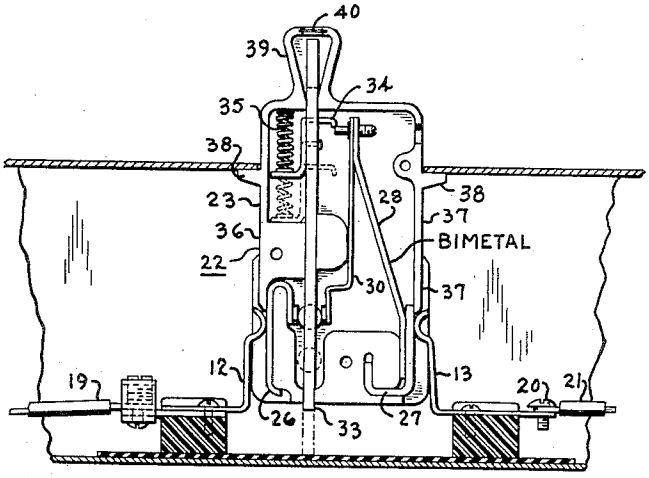


Fig. 2

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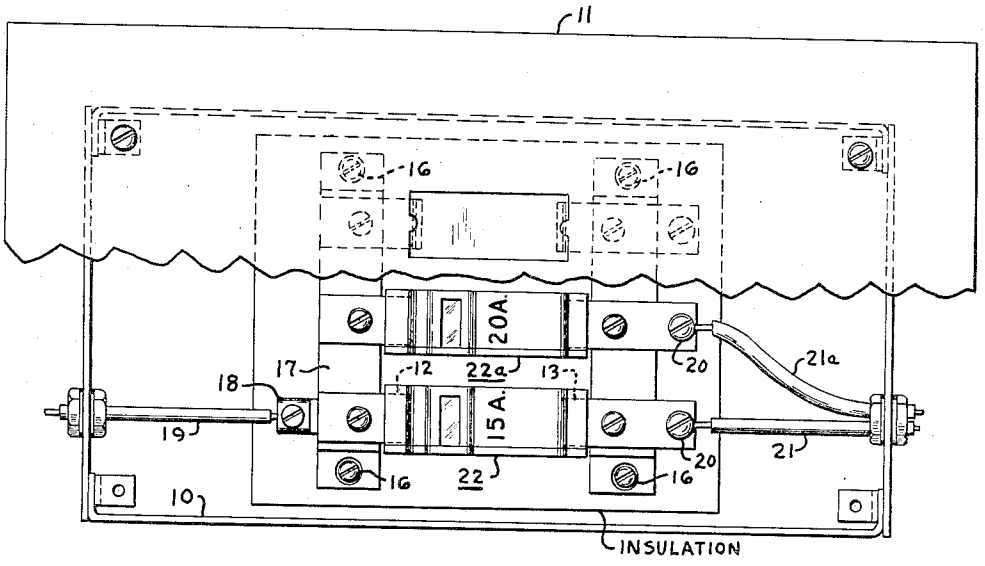


Fig. 3

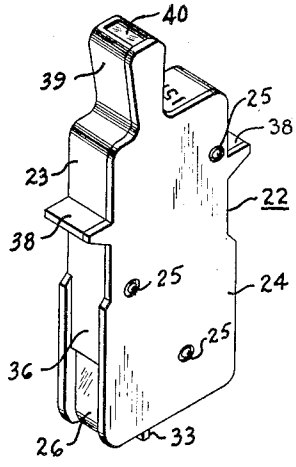


Fig. 4

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United States Patent Office 2,842,641 Patented July 8, 1958

2,842,641

CIRCUIT BREAKER

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Application February 16, 1956, Serial No. 565,836
10 Claims. (Cl. 200—114)

My invention relates to electric protective apparatus and particularly to protective apparatus including automatically separable contacts and suitable for use in protecting electrical wiring in main and branch circuits of residential and industrial buildings.

