June 14, 1966 K. W. KLEIN 3,256,407

CIRCUIT BREAKER AND ACCESSORY DEVICE COMBINATION

Filed Oct 28, 1963 2 Sheets-Sheet 1

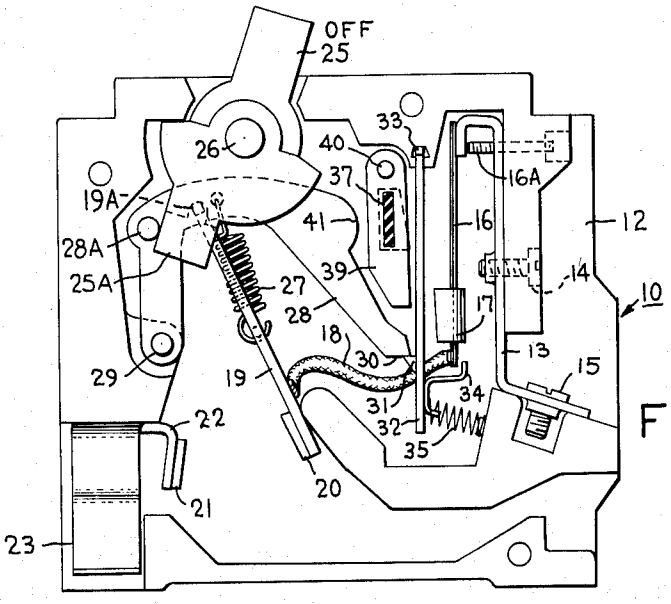


FIG. 2

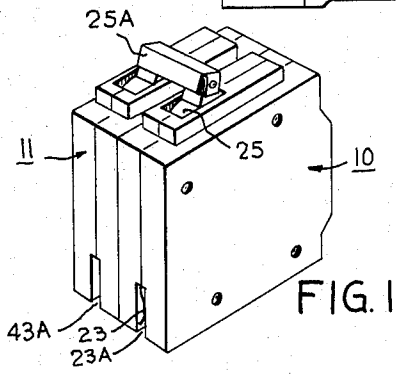


FIG. 1

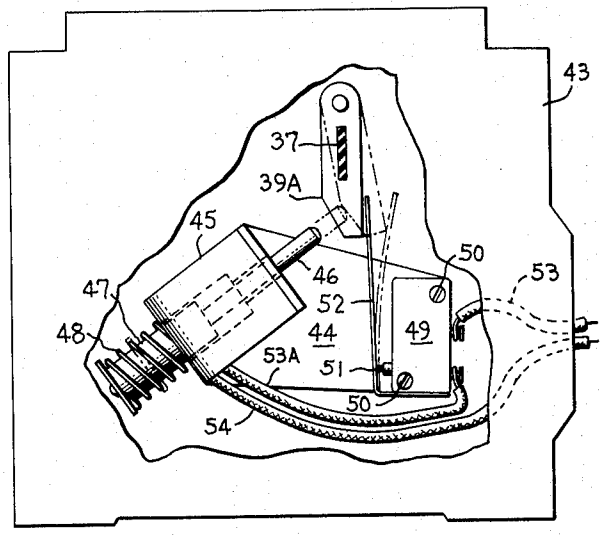


FIG. 4

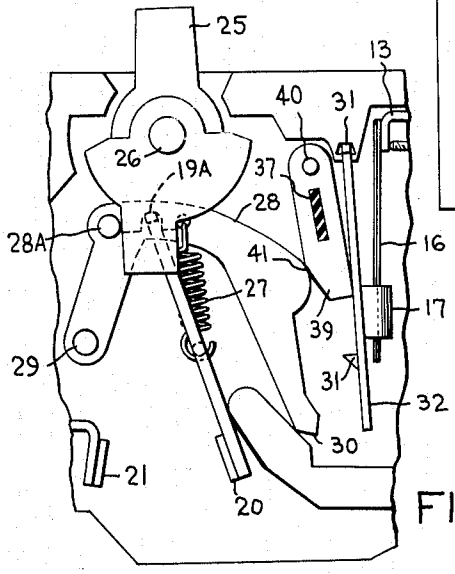


FIG. 3

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CIRCUIT BREAKER AND ACCESSORY DEVICE COMBINATION

Filed Oct 28, 1963 2 Sheets-Sheet 2

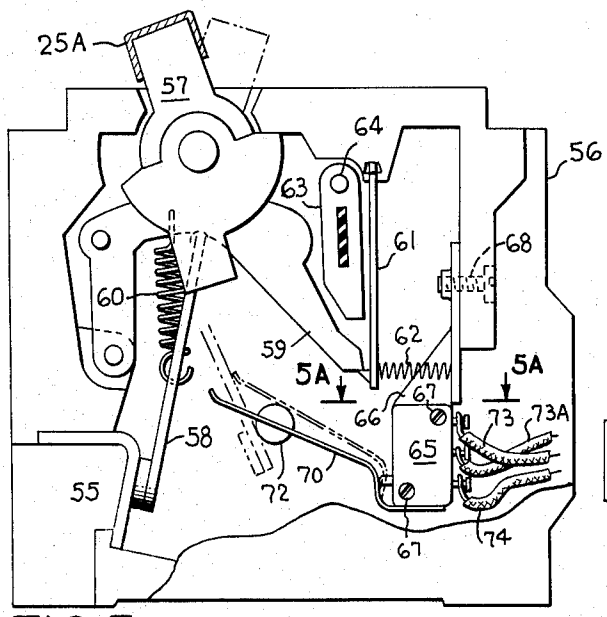


FIG. 5

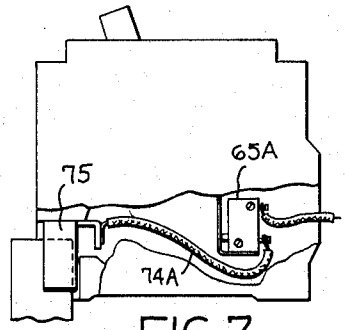


FIG. 7

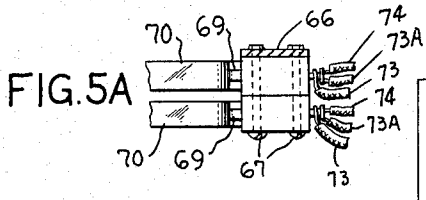


FIG. 5A

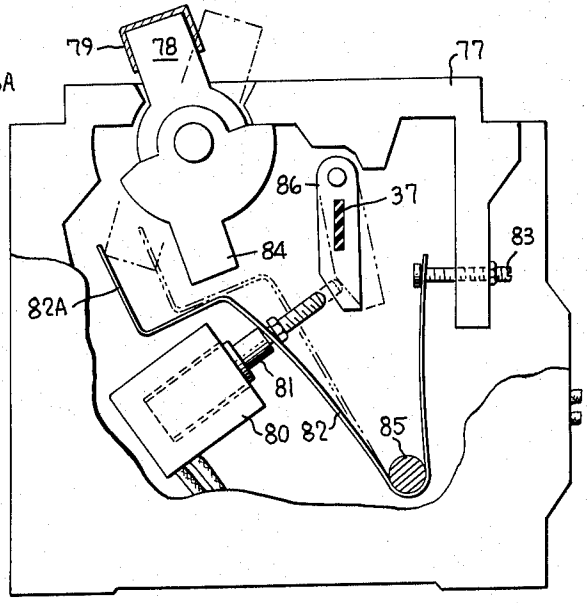


FIG. 8

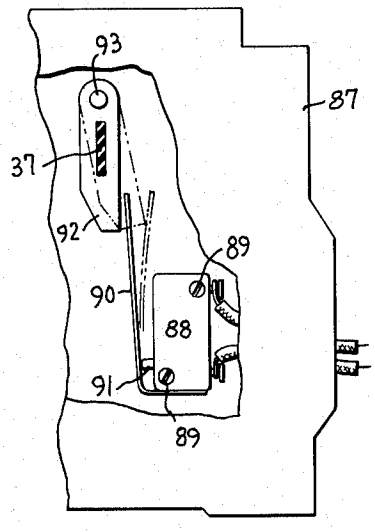


FIG. 6

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3,256,407

CIRCUIT BREAKER AND ACCESSORY DEVICE COMBINATION

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Filed Oct. 28, 1963, Ser. No. 319,237
14 Claims. (Cl. 200—116)

My invention relates to electric circuit breaker and accessory device combinations, and particularly to combinations of electric circuit breakers and accessory devices associated with trip elements of the circuit breakers.

The term "electric circuit breaker," in the sense used herein, refers to a manually operable switching device which also includes means for causing automatic opening of the switch upon the occurrance of predetermined electrical conditions. Accessory devices commonly used in connection with such circuit breakers are of two main types, (1) "operating" types, and (2) "indicating" types.

"Operating" types of accessory devices include (1) accessory devices for causing opening of the circuit breaker from a remote location, to be referred to as "remote tripping" devices, and (2) devices for causing opening operation of the circuit breaker upon the occurrence of predetermined low voltage conditions in the circuit being controlled or in a predetermined reference circuit, to be referred to as "undervoltage trip" devices.

"Indicating" types of accessory devices include (1) accessory devices which open or close a reference circuit in accordance with the open or closed condition of the circuit breaker, to be referred to as "auxiliary switches," and (2) accessory devices for giving a remote indication of the "tripped" condition of the circuit breaker to be referred to as "trip alarm" devices.

In accordance with the prior art, all of the above named functions have been provided by accessory devices included within the casing of the circuit breaker proper, or mounted on the circuit breaker, such as on the top or side wall of the breaker casing. Thus operating type accessory devices, according to the prior art, ordinarily comprise a solenoid contained within the circuit breaker, disposed and arranged to have its plunger engage a trip lever of the circuit breaker so as to cause tripping of the circuit breaker upon actuation of the solenoid. Indicating type accessory devices, in accordance with the prior art, comprise miniature switches within the circuit breaker, disposed and arranged to be actuated by the contact arm or other part of the circuit breaker so as to indicate the open, closed or "tripped" condition of the circuit breaker.

