July 1, 1969 F. H. MURPHY ET AL 3,453,568

ELECTRIC CIRCUIT BREAKER WITH IMPROVED AUXILIARY DEVICE

Filed Dec. 20, 1967 Sheet 1 of 2

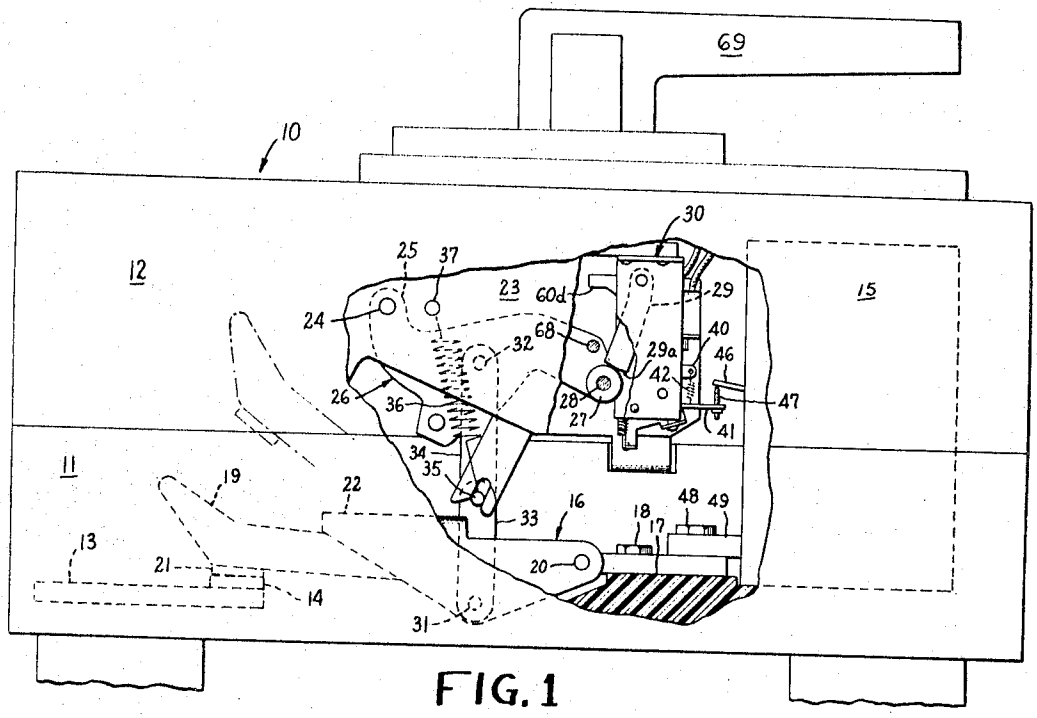
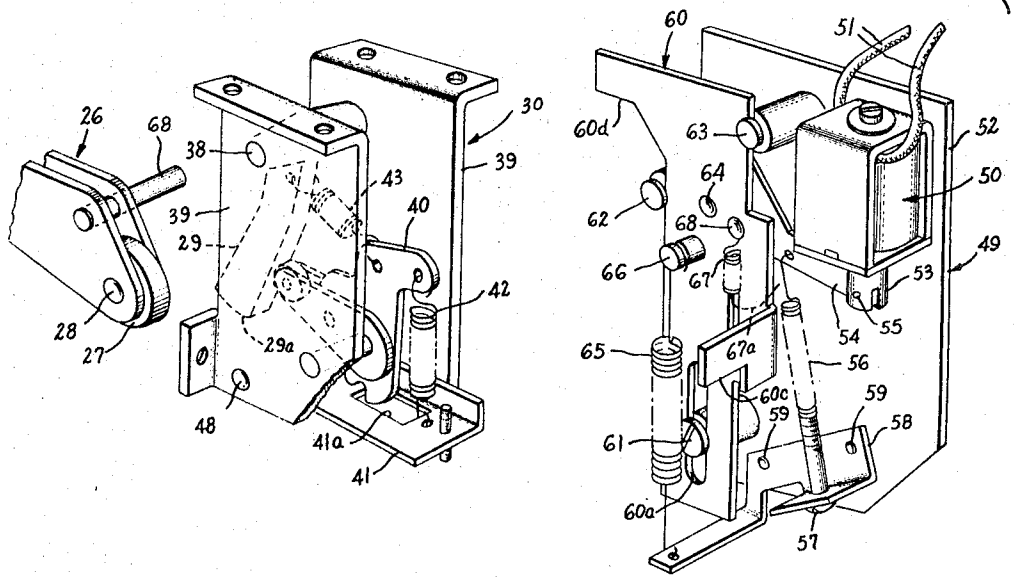