Electric protective apparatus of the type including automatically separable contacts, suitable for protecting electrical wiring in main and branch circuits of residential and industrial buildings have, in the past, ordinarily comprised one or more automatically operable switches or "circuit breakers" and housing and connecting means therefor. Such circuit breakers have included a casing, terminals for connecting the device in a circuit to be protected, a set of contacts within the casing, and manually and automatically operable mechanism for operating such contacts between open and closed position. Such mechanisms are characteristically complicated, difficult to manufacture and expensive. This complication results chiefly from the fact that provision must be made whereby the automatic opening mechanism takes precedence over and operates substantially independently of the manually operable mechanism when an overload or short circuit occurs, i. e., the mechanism must be "trip-free."

It is an object of the present invention to provide electric protective apparatus wherein the automatic opening function and the manual switching or disconnecting function are separately provided for, by separate sets of contacts.

While attempts have been made in the past to provide devices having separate contacts for the automatic and manually operating functions, such devices have usually only increased the cost by requiring two pairs of contacts and two mechanisms instead of one.

It is a further object of my invention to provide separate contacts for the manual switching function by utilizing for manual switching, the terminals ordinarily used to connect or disconnect the interrupter from the circuit to be protected.

It is a further object of my invention to provide such electric protective apparatus wherein the automatically separable contacts can be reclosed after an automatic opening only by first opening the manually operable contacts.

It is a further object of my invention to provide electric protective apparatus wherein the automatically separable contacts and resetting mechanism are never removed from their main enclosure, whereby tampering and misplacing of the unit are substantially prevented.

It is a general object of my invention to provide electric protective apparatus, which meets all of the functional requirements of performance and safety for such devices and which is nevertheless extremely simple and inexpensive in construction and small in size.

In accordance with my invention in one form, I provide an interrupting unit including a casing of insulating material having a set of interrupting contacts inside and a pair of terminal contacts outside, electrically in series therewith. The interrupting unit casing also contains a current-responsive element to cause opening of the internal contacts when an overload or short circuit occurs, and has a reset member, accessible from outside the interrupter unit, which must be moved to a reset position to reclose the interrupting contacts. A main enclosure is provided which can accept one or more

of such units, and which has a set of stationary contacts to cooperate with the outside terminal contacts of the interrupter. In order to provide a manual switching function, the interrupter is movable manually from outside the main enclosure, but without removal therefrom, between an "on" and an "off" position with respect to the stationary contacts, and in order to ensure that the automatic opening contacts shall always be free to open without restraint by the manual operating means, means is provided for operating the reset member when and only when the interrupter is moved manually to the "off" position.

My invention will be more fully understood from the following detailed description taken in conjunction with the accompanying drawings, in which;

Figure 1 is a side elevation view partially in section showing circuit interrupting apparatus embodying my invention, the side of the circuit interrupting unit being removed to show the interior parts, the unit being shown in the "off" position;

Figure 2 is a view similar to Figure 1, the circuit interrupting unit being shown in the normal "on" position and portions of the outer enclosure being broken away;

Figure 3 is a top plan view of the apparatus of Figure 1, showing mounting means for three circuit interrupting units, two of such units being shown in place;

Figure 4 is a view in perspective of the circuit interrupting unit incorporated in the apparatus of Figure 1.

In the drawings, I have shown my invention as embodied in electrical protective apparatus including an outer enclosure **10** having a removable cover plate **11** and containing a plurality of pairs of resilient stationary plug-in type contacts including line contacts **12** and load contacts **13**. The resilient contacts **12** and **13** are supported in juxtaposed position by suitable insulating means, such as by being mounted on insulating strips or blocks **14** and **15** respectively. The blocks **14** and **15** are mounted on the back wall of the enclosure **10** by screws **16** and a thin sheet of insulating material such as vulcanized fiber is provided, covering the major central area of the back wall of the enclosure, being trapped in position between the blocks **14** and **15** and the back wall. The resilient line contacts **12** are mounted on a common connecting strap **17** having a line terminal **18** for connection to an incoming line **19**. The resilient load terminal contacts **13** likewise are provided with suitable connecting means such as screws **20** for connection to branch circuit wires such as **21**, **21***a*.