Since such accessory devices have been required to be included within or carried by the circuit breaker casing, they have heretofore, been usable only with circuit breakers whose casing or enclosure was large enough to carry or to contain the accessory device. There has, however, been a need for some time for accessory devices which can be used with smaller circuit breakers. This need has been intensified in recent years by advances in circuit breaker design which have had the result of reducing the size of circuit breakers of a given rating and, conversely, of increasing the rating of circuit breakers of small size.

Another aspect of the problem is that small circuit breakers are commonly used in panel assemblies wherein each circuit breaker is provided with a mounting position of predetermined dimensions. It is, therefore, not feasible to increase the size of selected circuit breakers to permit the inclusions of accessory devices within the circuit breaker, since they would no longer be usable in such panel assemblies without special modification of the panel.

It is an object of the present invention to provide a combination including a standard circuit breaker and an accessory device for giving remote indication or permitting remote control of the circuit breaker without using any space within the circuit breaker.

It is another object of the invention to provide a combination of the type described which is readily usable in existing circuit breaker panel assemblies having predetermined mounting means for standard size circuit breakers.

It is another object of the invention to provide an accessory device construction which is usable in connection with any one of a number of desired functions, such as remote tripping of the circuit breaker, undervoltage tripping, remote indication of the tripped condition of the circuit breaker (trip alarm), and operation of one or more other circuits upon operation of the circuit breaker to open or to closed positions (auxiliary switch).

It is another object of the invention to provide an accessory device construction which can be added to or combined with a circuit breaker after the circuit breaker has been assembled and without the necessity of opening the casing of the circuit breaker.

In accordance with the invention is one form, I provide a circuit breaker and accessory device combination comprising a first insulating casing containing an electric circuit breaker mechanism, and a second insulating casing of the same external dimensions as the first insulating casing, the second insulating casing containing an accessory device. Means is also provided extending between the walls of the two adjacent casings for causing operation of the accessory device upon the occurrence of predetermined conditions.