FIG. 1

FIG. 2



INVENTORS
FRANK H. MURPHY,
HENRY E. S. OWEN
BY Arthur E. Jennis Jr.
ATTORNEY

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Filed Dec. 20, 1967 Sheet 2 of 2

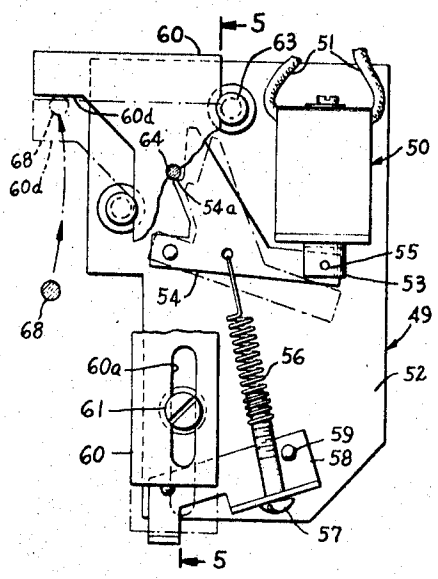


FIG. 3

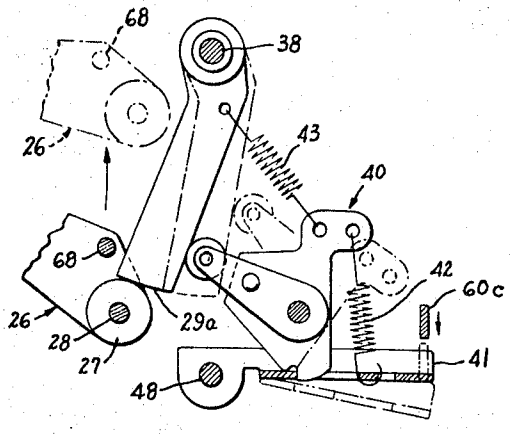


FIG. 4

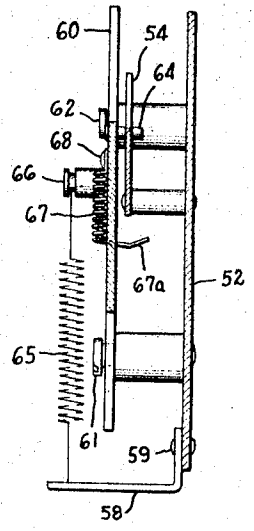


FIG. 5

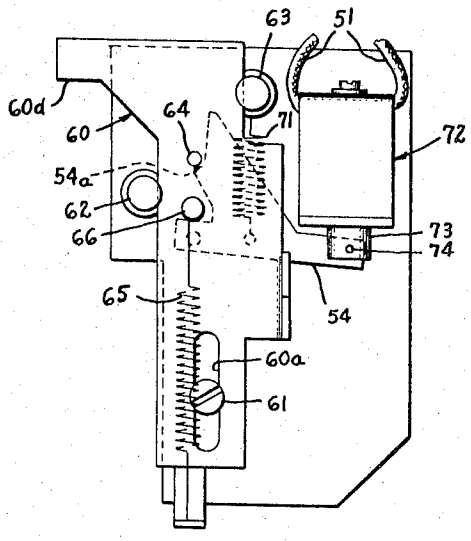


FIG. 6

INVENTORS
FRANK H. MURPHY,
HENRY E. S. OWEN
BY Arthur E. Lourie Jr.
ATTORNEY

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ELECTRIC CIRCUIT BREAKER WITH IMPROVED AUXILIARY DEVICE

Frank H. Murphy, West Hartford, and Henry E. S. Owen, Avon, Conn., assignors to General Electric Company, a corporation of New York

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Int. Cl. H01h 83/12
U.S. Cl. 335—20 7 Claims

ABSTRACT OF THE DISCLOSURE

A circuit breaker auxiliary device including a spring-biased tripping slide held against movement by a spring-biased latching member, the latter being held in latching position against its spring-bias by a solenoid and released when the solenoid's voltage drops sufficiently. The tripping movement of the circuit breaker moves the tripping slide to reset position whereby resetting of the circuit breaker, so as to permit subsequent reclosing, can occur only if the solenoid has sufficient voltage to hold the latching member in position to oppose the tripping movement of the tripping slide. In one form, the device functions as an "undervoltage release" device for sensing an undesirable drop in voltage. In another form, the device functions as a "shunt trip" to permit tripping of the circuit breaker from a remote location.