For the purpose of switching and/or automatically interrupting the circuit to the branch conductors **21**, **21***a* upon the occurrence of predetermined conditions, I provide circuit interrupting units indicated generally at **22**. The circuit interrupting unit **22** is shown in the "off" or resetting position in Figure 1, and in the normal "on" position in Figure 2. The unit **22** comprises a generally rectangular insulating casing **23** open at one side and having recesses therein for the reception of the parts, the parts being held therein by a flat side cover **24** (see Figure 4) of fiber or other suitable insulating material, by means of screws or rivets **25**. The circuit interrupting unit **22** is provided with contacts for connecting it in the circuit and including a line contact **26** and a load contact **27**, each being received within closely conforming slots or recesses in the casing **23**, and each having a contacting surface thereof exposed for contact from the outside of the circuit breaker with corresponding line and load contacts **12** and **13** carried in the enclosure **10** as shown in Figure 2.

The line contact **26** includes an interrupting contact **26***a* within the interior of the interrupting unit **22**. The

load contact 27 has a bimetallic strip 28 rigidly attached thereto by suitable means, such as by welding, and carries a latching screw 29 at its upper end. Bimetallic strip 28 also has attached to its upper end by suitable means, such as by welding, a resilient strip 30 carrying a contact 31 at the free end thereof.

Contacts 26*a* and 31 are normally bridged by contact roller 32, carried by an insulating slide 33 slidably supported within the enclosure 23. The insulating slide 33 has a generally S-shaped latch 34 passing therethrough adjacent its upper end, which latch is normally in latching engagement with the latching screw 29. A compression spring 35, biases slide 33 for sliding movement toward the bottom of the enclosure 23 at all times.

When the unit 22 is in the normal "on" condition, as in Figure 2, the circuit is complete between the conductor 19 and the outgoing conductor 21 through resilient contacts 12 and 13 and interrupting contacts 26*a* and 31, which are bridged by the bridging contact 32. Upon the occurrence of abnormal conditions in the circuit fed by conductor 21, the bimetallic strip 28 deflects to the right as viewed in Figure 2, and disengages latch screw 29 from the latch 34. Upon the release of the latch 34 from the screw 29, the slide 33 is moved downwardly by the action of compression spring 35, moving the bridging contact 32 from between the interrupting contacts 26*a* and 31, and interrupting the circuit. The contact 32 and slide 33 are then in the position indicated in dotted lines in Figure 2. It will be observed that in this position, one end of the slide 33 projects out of the bottom of the casing 23.

In order to reset the interrupting unit 22, the interrupter is moved inwardly toward the back wall 10*a* of the enclosure 10 to the position indicated in Figure 1. During such movement, the outer end of the slide 33 engages the back wall of the enclosure 10 and continued movement of the interrupter body causes the latch 34 to be moved to a position where it can once again re-engage the latching screw 29, if the bimetal 28 has cooled sufficiently.

It will be observed that during the initial part of such resetting movement of the interrupter 22, the resilient plug-in contacts 12 and 13 are disconnected from the corresponding contacts 26 and 27 of the interrupter 22, and slide along the insulating side wall portions 36 and 37 of the enclosure 23. This disconnects the interrupter from the line and provides an "off" position. The interrupter may then be drawn outwardly to its initial position as shown in Figure 2, to reclose the circuit, the outward movement of the interrupter being limited by the integral flanges 38 of the housing 22. Since the interrupter 22 must be moved inwardly to the extreme inward position as shown in Figure 1 in order to reset it, in which position it is disconnected from the line, it is impossible to hold the interrupter closed on an overload or short-circuit, and the safety of the operator is thus assured without the necessity of providing a complicated "trip free" mechanism. Also, since it is unnecessary and in fact impossible, without removing the cover 11, to remove the interrupter 22 from its enclosure 10 to reset it, there is no danger of the unauthorized user tampering with the device. If desired, a conventional seal or lock (not shown) may be used to prevent removal of the cover 11.

In order to facilitate the manual operation of the interrupter 22, a projecting manually engageable portion 39 is provided. The manually engageable handle portion 39 is furthermore provided with an opening or window 40 which is closed by suitable transparent means. The insulating slide 33 is dimensioned so that its end is normally in close proximity to the window 40 when the latch 34 is in engagement with screw 29. When released, as by an overload or short circuit, the slide moves away from the window in the handle. Thus, the user can readily tell by inspection which of the circuit interrupter units has automatically opened and should be reset. The end of the slide may be painted white or bear luminous paint to facilitate such observation.