Since the accessory device casing has the same external dimensions as the circuit breaker casing, the assembly can readily be mounted in any of the panel assemblies designed to accept such circuit breakers.

My invention will be more fully understood from the following detailed description, and its scope will be pointed out in the appended claims.

In the drawings,

FIGURE 1 is a perspective view of a combination circuit breaker and accessory device constructed in accordance with the invention;

FIGURE 2 is a side elevation view on larger scale of the circuit breaker of FIGURE 1, one side of the casing being removed;

FIGURE 3 is a view similar to FIGURE 2 but showing the circuit breaker mechanism in the "tripped" condition;

FIGURE 4 is an enlarged side elevation view of a "remote trip" type accessory device suitable for use in the combination of FIGURE 1, a portion of the side wall being removed to show the interior;

FIGURE 5 is an enlarged side elevation view of an "auxiliary switch" type accessory device suitable for use in the combination of FIGURE 1;

FIGURE 5A is a fragmentary sectional view taken on the line 5A—5A of FIGURE 5;

FIGURE 6 is a view of a portion of a "trip alarm" type accessory device suitable for use in the combination of FIGURE 1;

FIGURE 7 is a view of a trip alarm device of the type shown in FIGURE 6 but with a different means of electrical connection, and

FIGURE 8 is an enlarged side elevation view of an "undervoltage release" type accessory device suitable for use in the combination of FIGURE 1.

In FIGURE 1 of the drawings, the invention is shown as incorporated in an electric circuit breaker and auxiliary device combination comprising an electric circuit

breaker 10 and an accessory device 11. The construction of the circuit breaker is shown in FIGURE 2, and will be described in connection with that figure.

CIRCUIT BREAKER CONSTRUCTION

As shown in FIGURE 2, the circuit breaker 10 includes a two-part insulating casing 12 (only one part shown in this figure), in which the parts of the circuit breaker are received and supported in formed bearing surfaces and abutments molded integral with the casing. A load terminal strap 13 is supported in the insulating casing 12 and anchored thereto by means of screw 14, and carries a load wire connecting screw 15 at its outer end. The inner end of the terminal strap 13 is return-bent and has rigidly affixed thereto one end of an elongated bimetallic strip 16. The bimetallic strip 16 carries a generally U-shaped magnet field piece 17 adjacent its movable end, and is connected by means of a flexible conductive braid 18 to a movable contact arm 19. The contact arm 19 carries a movable contact member 20 which is adapted to engage a stationary contact 21 carried by a tang portion 22 of a generally U-shaped plug-in type socket member 23.

The contact arm 19 has its upper portion bifurcated, the ends of the bifurcations resting in bearing recesses in a molded insulating handle member 25 which in turn is pivotally supported for rotation about its hub 26 in the insulating casing.

The intermediate or bight portion of the contact member 19 is connected by a tension type operating spring 27 to an intermediate portion of a releasable member 28. The releasable member 28 is pivotally supported on the pivot pin 29 in the insulating casing at one end, and carries a latch portion 30 at its other end. The latch portion 30 of the releasable member 28 is normally in engagement with a latch projection 31 carried by an elongated combination armature-latch member 32 which is pivotally supported in the casing at 33. The armature-latch member 32 carries a bracket member 34 adapted to be engaged by the movable end of the bimetallic strip 16. The armature-latch member 32 is biased clockwise by a compression spring 35.

CIRCUIT BREAKER OPERATION (SINGLE-POLE)

In FIGURE 2, the circuit breaker is shown in the "off" condition. To close the circuit breaker, the handle member 25 is moved counterclockwise as viewed, moving the bearing points 19A of the movable contact member 19 across the line of action of the operating spring 27, causing the contact member to be moved in a clockwise direction with a snap action to move the contacts to closed position. In the closed position, the pivot points 19A of the movable contact member lie on the right hand side of the line of action of the spring 27. The contacts may be returned to open circuit position by moving the handle member 25 clockwise back to the position shown in FIGURE 2.

When the circuit breaker is in the closed circuit position, excessive current through the breaker causes the bimetallic strip 16 to heat and to warp so as to move its movable end to the right as viewed, engaging the bracket 34 of the armature 32 and rotating the armature member 32 slightly counterclockwise, withdrawing the latch projection 31 from the latch portion 30 of the releasable member 28. When the member 28 is released, the force of the tension spring 27 pulling downward on an intermediate portion thereof rotates the member 28 in clockwise direction, thereby moving the line of action of the spring across the pivot points 19A of the movable contact member, and causing the contact member to be moved quickly to open or "tripped" position, see FIGURE 3. This occurs whether or not the handle member 25 is forceably restrained in the "on" or closed position.

Following tripping of the circuit breaker, the circuit breaker may be reset by moving the handle 25 from the center or trip indicating position as shown in FIGURE 3 back to the full "off" position as shown in FIGURE 2. When the handle is moved in this manner, the extensions 25A of the handle engage a pin 28A carried by the releasable member 28 and cause the releasable member 28 to rotate in counterclockwise direction until the latch portion 30 is once again in engagement with the latch projection 31.

The particular position of the free end of the bimetallic strip, and therefore the calibration of the circuit breaker, may be adjusted by adjusting the screw 16A, which is threaded into one side of the terminal strap 13 and bear upon the return-bent portion, thereby adjusting the free position of the return-bent portion.

CIRCUIT BREAKER OPERATION (MULTI-POLE)

For the purpose of providing common tripping of two such circuit breakers when mounted in side-by-side relation, a trip bar supporting member 39 is provided, pivotally supported on a pivot pin 40 and having an opening through which a trip bar such as 37 may extend. In use, the common trip bar 37 extends through adajcent walls of two circuit breakers and has a portion extending into the trip bar supporting member 39 of each.