BACKGROUND OF THE INVENTION

Field of the invention

Our invention relates to electric circuit breakers and more particularly to circuit breakers including auxiliary devices of the "undervoltage release" and "shunt trip" types.

Description of the prior art

In accordance with the prior art, circuit breakers have been provided with undervoltage and shunt trip devices for the respective purposes of causing tripping of the breaker when an undesirable drop in voltage occurs and for enabling a breaker to be tripped from a remote location. Generally speaking, such devices comprise a solenoid having a plunger movably mounted therein wherein movement of the plunger in a given direction is utilized to cause tripping of the circuit breaker. In prior art structures, the plunger having completed its movement to cause tripping of the breaker is returned to its "reset" position through the action of a part of the circuit breaker contact arm or other part of the circuit breaker mechanism as the circuit breaker mechanism moves to its open position as a result of the tripping thereof.

With such an arrangement the plunger is held in its "reset" position so long as the circuit breaker is in its open condition. Accordingly, the breaker must begin its movement toward closed position before the plunger of the auxiliary device can become operative to cause retripping of the breaker. Thus, irrespective of the relative position of the operating parts of the auxiliary device, the circuit breaker can always begin a closing operation. Because of the nature of commonly used circuit breaker mechanisms, this means that the contacts of the circuit breaker can temporarily close or touch before the breaker mechanism is returned to its open position by virtue of the retripping action of the auxiliary device. Also, for this same reason, this type of device cannot be used as an electrical interlock, that is, to prevent for example the closing of the circuit breaker contacts should the undesirable drop in voltage in the breaker circuit continue to exist.

OBJECTS OF THE INVENTION

It is an object of the present invention to provide an auxiliary device for tripping an electric circuit breaker upon the occurrence of predetermined electrical conditions wherein the device after causing tripping of the breaker also prevents the beginning of a subsequent circuit breaker closing operation and thus any temporary closing or touching of the contacts of the breaker until or unless the aforesaid predetermined electrical conditions no longer exist.

It is another object of the present invention to provide an auxiliary device for tripping an electric circuit breaker upon the occurrence of predetermined electrical conditions wherein the device after causing tripping of the breaker prevents relatching of the circuit breaker mechanism which is necessary prior to re-closing of the breaker contacts, and which does so regardless of the position of the circuit breaker mechanism or contact arms until or unless the aforesaid predetermined electrical conditions no longer exist.

A still further object of the present invention is to provide an auxiliary device for tripping an electric circuit breaker which is capable of serving as an electrical interlock to prevent closing of the breaker contacts upon the presence of predetermined electrical conditions in a reference circuit.

Another object of the present invention is to provide an auxiliary device for tripping an electric circuit breaker wherein the device is reliable in operation, simple in construction, and relatively inexpensive to manufacture.

Yet another object of the present invention is to provide an auxiliary device for tripping an electric circuit breaker wherein the device is readily useable with presently existing circuit breakers without requiring any substantial modifications in the breaker.

SUMMARY OF THE INVENTION

In accordance with the present invention, there is provided an electrical circuit breaker including an insulating casing having a pair of relatively movable contacts supported therein, the contacts being movable between open and closed circuit positions. Releasable means is provided to cause movement of the contacts to the open circuit position. Latch means is supported in the casing and releasably engages the releasable means. An auxiliary device, which is suitably mounted in the casing for engagement with the latch means, causes release of the releasable means from the latch means upon the occurrence of predetermined electrical conditions to thereby cause opening of the contacts. The auxiliary device includes a solenoid actuated latch member which when released by the solenoid becomes disengaged from a spring-biased tripping slide of the device whereby the tripping slide, being thus free, moves under the influence of its spring bias and strikes the aforesaid latch means of the breaker mechanism thereby causing tripping of the breaker. The circuit breaker mechanism, in moving to the open condition as a result of the tripping of the breaker, engages the tripping slide of the auxiliary device and moves it against its spring bias to reset or relatched position, where it is held by the latch member of the auxiliary device. Should the aforesaid predetermined electrical conditions continue to exist, the latch member of the auxiliary device will not hold the tripping lever of the device in the relatched position because of the action of the solenoid associated therewith, whereby the tripping slide prevents the releasable means of the breaker from being relatched. Consequently the breaker contacts remain separated since the circuit breaker mechanism must be latched before the contacts can be closed.