I also provide for use of the interrupter 22 as a manual switching device. Thus, the unit 22 may be pushed inwardly to the position of Figure 1 at any time, regardless of whether the slide 33 has been released, the unit being retained in such inner or "off" position by the gripping action of resilient contacts 12 and 13. To restore the circuit, the unit is merely pulled outwardly again.

Thus, all the functions of a trip-free manually operable circuit breaker mechanism are provided in an extremely simple assembly, with a minimum number of parts.

Although I have illustrated a particular embodiment of my invention, it will be apparent that many modifications thereof may be made, and I, therefore, intend by the appended claims to cover all such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. Electrical apparatus comprising a main enclosure at least one stationary contact within said main enclosure, an enclosed circuit interrupting unit adapted to be mounted within said enclosure and having at least one contact adapted to make contact with said stationary contact, said interrupting unit containing at least two relatively moveable contacts and means for opening said relatively moveable contacts upon the occurrence of predetermined current conditions through said interrupting unit, said interrupting unit being moveable as a unit within said main enclosure between an "on" position and an "off" position with respect to said stationary contact and cooperating stop means carried by said interrupter unit and said enclosure respectively for limiting movement of said unit to movement between said "on" and "off" positions.

2. Electrical protective apparatus comprising a main enclosure, at least one stationary contact within said main enclosure, a circuit interrupting unit adapted to be mounted within said main enclosure, said circuit interrupting unit having an insulating casing, at least one terminal contact carried by said insulating casing and accessible from the exterior thereof to make contact with said stationary contact, said interrupting unit comprising at least two relatively moveable contacts therewithin and resettable means for opening said relatively moveable contacts upon the occurrence of predetermined current conditions through said interrupting unit, said interrupting unit being moveable as a whole within said main enclosure between an "on" position and an "off" position with respect to said stationary contact, said interrupting unit including a reset member having a portion accessible for movement from outside of said casing and means carried by said main closure for moving said reset member to reset said resettable means upon movement of said interrupter unit to said "off" position.

3. Electrical protective apparatus comprising a main enclosure, at least one insulating support mounted within said main enclosure, at least one stationary contact mounted on said insulating support within said main enclosure, a wire-connecting terminal supported within said main enclosure and connected to said stationary contact, a circuit interrupting unit mounted within said main enclosure and having an insulating casing, at least one terminal contact carried by said insulating casing and disposed to make contact with said stationary contact, said interrupting unit comprising at least two relatively movable contacts and resettable mechanism for opening said relatively movable contacts upon the occurrence of predetermined current conditions through said interrupting unit, said interrupting unit being movable as a whole within said main enclosure between "on"

and "off" positions with respect to said stationary contact, said interrupting unit including a reset member having a portion accessible for movement from outside of said casing and means carried by said main enclosure for engaging and moving said reset member to reset said resettable mechanism upon movement of said interrupting unit from said "on" to said "off" position, said apparatus also comprising a cover for said main enclosure having at least one aperture therein through which a portion of said interrupter unit projects for manual operation thereof from outside said main enclosure between "on" and "off" positions by movement rectilinearly in a direction substantially normal to the plane of said cover, said interrupter unit casing comprising shoulders adapted to engage the inner surface of said cover to limit said rectilinear movement of said unit in an outward direction.

4. Electrical protective apparatus comprising a main enclosure, a pair of relatively stationary contact members supported in spaced-apart relation in said enclosure, a pair of wire-connecting terminals mounted in said enclosure and connected to said contact members, a cover for said main enclosure having at least one aperture therein, a circuit interrupter unit comprising an insulating casing supported within said main enclosure between said stationary contacts and with a portion thereof extending outwardly through said aperture, said unit being movable bodily inwardly and outwardly of said enclosure in a direction generally perpendicular to said cover between "on" and "off" positions relative to said stationary contacts, and means preventing withdrawal of said unit through said cover.

5. Electrical apparatus as set forth in claim 2 wherein the interrupter unit comprises a housing having an aperture therein, transparent closure means closing said aperture, at least a portion of said reset member being visible through said aperture whereby change of relative position of said reset member may be observed.