When the circuit breaker is in closed circuit position, and tripping occurs as described above, the releasable member 28 moves in clockwise direction as described. During this movement the enlarged portion 41 thereof engages the trip bar supporting member 39, and rotates it slightly in counterclockwise direction, carrying with it the trip bar 37. See FIGURE 3. The trip bar 37, since it extends into a similar trip bar supporting member of the adjacent breaker, causes the adjacent breaker's trip bar supporting member to rotate in a similar manner counterclockwise. When the trip bar supporting member 39 of the adjacent circuit breaker is rotated in this manner, its lower end engages the armature-latch member 32 of that breaker, causing it to move away from the latch portion 30 of the releasable member 28 in that breaker, thereby causing it to trip also. In this manner, common tripping of two, three or more adjacent poles may be provided in order to provide a multipole circuit breaker.

ACCESSORY DEVICES

In accordance with the invention, accessory devices are provided which are usable with the circuit breaker described above, including the single and multi-pole forms, without modification of the basic circuit breaker, and such devices may be used in the same panel assemblies with no special mounting provisions.

Remote trip.—In FIGURE 4, one embodiment of the invention is shown comprising a remote trip accessory device having an insulating casing 43, similar in construction and outline to the casing 12 of the circuit breaker 10. Mounted within the casing 43, is a supporting plate 44 attached thereto by suitable means, not shown. The plate 44 supports a solenoid 45 including a plunger portion 46. The plunger 46 includes an enlarged portion 47 projecting from one end of the solenoid 45, on which a compression spring 48 is supported, which biases the plunger away from the position shown in solid lines in FIGURE 4.

The plate 44 also supports a miniature switch 49 attached thereto by suitable means such as by screws 50, and including an actuating plunger portion 51. An elongated resilient generally L-shaped actuator 52 is also supported on the miniature switch 49 by suitable means, not shown. The free end of the actuator 52 extends into close proximity to a trip bar supporting member 39A pivotally supported in the casing. The miniature switch 49 is normally closed, and is connected electrically in series with the solenoid 45 by means of conductors 53, 53A and 54.

In use, the remote trip accessory device shown in FIGURE 4 is mounted in side-by-side relation with a circuit breaker 10, as shown in FIGURE 2, and the common trip bar 37 extends into both casings. When it is desired

to open the circuit breaker **10** from a remote location, voltage is applied to the conductors **53**, **54** by suitable means, ordinarily by means of a relay. This energizes the solenoid **45**, causing the plunger **46** to strike the lower end portion of the trip bar supporting member **39A**, rotating it to the dotted line position as shown in FIGURE 4. When this occurs, the common trip bar **37** is moved in a counterclockwise direction, carrying the trip bar supporting member **39** of the circuit breaker in similar direction and causing it to engage the armature-latch member, causing release and opening of the circuit breaker. At the same time, the rotation of the trip bar supporting member **39A** of the remote trip unit causes it to engage the resilient member **52**, which causes actuation of the miniature switch **49** from its normally closed to a normally open position, thereby dropping out the energizing relay (not shown) and removing power from the solenoid **45**.

The insulating casing **43** of the remote trip assembly is provided with a corner slot **43A** similar to the corner slot **23A** of the circuit breaker casing **12**. Since the mounting provisions of the two units are identical, they can be mounted in any existing apparatus which is designed to receive two side-by-side circuit breakers of this type.

Auxiliary switch.—An auxiliary switch is defined as a switch usable with an electric circuit breaker and so coordinated therewith that the auxiliary switch is in one condition when the circuit breaker is in its "on" position, and is in the opposite condition when the circuit breaker is in its "off" condition, whether manual "off" or "tripped." As shown in FIGURES 5 and 5A, the auxiliary switch assembly includes an insulating casing **56** of similar shape and construction as the circuit breaker **10**. The auxiliary switch assembly also includes a handle member **57**, corresponding to the handle **25** of the circuit breaker **10**, and an overcenter member **58** corresponding to the movable contact arm **19** of the circuit breaker **10**. It also includes a releasable member **59** and an operating spring **60**. The releasable member **59** is held by a pivotally supported elongated latch member **61**, biased to latching position by a compression spring **62**. A trip bar supporting member **63** is also included, pivotally supported at **64**.

A pair of miniature switch members **65** are mounted on a supporting bracket **66** by suitable means such as by screws **67**. The bracket **66** is mounted in the casing **56** by suitable means such as by a screw **68**. Each miniature switch **65** includes an actuating plunger **69** and an elongated resilient actuator arm **70**.

The overcenter member **58** is shaped generally similar to the movable contact member **19** of the circuit breaker **10**, but omits the movable contact member **20** and merely engages a stop member **55** mounted in the casing.

In use, the auxiliary switch assembly is also mounted in close side-by-side relation with a corresponding circuit breaker unit **10**. In this case, the handle **57** of the auxiliary switch unit is rigidly tied by means of a handle-tie member **25A** to the handle member **25** of the circuit breaker unit. Thus when the handle **25** of the circuit breaker is manually operated, the handle **57** of the auxiliary switch unit will also be operated to corresponding positions. When the handle **57** is operated, the overcenter member **58** moves between the extreme positions as indicated in solid and dotted lines respectively in FIGURE 5, between the stop member **55** and the stop member **72**. When the circuit breaker **10** trips as shown for example in FIGURE 3, the pivotally supported member **63** of the auxiliary switch unit **56** is rotated slightly counterclockwise as viewed, engaging the restraining latch member **61** and causing release of the releasable member **59**. This causes movement of the overcenter member counterclockwise to actuating position whether or not the handle **57** moves. This action is as described in connection with the circuit breaker mechanism, see second paragraph above under heading, "Circuit Breaker Operation (Single-Pole)."

Thus, whenever the circuit breaker **10** is in the "on" condition, the overcenter member **58** of the auxiliary switch unit **56** will be in the position shown in FIGURE 5 in solid lines. When the circuit breaker is in the manual "off" condition or in the tripped "off" condition, the overcenter member **58** of the auxiliary switch member will be in the position shown in dotted lines in FIGURE 5, in which position it engages the resilient members **70**, causing actuation of the miniature switches **65** to a different condition. The miniature switches **65** shown are each of the single-pole, double-throw variety, and are provided with conductors **73**, **73A**, **74** for connection to other circuit components. It will be appreciated that various combinations of miniature switches may be used as desired and as space permits.