BRIEF DESCRIPTION OF THE DRAWING

In the drawings:

FIGURE 1 is a side elevational view of an electric circuit breaker incorporating the present invention with a portion of the side wall of the insulating casing being broken away for clarity of illustration, and showing the circuit breaker operating elements in the closed circuit position;

FIGURE 2 is an exploded perspective view of a portion of the circuit breaker of FIGURE 1, illustrating on an enlarged scale the cradle latch, the intermediate latch mechanism, and the auxiliary device thereof in accordance with the present invention;

FIGURE 3 is a side elevational view of the auxiliary device of the circuit breaker of FIGURE 1, comprising an "undervoltage" trip device, the operative parts thereof being shown in the latched condition;

FIGURE 4 is a side elevational view of a portion of the circuit breaker of FIGURE 1 illustrating the cooperation between the operative parts of the intermediate latch mechanism;

FIGURE 5 is a cross-sectional view of the auxiliary device of FIGURE 3, taken substantially on the line 5—5 of FIGURE 3; and

FIGURE 6 is a side elevational view of another embodiment of an auxiliary device in accordance with the present invention comprising a "shunt trip" device, the operative parts thereof being shown in the latched condition.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to the drawings, and more particularly to FIGURE 1 thereof, the invention is shown embodied in a circuit breaker designated by the numeral **10** which has a generally rectangular insulating casing with a base portion **11** and a removable cover portion **12**. For convenience, the construction of a single pole chamber of the circuit breaker **10** is shown and will be described in detail although it will be understood that the circuit breaker **10** generally includes three pole chambers, all substantially identical except that the center pole chamber contains the major portion of the operating mechanism.

A line terminal (not shown) is supported at one end of the base portion **11** and is electrically connected to one end of a conductive strap **13**, the latter having a relatively stationary contact **14** supported at the other end thereof. A load terminal (not shown) is supported at the other end of the base portion **11** of the circuit breaker, and is electrically connected to a conventional circuit breaker trip unit **15**, the latter being supported in close proximity to the load terminal.

A pivoted contact arm assembly, indicated generally by the reference numeral **16**, is supported in the base portion **11** of the circuit breaker between the trip unit **15** and the stationary contact **14**. The pivoted contact arm assembly **16** includes a current carrying support block **17** which is fastened by means of bolts **18** (only one shown) to the base portion **11** of the circuit breaker, and an elongated contact arm segment **19** supported on the block **17** by means of the pivot pin **20**. The contact arm segment **19** carries at its free end a movable contact **21**. The contact arm pivot assembly **16** also includes a U-shaped bracket member **22** which overlies the contact arm segment **19**, and is also pivotally supported on the pivot pin **20**. Any suitable restraining means which will not interfere with the pivoting of the U-shaped bracket member **22** may be utilized to hold the latter on the pivot pin **20**. Suitable biasing means (not shown) are provided between the bracket member **22** and the contact arm segment **19** resiliently limiting movement of the arm segment **19** toward the back of the contact arm assembly **16**.

Pivotally mounted on the frame member **23** by the pivot pin **24** is the pivoted end portion **25** of the releasable member or cradle generally designated by

the numeral **26**. The opposite end of the releasable member **26** carries a roller **27** which is rotatably mounted thereon by means of the pin **28**. The roller **27** engages the end portion **29***a* of the primary latch **29** of the intermediate latch mechanism, generally designated by the reference numeral **30**, in a manner to be more fully described hereinafter. The cradle **26** and the contact arm pivot assembly **16** are connected intermediate their ends by the pivot pins **31**, **32** to the toggle linkage provided by the toggle links **33**, **34** which are pivotally connected to each other by the knee pin **35**. The toggle linkage is biased toward straightened condition by a pair of tension springs **36** (the second spring is behind the cradle **26**) which are engaged by the knee pin **35** at one end and attached to the pin **37** fixedly carried by the frame member **23**, at the other end.

The fixed ends of the tension springs **36** are thus spaced toward the stationary contact **14** to the side of the line drawn between the pivot pins **31**, **32** for the toggle links **33**, **34** in the latched position of the cradle **26**. Thus, the springs bias the toggle links **33**, **34** toward the stationary contact **14** in the latched position of the cradle **26** as shown in FIGURE 1. At the same time the springs **36** tend to rotate the cradle **26** in a counterclockwise direction (as viewed in FIGURE 1) about the pivot pin **24** to hold the roller **28** against the end portion **29***a* of the primary latch **29**.