6. Electrical apparatus comprising a main enclosure, a pair of opposed resilient relatively stationary contacts within said main enclosure, a circuit interrupting unit adapted to be mounted within said main enclosure and having an insulating casing including a portion receivable between said opposed relatively stationary contacts and being rectilinearly movable bodily in a direction substantially normal to the back wall of said main enclosure between said opposed contacts between an "on" position and an "off" position, said interrupter comprising a pair of terminal contacts including portions accessible outside of said insulating casing adapted to engage said opposed contacts respectively when said unit is in said "on" position, said interrupter unit also comprising at least two relatively movable internal contacts within said casing and a trip member operable upon the occurrence of predetermined conditions to open said relatively movable contacts, said trip member being movable between a tripped position in which said internal contacts are open and a reset position in which said internal contacts are closed, means for moving said trip member from said tripped position to said reset position when said interrupter is moved from said "on" position to said "off" position, said relatively stationary contacts being separated from said interrupter terminal contacts before said internal contacts reclose as said interrupter unit is moved to said "off" position.

7. An electric circuit interrupting unit comprising a casing of insulating material, a pair of terminal members carried by said casing, a relatively stationary contact carried by one of said terminal members, an elongated strip of bimetallic material mounted at one end on the other of said terminal members and carrying a latching surface adjacent its other end, an elongated resilient contact strip having one end fixedly mounted on said other end of said bimetallic strip adjacent said latching surface and carrying a second relatively stationary contact adjacent its other end in juxtaposition to said first relatively stationary contact, a movable contact slide of insulating material slidably supported in said casing, an aperture in said casing, said contact slide including a portion extending into said aperture, biasing means biasing said contact slide for movement outwardly through said aperture, a latch portion carried by said contact slide and normally engaged and held by said latching surface of said bimetallic strip, and a movable bridging contact member carried by said contact slide and bridging said first and second relatively stationary contacts when said contact slide is in said latched position.

8. Electrical apparatus comprising a generally rectangular enclosure, at least two pairs of opposed relatively stationary resilient contacts supported by insulating means within said enclosure, a cover for said enclosure having at least one aperture therein in alignment with said relatively stationary contacts, at least one electrical interrupting unit within said main enclosure and including a pair of terminal contacts on opposed walls thereof adapted to make contact with said relatively stationary contacts, said interrupter unit including a casing portion adapted to project through said aperture in said cover for manual operation from outside said enclosure, said interrupting unit being movable rectilinearly in a direction at right angles to the plane of said cover between an "on" position in which its terminal contacts are in contact with the said relatively stationary contacts and an "off" position in which its contacts are out of contact with said relatively stationary contacts, cooperating means carried by said interrupter unit adapted to engage said cover to limit said rectilinear movement of said interrupter unit in an outward direction to a position where said interrupter unit is in contact with said stationary contacts, said interrupter unit in said "on" condition being spaced away from the rear wall of said enclosure.

9. Electrical apparatus comprising a generally rectangular outer enclosure, a pair of relatively stationary resilient opposed contacts supported by insulating means in said enclosure, a cover for said enclosure including an aperture in alignment with said relatively stationary contacts, an electrical interrupting unit adapted to be received between said relatively stationary contacts and including a portion adapted to project through said aperture for manual operation from outside said enclosure, said interrupting unit including a releasable plunger adapted to be released upon the occurrence of predetermined current conditions through said interrupter unit and including a portion adapted to project from the back wall of said interrupter unit upon such automatic opening, said reset plunger being adapted to cause reclosing and resetting of said interrupter unit when returned to its original position within said interrupter unit, said interrupter unit when in normal "on" condition being spaced away from the back wall of said main enclosure a distance sufficient to allow unrestricted travel of said reset plunger upon automatic opening of said circuit interrupting unit.

10. An electric interrupting unit comprising a generally rectangular insulating casing, at least two relatively movable contacts within said casing, a rectilinearly movable reset plunger within said interrupting unit casing movable upon the occurrence of predetermined current conditions to cause automatic opening of said contacts, the top wall of said interrupting unit including an aperture therein, transparent closure means for said aperture, said reset plunger including a portion adapted to extend in close proximity to said transparent closure means when said reset plunger is in reset position.

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