In FIGURE 7 there is shown a slightly different embodiment of auxiliary switch. In this form, the miniature switches **65A** draw their power by way of the conductor **74A**, from the line socket member **75**. Thus the unit also provides the source of voltage for energizing the remote condition indicating means (not shown).

Undervoltage release.—In FIGURE 8 there is shown another embodiment of the invention comprising an undervoltage release assembly, including an insulating casing **77**, of similar size and shape as the casing **12** of the circuit breaker **10**. A handle member **78** is provided, which is tied by means of the handle-tie **79** to the handle member **25** of a circiut breaker **10**.

A solenoid member **80** is mounted in the casing **77** by suitable means, not shown. The solenoid **80** includes a plunger member **81**, which is normally biased by an elongated strip type resilient spring member **82** to its outer position, as shown in dotted lines. The resilient member **82** is supported partly on a pin **85** carried by the casing **77**. The tension of the spring **82** may be adjusted by suitable means such as by adjusting screw **83**. The elongated resilient member **82** includes an offset end portion **82A** which is adapted to be acted upon by the extensions **84** of the handle **78**.

In operation, the undervoltage release assembly is also used in close side-by-side arrangement with a circuit breaker **10**, with the common trip bar **37** extending into both devices and into the trip bar supporting member **86**. Assuming the circuit breaker to be in the "off" condition, the circuit breaker handle will be in "off" position, and the handle **78** of the undervoltage release assembly will be in the position shown in dotted lines in FIGURE 8. As shown when the handle **78** is in the dotted line position, the extensions **84** engage the portion **82A** of the resilient member **82** and restrain it in the solid line position as shown in FIGURE 8, in which the plunger **81** is held in the solenoid **80**. When the circuit breaker handle is thrown to the "on" position, the handle **78** will move with it by reason of the handle-tie **79**. If the voltage applied to the solenoid **80** is sufficient, the plunger **81** will be held in despite the bias of the member **82**, and the parts will remain in the position shown in solid lines in FIGURE 8. If the voltage applied to the solenoid **80** drops below a predetermined level, however, the plunger **81** will be released, and will be moved by the spring member **82** to the dotted line position shown in FIGURE 8, in which the outer end of the plunger **81** engages the trip bar supporting member **86**, rotating it counterclockwise, and carrying with it the trip bar **37**, causing tripping of the circuit breaker. When the circuit breaker handle **25** is moved back to the full "off" position, as is necessary in order to reset the circuit breaker, the extension **84** of the handle **78** engages the end portion **82A** of the spring member **82**, thereby moving the plunger **81** back to its fully retracted position, in which it can once again be held when the voltage applied to the solenoid **80** is restored.

Trip alarm.—In FIGURE 6 there is illustrated an embodiment of the invention which provides a remote indi-

cation or alarm in case the circuit breaker moves to automatically tripped condition. This is to be distinguished from the auxiliary switch device of FIGURE 5, in which remote indication or alarm is given whenever the circuit breaker is in "off" condition, whether manually or automatically. In accordance with the invention in this form, an insulating casing **87** is provided which is of the similar size and dimension as the casing **12** of the circuit breaker **10**. A miniature switch **88** is mounted in the casing by suitable means such as by screws **89**, and carries an L-shaped elongated resilient actuator **90** arranged to operate its operating plunger **91**. A trip bar support member **92** is also included pivotally supported on the pivot pin **93** and receiving a portion of the common trip bar **37**.

In use, the trip alarm assembly of FIGURE 6 is mounted in close side-by-side relation to the circuit breaker **10** with the common trip bar **37** extending into the supporting members **92** and **39**. When tripping occurs in the circuit breaker **10**, causing rotation of the trip bar supporting member **39** as previously described, and similar rotation of the trip bar **37**, similar rotation is also caused of the trip bar supporting member **92** which then engages the actuating member **90** and operates the plunger **91** of the switch **88**.

It should be noted that the accessory devices provided in accordance with the present invention are completely separable from the associated circuit breakers, and the associated circuit breakers, may therefore be constructed and stocked separately, and the accessory device assembled therewith when desired. It should also be noted that the invention makes it possible to provide a number of accessory devices all having substantially identical outward appearance, from which the user may select the desired device and use it with a pre-selected circuit breaker.

This greatly simplifies the satisfying of customers' various needs since devices to fill such needs would otherwise have to be specifically requested from the factory and assembled at the factory before delivery.

While the invention has been shown in only certain particular embodiments, it will be readily appreciated that many modifications thereof may readily be made. It is therefore intended by the appended claims to cover all such modifications as fall within the true spirit and scope of the invention.

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

1. A circuit breaker and accessory device combination comprising:

(a) a circuit breaker having a generally rectangular insulating housing;

(b) said circuit breaker including at least one pair of relatively movable contacts and manually operable means for operating said contacts between open and closed circuit positions and automatically operable means for opening said contacts in response to predetermined electrical conditions through said circuit breaker;

(c) said circuit breaker including a pivotally supported trip member;

(d) an accessory device comprising a generally rectangular insulating casing having opposed top, bottom and end walls, said accessory device being mounted in side-by-side relation to said circuit breaker, and having its dimensions conforming substantially to those of said circuit breaker casing;

(e) a pivotally supported member supported in said accessory device casing in a position corresponding to the position of said pivotally supported trip member of said circuit breaker;

(f) tie bar means extending between said pivotally supported member of said accessory device and said pivotally supported trip member of said circuit breaker, whereby rotational movement of said trip member causes corresponding movement of said accessory device member and rotational movement of said accessory device member causes corresponding movement of said trip member;

(g) an electrical control device within said accessory device casing, and means operatively connecting said electrical control device to said pivotally supported member whereby to ensure interdependent operation of said control device and said circuit breaker, and

(h) said accessory device having no manually operable contacts therein which are also automatically operable in response to current conditions through said accessory device.