Referring now to FIGURE 2, the primary latch **29** of the intermediate latch mechanism **30** is pivotally mounted by means of pivot pin **38** on the supporting frame members **39** of the latch mechanism **30**, while the entire mechanism **30** is supported within the circuit breaker housing by suitable means, not shown. Primary latch **29** has a radius on the end portion **29***a* which has a center slightly to the back of the pivot point of the latch **29** itself. This causes the primary latch **29** to be biased backwardly due to the breaker mechanism force being exerted on the end portion **29***a* of the latch **29**. The primary latch bias force is then transmitted to an intermediate latch **40** which further reduces the force components, so that the final tripping force required on the tripping latch lever **41** is very low compared to the initial breaker force. The tripping latch lever **41** is spring biased upwardly by the latch reset spring **42**. A similar latch reset spring **43** interconnects the intermediate latch **40** and the primary latch **29**. As best seen in FIGURE 2, the latch lever **41** is suitably provided with a slot **41***a* which engages the hook portion **40***a* of the intermediate latch **40** when the latter are in the latched position.

As seen in FIGURE 1, the trip unit **15** is supported within the base portion **11** of the circuit breaker closely adjacent the contact arm pivot assembly **16** and the intermediate latch mechanism **30**, and is electrically connected to the current carrying support block **17** of the contact arm pivot assembly **16** by means of the connector **44** which fixedly secures the terminal **45** of the trip unit **15** to the block **17**. In order to complete the current carrying path through the circuit breaker **10**, the trip unit **15** is provided with another terminal (not shown) which is connected in the conventional manner to the load terminal (not shown) of the circuit breaker, referred to earlier.

Housed in the trip unit **15** is a conventional thermal sensitive device (not shown) and a conventional magnetic sensitive device (also not shown). Upon the occurrence of overload conditions of current flow through the circuit breaker, one or the other of these devices operates automatically to cause the trip bar **46** to move in a counterclockwise direction as viewed in FIGURE 1. During the course of this counterclockwise or downwardly movement, the trip bar **46** engages the calibrating screw **47** supported on the tripping latch lever **41** of the intermediate latch mechanism **30** causing the latch lever **41** to also pivot downwardly, about pivot pin **48** and against the bias of latch reset spring **42**. This tripping movement

of the latch lever **41** is transmitted to the primary latch **29** by means of the intermediate latch **40** whereby movement of the primary latch **29** releases the cradle **26** of the circuit breaker **10** to thereby cause opening of the contacts **14** and **21** in the conventional manner.

For the purpose of causing actuation of the tripping latch lever **41** upon the occurrence of predetermined low voltage conditions in the circuit, the circuit breaker **10** is provided with an "undervoltage trip" auxiliary device, generally designated by the reference numeral **49**, which is mounted on a frame side of the center pole of the breaker by means of screws (not shown). As best seen in FIGURES 2 and 3, the undervoltage trip device **49** includes an energizing coil **50** which is provided with leads **51** for connection to a suitable power source and which is fixedly mounted on frame member **52** by means of a pair of screws (not shown). Plunger **53** which extends outwardly of the energizing coil **50** is supported in the coil **50** for movement relative thereto, and has one end attached to the latch **54** by means of pin **55** whereby movement of the plunger **53** is imparted to the latch **54**. As viewed in FIGURE 2, the latch **54** is biased in a downwardly direction by spring **56** which has one end attached to the latch **54** and the other to the screw **57** which may be rotated in order to adjust the amount of spring force being applied to the latch **54** by the spring **56**. Screw **57** is rotatably mounted in support bracket **58** which is fixedly secured to the frame member **52** by suitable means such as by a pair of rivets **59**.

The undervoltage trip device **49** further includes a slide **60** which is slidably supported on the frame member **55** in spaced relation thereto by means of guide pins **61**, **62**, **63**, the pin **61** being received in slot **60***a* suitably provided in the slide **60**. As best seen in FIGURE 3, the slide **60** is provided with a roll pin **64** which extends outwardly in juxtaposed relation to the latch **54** so as to be engageable by the notched portion **54***a* of the latch **54** whereby the slide **60** may be held in latched position against the bias of spring **65** when the coil **50** is energized. Spring **65** which biases the slide **60** in a downwardly direction as viewed in FIGURE 2, has one end fixed to the stud **66** and the other fixed to the bracket **58**. Also mounted on the slide **60** is a spring **67** which has one end fixedly secured thereto by means of rivet **68** while the other end **67***a* of the spring **67** which is freely movable extends outwardly through the slot **60***b* suitably provided in slot **60** and into the path of movement of the latch **54** for a purpose to be more fully described hereinafter.

Referring now to FIGURES 2, 3, and 4, when the voltage in the electrical circuit to which the leads **51** are connected drops below a predetermined level, the coil **50** becomes deenergized. The latch **54** will thus move in a downwardly direction to the position illustrated in phantom lines in FIGURE 3 because the spring force being applied thereto by spring **56** is now of sufficient strength to overcome the upward pull being applied to latch **54** through plunger **53** by the coil **50**. The downward movement of the latch **54** disengages the notched portion **54***a* of latch **54** from the roll pin **64** thereby allowing the slide **60** to move downwardly as viewed in phantom in FIGURE 3 under the influence of the spring force being applied thereto by spring **65**. In doing so, projection **60***c* on the slide **60** strikes the tripping latch lever **41** moving it downwardly to the position shown in phantom lines in FIGURE 4 to thereby cause the breaker to trip. This occurs by virtue of the fact that the downward movement of latch lever **41** releases the intermediate latch **40** and thereby causes the primary latch **29** to release the cradle **26** whereby the contacts **14** and **21** are opened. It is thus seen that the undervoltage trip device **49** causes the contacts **14** and **21** to open in a manner similar to that previously described in connection with the automatic tripping of the circuit breaker resulting from the sensing of overload currents by the current sensitive devices housed in the trip unit **15**.

When the breaker trips, the cradle **26** pivots about pivot pin **24** in an upwardly direction as viewed in FIGURES 1 and 2 during which movement the cradle pin **68** engages the end portion **60***d* of slide **60** to thereby cause the slide **60** to also move in an upwardly direction against the bias of spring **65**. While the slide **60** moves upwardly, the freely movable end **67***a* of spring **67** engages the latch **54** causing the latter to pivot in an upwardly direction whereby the notched portion **54***a* of the latch **54** is positioned so as to reengage the roll pin **64** carried by the slide **60**. When the breaker is reset in the conventional manner, the cradle **26** is moved in a downwardly direction back to the latched position where it is held by the primary latch **29**. The slide **60**, however, does not follow the cradle **26** during the latter's downward movement since the latch **54** by virtue of the engagement of the notched portion **54***a* thereof with roll pin **64** holds the slide **60** in its upper position as viewed in FIGURES 2 and 3. With the breaker reset, the contacts **14** and **21** may then be reclosed by operation of the handle **69** in the manner described and claimed in the copending application of C. L. Jencks and G. W. Kiesel, Ser. No. 597,946 filed Nov. 30, 1966, and assigned to the same assignee as the present application.

If however when the breaker is reset the coil **50** is not energized, then the latch **54** because of the force being applied thereto by spring **56** will pivot downwardly as viewed in FIGURES 2 and 3 and will not hold the roll pin **64**. The slide **60** will therefore follow along with the cradle pin **68** in a downwardly direction such that the engagement of the projection **60***c* of slide **60** with the tripping latch lever **41** moves the latter downwardly preventing the cradle **26** from becoming latched by the engagement therewith with the primary latch **29**. Consequently the springs **36** of the breaker mechanism will hold the contacts **14** and **21** in an open condition. It is therefore seen that inasmuch as the breaker cannot be reset if the coil **50** is deenergized and inasmuch as the breaker must be reset before the contacts **14** and **21** can be reclosed, the possibility, so commonly found to exist with prior art devices of the contacts either touching or slightly closing before operation of the undervoltage device causes in essence the retripping of the breaker is completely eliminated in accordance with the present invention by the undervoltage device **49**. Furthermore by virtue of the elimination of the aforesaid possibility of the contacts touching or slightly closing, the undervoltage device **49** of the present invention may be used as an electrical interlock to prevent reclosing of the contacts when the voltage in the circuit to which the leads **51** are connected is below a predetermined level and the coil **50** is therefore deenergized.

Referring now to FIGURE 6, there is illustrated another embodiment, generally designated by the reference numeral **70**, of the auxiliary device of FIGURES 2, 3, 4, and 5, which has been modified so as to function as a "shunt trip" device rather than as an undervoltage trip device whereby through its use the breaker can be caused to trip by a predetermined decrease in voltage such as may occur accidentally or intentionally for purposes of remote control in response to the operation of some remote device such as a switch or relay. Elements common to the undervoltage trip illustrated in FIGURE 3 and the shunt trip illustrated in FIGURE 6 are identified by use of the same reference numerals.