2. An electric circuit breaker and accessory device combination comprising:

(a) an electric circuit breaker having a generally rectangular insulating casing having opposed top, side, and end walls;

(b) said circuit breaker including at least one pair of relatively movable contacts and manually operable mechanism for moving said contacts between open and closed circuit positions, and automatically operable means for causing opening of said contacts in response to current conditions through said circuit breaker;

(c) said manually operable means including a handle portion projecting through said top wall of said circuit breaker;

(d) an auxiliary device assembly comprising a rectangular casing of insulating material having opposed top and bottom, side, and end walls;

(e) said auxiliary device casing being mounted in side-by-side relation to said circuit breaker casing with one of said side walls of said auxiliary device casing adjacent one of said side walls of said circuit breaker casing, and having its dimensions conforming substantially to those of said circuit breaker casing;

(f) means contained in said accessory device casing including means extending through said adjacent walls of said accessory device casing and said circuit breaker casing for causing interrelated operation of said circuit breaker and said accessory device assembly;

(g) an electrical control device within said accessory device casing, and means operatively connecting said electrical control device to said automatically operable means whereby to ensure interdependent operation of said control device and said circuit breaker, and

(h) said accessory device casing having no contacts therein which are manually operable and automatically operable in response to electric current through said accessory device.

3. An electric circuit breaker and accessory device combination comprising:

(a) an electric circuit breaker having a generally rectangular insulating casing having opposed top and bottom, side and end walls;

(b) said circuit breaker including at least one pair of relatively movable contacts and manually operable means for moving said contacts between open and closed circuit positions, and automatically operable means for moving said contacts from said closed to said open position upon the occurrence of predetermined electrical conditions through said circuit breaker;

(c) a manually operable handle member projecting through said top wall of said circuit breaker casing;

(d) an individually housed accessory device comprising a generally rectangular casing of insulating material having opposed top and bottom, side and end walls; said insulating casing being mounted in side-by-side relation to said circuit breaker casing and having generally conforming dimensions thereto;

(e) said circuit breaker having a pivotally supported trip member therein;

(f) said accessory device having a pivotally supported member therein in side-by-side alignment with said pivotally supported trip member of said circuit breaker;

(g) an electric solenoid contained within said accessory device housing and including a plunger disposed and arranged to engage said pivotally supported member upon the occurrence of predetermined current conditions through said solenoid, and tie bar means extending between said pivotally supported member of said accessory device and said pivotally supported trip member of said circuit breaker, said tie bar causing simultaneous pivotal movement of said pivotally supported trip member and said pivotally supported member of said accessory device;

(h) said accessory device having no contacts therein which are both manually operable and automatically operable in response to current through said accessory device.

4. An electric circuit breaker and accessory device combination comprising:

(a) an electric circuit breaker having a generally rectangular insulating casing having opposed top and bottom, side and end walls;

(b) said circuit breaker including at least one pair of relatively separable contacts and manually operable means for operating said contacts between open and closed circuit positions and automatically operable means for operating said contacts from said closed to said open position in response to predetermined current conditions through said circuit breaker;

(c) a manually operable handle member projecting through said top wall of said circuit breaker casing;

(d) a separately housed accessory device comprising a generally rectangular insulating casing having opposed top and bottom and opposed side and end walls, said accessory device being mounted in side-by-side relation with said circuit breaker;

(e) said circuit breaker including a pivotally supported trip member;

(f) said accessory device including a pivotally supported member in alignment with said circuit breaker trip member;

(g) an electric solenoid mounted in said accessory device casing and including a plunger, said plunger engaging said pivotally supported member of said accessory device when said solenoid is actuated;

(h) tie bar means extending between said pivotally supported trip member of said circuit breaker and said pivotally supported member of said accessory device to assure simultaneous pivotal movement of said members;

(i) a separately enclosed miniature switch mounted in said accessory device casing, said switch being normally closed;

(j) means connecting said miniature switch electrically in series with said solenoid;

(k) means for actuating said miniature switch from said closed to open position upon pivotal movement of said pivotally supported member, whereby to open the circuit to said solenoid upon pivotal movement of said pivotally supported member;

(l) said accessory device housing having dimensions conforming substantially to corresponding dimensions of said circuit breaker, but said accessory device having no contacts therein which are both manually operable and automatically operable in responsive to current passing through said accessory device.

5. An electric circuit breaker and accessory device combination comprising:

(a) an electric circuit breaker having a generally rectangular insulating enclosure having opposed top and bottom, side and end walls;

(b) said circuit breaker having at least one pair of relatively movable contacts and manually operable means for moving said contacts between open and closed circuit positions and automatically operable means for moving said contacts from said closed to said open position in response to current conditions through said circuit breaker;

(c) said circuit breaker including a manually operable handle member projecting through said top wall of said insulating casing;

(d) a separately enclosed accessory device comprising a generally rectangular insulating enclosure having opposed top and bottom, side and end walls, said accessory device being mounted in side-by-side relation with said circuit breaker;

(e) said circuit breaker having a pivotally supported trip member therein within said casing;

(f) said accessory device having a pivotally supported member in alignment with said pivotally supported trip member of said circuit breaker;

(g) an electric solenoid supported within said accessory device casing and including a plunger, said plunger engaging said pivotally supported member of said accessory device when actuated;

(h) tie bar means extending between said pivotally supported trip member of said circuit breaker and said pivoted member of said accessory device and assuring simultaneous pivotal movement of said members;

(i) means biasing said solenoid plunger toward engagement with said pivotally supported member of said accessory device;

(j) manually operable handle means projecting through said top wall of said accessory device casing, said manually operable handle means including a portion disposed and arranged to move said solenoid plunger away from said pivotally supported member against the bias of said biasing means.

6. An electric circuit breaker and accessory device combination as set forth in claim 5, wherein said combination also includes means accessible externally of said accessory device enclosure for adjusting the bias of said solenoid plunger biasing means.

7. An electric circuit breaker and accessory device combination comprising:

(a) an electric circuit breaker having a generally rectangular insulating casing having opposed top and bottom, side and end walls;

(b) said circuit breaker including at least one pair of relatively movable contacts and manually operable means for moving said contacts between open and closed circuit positions, and automatically operable means for moving said contacts from said closed to said open position in response to the current of predetermined current conditions through said circuit breaker;

(c) said circuit breaker also including a manually operable handle member projecting through said top wall of said circuit breaker;

(d) a separately enclosed trip accessory device comprising a generally rectangular insulating casing having opposed top and bottom, side and end walls, said accessory device being mounted in side-by-side relation with said circuit breaker;

(e) said electric circuit breaker including a pivotally supported trip member;

(f) said accessory device including a pivotally supported member in alignment with said pivotally supported trip member of said circuit breaker;

(g) an electric solenoid supported in said accessory device casing and including a plunger, said plunger engaging said pivotally supported member of said accessory device when said solenoid is energized;

(h) rigid tie bar means interconnecting said pivotally supported member of said circuit breaker and said

pivotally supported member of said accessory device, and assuring simultaneous pivotal movement of said members;

(i) an elongated resilient member mounted within said accessory device casing and including a portion engaging said solenoid plunger and normally biasing said solenoid plunger toward engagement with said pivotally supported trip member, said resilient member including a portion extending beyond said solenoid plunger member;

(j) a manually engageable handle member carried by said casing and including a portion projecting through said top wall of said casing, said manually engageable member having a portion thereof engageable with said extended portion of said resilient member to move said resilient member in a direction to move said solenoid plunger away from said pivotally supported member.

8. An electric circuit breaker and accessory device combination as set forth in claim 7 wherein means is provided interconnecting said manually operable member of said accessory device and said manually operable member of said circuit breaker:

(a) movement of said manually operable member of said accessory device in the same direction as said circuit breaker handle member moves when moving to reset position serving to move said solenoid plunger away from said pivotally supported member, whereby resetting movement of said circuit breaker handle also causes resetting movement of said solenoid.

9. An electric circuit breaker and accessory device combination comprising:

(a) an electric circuit breaker having a generally rectangular insulating casing having opposed top and bottom, side and end walls;

(b) said circuit breaker including at least one pair of relatively movable contacts and manually operable means for moving said contacts between open and closed circuit positions, and automatically operable means for moving said contacts from said closed to said open position in response to predetermined electrical conditions through said circuit breaker;

(c) said electric circuit breaker also including a manually operable handle member projecting through said top wall of said insulating casing;

(d) said circuit breaker including a pivotally supported trip member, said trip member moving from a normal position to a rotated position upon the occurrence of automatic opening of said circuit breaker contact;

(e) a separately enclosed trip accessory device comprising a generally rectangular insulating casing having opposed top and bottom, side and end walls, said accessory device being mounted in side-by-side relation with said circuit breaker;

(f) a pivotally supported member mounted in said accessory device insulating casing in alignment with said pivotally supported trip member of said circuit breaker;

(g) rigid tie bar means extending between said pivotally supported trip member of said circuit breaker and said pivotally supported member of said accessory device;

(h) at least one separately enclosed miniature switch mounted in said accessory device insulating casing;

(i) means mounted within said insulating casing of said accessory device for causing actuation of said miniature switch on rotational movement of said pivotally supported member of said accessory device accompanying movement of said pivotally supported trip member of said circuit breaker from said normal to said tripped position;

(j) said accessory device having its dimensions corresponding generally to corresponding dimensions of said circuit breaker but said accessory device having no contacts therein which are both manually operable and automatically operable in response to current conditions through said accessory device.

10. An electric circuit breaker and accessory device combination comprising:

(a) an electric circuit breaker having a generally rectangular insulating casing having opposed top and bottom, side and end walls;

(b) said circuit breaker including at least one pair of relatively movable contacts and manually operable means for moving said contacts between open and closed circuit positions, and automatically operable means for moving said contacts from said closed to said open position in response to predetermined electrical conditions through said circuit breaker;

(c) said electric circuit breaker also including a manually operable handle member projecting through said top wall of said insulating casing;

(d) said circuit breaker including a pivotally supported trip member, said trip member moving from a normal position to a rotated position upon the occurrence of automatic opening of said circuit breaker contact;

(e) a separately enclosed trip accessory device comprising a generally rectangular insulating casing having opposed top and bottom, side and end walls, said accessory device being mounted in side-by-side relation with said circuit breaker;

(f) a pivotally supported member in said accessory device casing, said pivotally supported member being in alignment with said pivotally supported trip member of said circuit breaker;

(g) a rigid tie bar interconnecting said pivotally supported trip member and said pivotally supported member of said accessory device and assuring simultaneous pivotal movement of said members;

(h) at least one separately enclosed miniature switch mounted within said accessory device casing;

(i) a manually operable handle member mounted in said accessory device casing and having a portion projecting through said top wall of said casing;

(j) means connected to said manually operable member of said accessory device for causing actuation of said miniature switch upon movement of said manually operable handle member;

(k) means rigidly interconnecting said manually operable member of said accessory device and said manually operable member of said circuit breaker, means operated by said pivotally supported member of said accessory device for causing actuation of said miniature switch upon pivotal movement of said pivotally supported member despite lack of movement of said manually operable member of said accessory device;

(l) said accessory device casing having its dimensions conforming generally to corresponding dimensions of said circuit breaker, but said accessory device having no contacts therein which are both manually operable and operable in response to occurrence of predetermined electrical conditions through said accessory device.

11. An electric circuit breaker and accessory device combination comprising:

(a) an electric circuit breaker having a generally rectangular insulating casing having opposed top and bottom, said and end walls;

(b) said electric circuit breaker including at least one pair of relatively movable contacts and manually operable means for moving said contacts between open and closed circuit positions, and automatically operable means for moving said contacts from said closed to said open position upon the occurrence of predetermined current conditions through said circuit breaker;

(c) said circuit breaker including a pivotally supported trip member, said trip member moving from a normal position to a tripped position upon the occurrence of automatic opening of said contacts;
(d) a separately enclosed trip accessory device comprising a generally rectangular insulating casing having opposed top and bottom, side and end walls;
(e) a pivotally supported member mounted within said accessory device casing in side-by-side alignment with said pivotally supported trip member of said circuit breaker;
(f) a rigid tie bar extending between said pivotally supported trip member and said pivotally supported member of said accessory device assuring simultaneous pivotal movement of said members;
(g) at least two separately enclosed miniature switches mounted within said accessory device casing;
(h) operating handle means mounted in said accessory device casing and including a portion projecting through said top wall of said casing;
(i) means interconnecting said operating means of said accessory device and said manually operable means of said circuit breaker for common pivotal movement;
(j) operating means within said accessory device casing for causing actuation of both of said miniature switches upon movement of said operating handle means of said accessory device from a first position to a second position;
(k) means for causing automatic operation of said miniature switch operating means upon rotation of said pivotally supported member in response to movement of said pivotally supported trip member from said normal to said tripped position;
(l) said accessory device casing having its dimensions conforming substantially to corresponding dimensions of said circuit breaker but said accessory device having no contacts therein which are both manually operable and automatically operable in response to predetermined electrical current through said accessory device.