With continued reference to FIGURE 6, the slide **60** of the shunt trip device **70** is normally retained in latched position by means of the engagement of roll pin **64** carried by the slide **60** and the notched portion **54***a* of latch **54**. In the shunt trip device **70**, the latch **54** is held in slide engaging position by the upwardly directed spring force applied thereto by spring **71** rather than by the pull of an energized coil as in the case of the undervoltage trip device **49** of FIGURE 3. The spring **71** has one end

suitably fixed to the latch **54** and the other affixed to pin **63**. The coil **72** of shunt trip device **70** comprises a push-type solenoid having a plunger **73** movably supported therein and having one end thereof extending outwardly of the coil **72** for engagement with the latch **54** by means of pin **74** whereby movement of the plunger **73** may be imparted to the latch **54**. By means of electrical power supplied to the coil **72** through leads **51** which are connected to a suitable power source, the plunger **73** of coil **72** may under predetermined conditions be caused to extend itself, i.e., move outwardly of the coil **72** which movement of the plunger **73** is imparted to the latch **54** causing the latter to pivot in a downwardly direction as viewed in FIGURE 6. The downward movement of the latch **54** results in a disengagement of the roll pin **64** from the notched portion **54***a* of latch **54** thereby freeing the slide **60** for movement in a downwardly direction also as viewed with reference to FIGURE 6.

From this point onward the operation of the shunt trip device **70** and the undervoltage trip device **49** are identical. Thus, in both devices during the downward movement of slide **60**, the projection **60***c* thereof engages the tripping latch lever **41** of the intermediate latch mechanism **30** causing the latch lever **41** to also move downwardly whereby roller **27** of the cradle **26** becomes freed from engagement with the primary latch **29** in the manner previously set forth with respect to the operation of the undervoltage trip device **49** with the result that the contacts **14** and **21** are caused to open.

Similarly, both devices are reset in the same manner. That is, during the upward movement of cradle **26** about pivot pin **24** as viewed with reference to FIGURES 1 and 2, the cradle pin **68** carried by cradle **26** engages the end portion **60***d* of slide **60**, of shunt trip device **70** for example, causing the slide **60** to also move upwardly. When roll pin **64** once again becomes engaged with the notched portion **54***a* of latch **54**, slide **60** of shunt trip device **70** will be held in its upward position by virtue of the force being applied thereto by spring **71** as previously described. However, should conditions be such in the electrical circuit to which leads **51** of shunt trip device **70** are connected such that the plunger **73** remains extended, the latch **54** which is connected thereto by pin **74** will remain in its downward position whereby the notched portion **54***a* thereof will not engage roll pin **64**. Thus, when an attempt is made to reset the cradle **26** in the manner previously described in connection with the operation of the undervoltage trip device **49**, the slide **60** will follow along with the cradle pin **68** such that the engagement of the projection **60***c* of slide **60** with the tripping latch lever **41** prevents the cradle **26** from becoming latched by the engagement therewith with the primary latch **29**.

While the invention has been shown in two embodiments, it will be apparent that many other modifications thereof may be made, and we therefore intend by the appended claims to cover all such modifications as fall within the true spirit and scope of the invention.

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

1. An electric circuit breaker comprising:

(a) an insulating casing;

(b) a pair of relatively movable contacts supported in said casing, said contacts being movable between open and closed circuit positions;

(c) an operating mechanism supported in said casing, said operating mechanism including a cradle member releasable to cause movement of said contacts to said open circuit position;

(d) latch means supported in said casing, said latch means releasably engaging said cradle member;

(e) an auxiliary device mounted in said casing for engagement with said latch means;

(f) said auxiliary device including a latch member, mounted for movement between a first position and a second position, means responsive to the occurrence of predetermined circuit conditions to cause movement of said latch member from said first position to said second position, a movably mounted slide member, means releasably holding said slide member in engagement with said latch member when said latch member is in said first position, and spring means operative when said latch member is in said second position to cause said slide member to move into engagement with said latch means to release said cradle member and thereby cause tripping of said circuit breaker and opening of said contacts;

(g) said operating mechanism further including reset means operatively only upon the tripping of said circuit breakers, said reset means when operative engaging said slide member to cause movement of said slide member into position for re-engagement with said latch member of said auxiliary device;

(h) means for returning said cradle member to the relatched condition wherein said cradle member is again releasably engaged by said latch means; and

(i) said releasably holding means of said auxiliary device upon the continued existence of said predetermined circuit conditions being incapable of holding said slide member in engagement with said latch member of said auxiliary device as said cradle member is returning to said relatched condition whereby said slide member is again moved into engagement with said latch means by said spring means thereby preventing relatching of said cradle member and movement of said contacts to said closed circuit position.