12. An electric circuit breaker and accessory device combination comprising:
(a) an electric circuit breaker having a generally rectangular insulating casing having opposed top and bottom, side and end walls;
(b) said electric circuit breaker including at least one pair of relatively movable contacts and manually operable means for moving said contacts between open and closed circuit positions, and automatically operable means for moving said contacts from said closed to said open position upon the occurrence of predetermined current conditions through said circuit breaker;
(c) said circuit breaker including a pivotally supported trip member, said trip member moving from a normal position to a tripped position upon the occurrence of automatic opening of said contacts;
(d) a separately enclosed trip accessory device comprising a generally rectangular insulating casing having opposed top and bottom, side and end walls;
(e) a pivotally supported member mounted within said accessory device casing in side-by-side alignment with said pivotally supported trip member of said circuit breaker;
(f) a rigid tie bar extending between said pivotally supported trip member and said pivotally supported member of said accessory device for assuring simultaneous pivotal movement of said members;
(g) at least one separately enclosed miniature switch mounted within said accessory device casing;
(h) means for causing automatic operation of said miniature switch upon rotation of said pivotally supported member in response to pivotal movement of said pivotally supported trip member from said normal to said tripped position;
(i) said accessory device casing having its dimensions conforming substantially to corresponding dimensions of said circuit breaker but said accessory device having no contacts therein which are both manually operable and automatically operable in response to predetermined electrical current through said accessory device.

13. An electric circuit breaker and accessory device combination comprising:
(a) an electric circuit breaker having a generally rectangular insulating casing having opposed top and bottom, side and end walls;
(b) said electric circuit breaker including at least one pair of relatively movable contacts and manually operable means for moving said contacts between open and closed circuit positions, and automatically operable means for moving said contacts from said closed to said open position upon the occurrence of predetermined current conditions through said circuit breaker;
(c) said circuit breaker including a pivotally supported trip member, said trip member moving from a normal position to a tripped position upon the occurrence of automatic opening of said contacts;
(d) a separately enclosed trip accessory device comprising a generally rectangular insulating casing having opposed top and bottom, side and end walls;
(e) a pivotally supported member mounted within said accessory device casing in side-by-side alignment with said pivotally supported trip member of said circuit breaker;
(f) a rigid tie bar extending between said pivotally supported trip member and said pivotally supported member of said accessory device assuring simultaneous pivotal movement of said members;
(g) at least one separately enclosed miniature switch mounted within said accessory device casing;
(h) means for causing automatic operation of said miniature switch upon rotation of said pivotally supported member in response to pivotal movement of said pivotally supported trip member from said normal to said tripped position;
(i) said accessory device casing having its dimensions conforming substantially to corresponding dimensions of said circuit breaker but said accessory device having no contact therein which are both manually operable and automatically operable in response to predetermined electrical current through said accessory device;
(j) said accessory device having a terminal means carried thereby adjacent one end thereof, and
(k) each of said miniature switches having one terminal thereof electrically connected to said terminal means carried by said casing.

14. An electric circuit breaker and accessory device combination comprising:
(a) an electric circuit breaker having a generally rectangular insulating casing having opposed top and bottom, side and end walls;
(b) said circuit breaker including at least one pair of relatively movable contacts and manually operable means for moving said contacts between open and closed circuit positions, and automatically operable means for moving said contacts from said closed to said open position in response to predetermined electrical conditions through said circuit breaker;
(c) said electric circuit breaker also including a manually operable handle member projecting through said top wall of said insulating casing;
(d) said circuit breaker including a pivotally supported trip member, said trip member moving from a normal position to a rotated position upon the occurrence of automatic opening of said circuit breaker contacts;
(e) a separately enclosed trip accessory device comprising a generally rectangular insulating casing having opposed top and bottom, side and end walls, said

accessory device being mounted in side-by-side relation with said circuit breaker;

(f) a pivotally supported member in said accessory device casing, said pivotally supported member being in alignment with said pivotally supported trip member of said circuit breaker;

(g) a rigid tie bar interconnecting said pivotally supported trip member and said pivotally supported member of said accessory device and assuring simultaneous pivotal movement of said members;

(h) at least one pair of relatively separable contacts mounted within said accessory device casing;

(i) a manually operable handle member mounted in said accessory device casing and having a portion projecting through said top wall of said casing;

(j) means connected to said manually operable handle member of said accessory device for causing movement of said relatively separable contacts upon movement of said manually operable handle member;

(k) means rigidly interconnecting said manually operable member of said accessory device and said manually operable member of said circuit breaker;

(l) means operated by said pivotally supported member of said accessory device for causing movement of said relatively movable contacts upon pivotal movement of said pivotally supported member despite lack of movement of said manually operable member of said accessory device;

(m) said accessory device casing having its dimensions conforming generally to corresponding dimensions of said circuit breaker, said accessory device having no contacts therein which are both manually operable and operable in response to occurrence of predetermined electrical conditions through said accessory device.

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Disclaimer

3,256,407.—*Keith W. Klein*, Simsbury, Conn. CIRCUIT BREAKER AND ACCESSORY DEVICE COMBINATION. Patent dated June 14, 1966. Disclaimer filed June 11, 1968, by the assignee, *General Electric Company*.

Hereby enters this disclaimer to claim 1 of said patent.

[*Official Gazette September 10, 1968.*]