2. An electric circuit breaker comprising:

(a) an insulated casing;

(b) a pair of relatively movable contacts supported in said casing, said contacts being movable between open and closed circuit positions;

(c) means including a cradle member releasable to cause movement of said contacts to said open circuit position;

(d) latch means supported in said casing, said latch means releasably engaging said cradle member;

(e) an auxiliary device mounted in said casing for engagement with said latch means;

(f) said auxiliary device including a latch member mounted for movement between a first position and a second position, means responsive to the occurrence of predetermined circuit conditions to cause movement of said latch member from said first position to said second position, a movably mounted slide member, means releasably holding said slide member in engagement with said latch member when said latch member is in said first position, and means operative when said latch member is in said second position to cause said slide member to move into engagement with said latch means to release said cradle member and thereby cause tripping of said circuit breaker and opening of said contacts;

(g) resetting means carried by said cradle member, said resetting means engaging said slide member after release of said cradle member by said latch means to cause movement of said slide member into position for re-engagement with said latch member of said auxiliary device;

(h) means for returning said cradle member to the relatched condition wherein said cradle member is again releasably engaged by said latch means; and

(i) said releasably holding means of said auxiliary device upon the absence of said predetermined circuit conditions releasably holding said slide member in engagement with said latch member of said auxiliary device as said cradle member is returned to said relatched condition.

3. An electric circuit breaker as defined in claim **2** wherein:

(a) said auxiliary device comprises an undervoltage trip release device;

(b) said means responsive to the occurrence of predetermined circuit conditions includes an energizing coil normally holding said latch member in said first position, means connecting said coil to said latch member, and a spring operative upon the occurrence of said predetermined circuit conditions to cause movement of said latch member from said first position to said second position; and

(c) said resetting means carried by said cradle member comprises a pin member fixedly secured to said cradle member adjacent one end thereof.

4. An electric circuit breaker as defined in claim 2 wherein:

(a) said auxiliary device comprises a shunt trip device;

(b) said means responsive to the occurrence of predetermined circuit conditions includes a spring normally holding said latch member in said first position, an energizing coil operative upon the occurrence of said predetermined circuit conditions to cause movement of said latch member from said first position to said second position, and means connecting said coil to said latch member; and

(c) said resetting means carried by said cradle member comprises a pin member fixedly secured to said cradle member adjacent one end thereof.

5. An electric circuit breaker comprising:

(a) an insulated casing;

(b) a pair of relatively movable contacts supported in said casing, said contacts being movable between open and closed circuit positions;

(c) means including a cradle member releasable to cause movement of said contacts to said open circuit position;

(d) latch means supported in said casing, said latch means releasably engaging said cradle member;

(e) an auxiliary device mounted in said casing for engagement with said latch means;

(f) said auxiliary device including a latch member mounted for movement between a first position and a second position, means responsive to the occurrence of predetermined circuit conditions to cause movement of said latch member from said first position to said second position, a movably mounted member, means releasably holding said movably mounted member in engagement with said latch member when said latch member is in said first position, and spring means operative when said latch member is in said second position to cause said slide member to move into engagement with said latch means to release said cradle member and thereby cause tripping of said circuit breaker and opening of said contacts;

(g) resetting means carried by said cradle member, said resetting means engaging said movably mounted member after release of said cradle member by said latch means to cause movement of said slide member

into position for re-engagement with said latch member of said auxiliary device;

(h) means for returning said cradle member to the relatched condition wherein said cradle member is again releasably engaged by said latch means; and

(i) said releasable holding means of said auxiliary device upon the continued existence of said predetermined circuit conditions being incapable of holding said movably mounted member in engagement with said latch member of said auxiliary device as said cradle member is returning to said relatched condition whereby said movably mounted member is again moved into engagement with said latch means by said spring means thereby preventing relatching of said cradle member and movement of said contacts to said closed circuit position.

6. An electric circuit breaker as defined in claim 5 wherein:

(a) said auxiliary device comprises an undervoltage trip release device;

(b) said means responsive to the occurrence of predetermined circuit conditions includes an energizing coil normally holding said latch member in said first position, means connecting said coil to said latch member, and a spring operative upon the occurrence of said predetermined circuit conditions to cause movement of said latch member from said first position to said second position; and

(c) said resetting means carried by said cradle member comprises a pin member fixedly secured to said cradle member adjacent one end thereof.

7. An electric circuit breaker as defined in claim 5 wherein:

(a) said auxiliary device comprises a shunt trip device;

(b) said means responsive to the occurrence of predetermined circuit conditions includes a spring normally holding said latch member in said first position, an energizing coil operative upon the occurrence of said predetermined circuit conditions to cause movement of said latch member from said first position to said second position, and means connecting said coil to said latch member; and

(c) said resetting means carried by said cradle member comprises a pin member fixedly secured to said cradle member adjacent one end thereof.

References Cited

UNITED STATES PATENTS

2,566,866	9/1951	Yarrick	335—20
3,175,064	3/1965	Myers	335—20

BERNARD A. GILHEANY, *Primary Examiner.*

H. BROOME, *Assistant Examiner.*