

Sept. 22, 1970

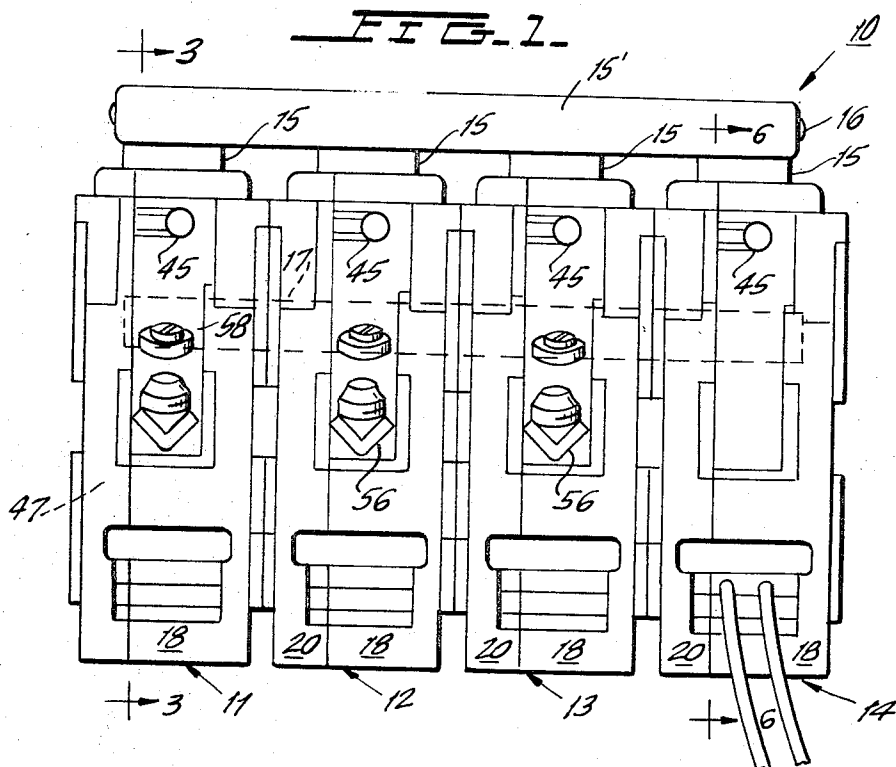
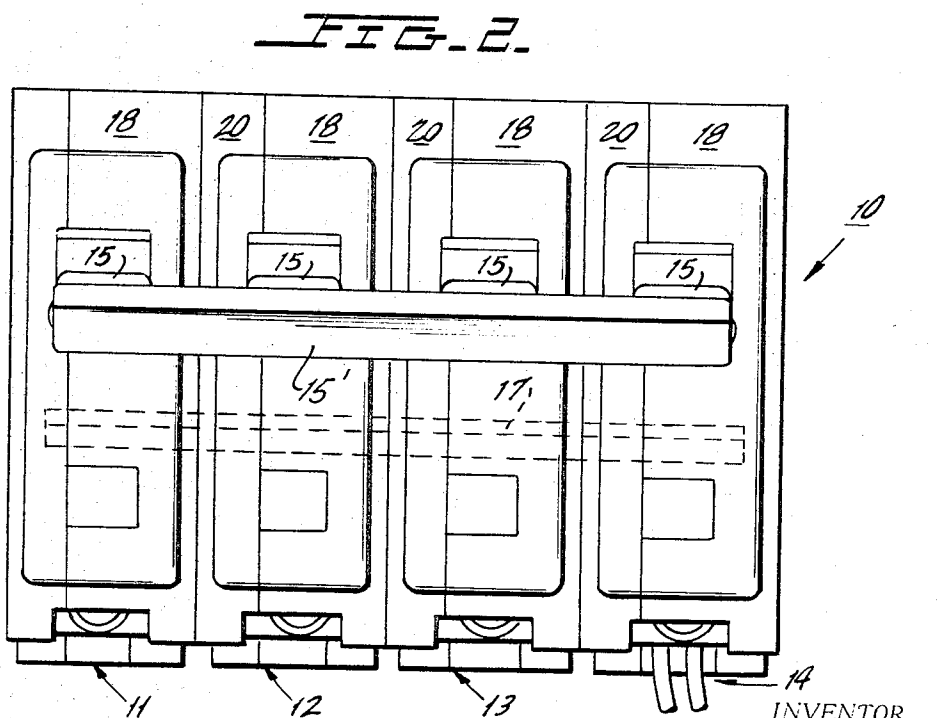
C. E. GRYCKO

3,530,412

CIRCUIT BREAKER STACK INCLUDING AUXILIARY ALARM SWITCH

Filed July 17, 1968

4 Sheets-Sheet 1



INVENTOR.
CARL E. GRYCKO

BY
OSTROLENK, FABER, GERB & SOFFEN
ATTORNEYS

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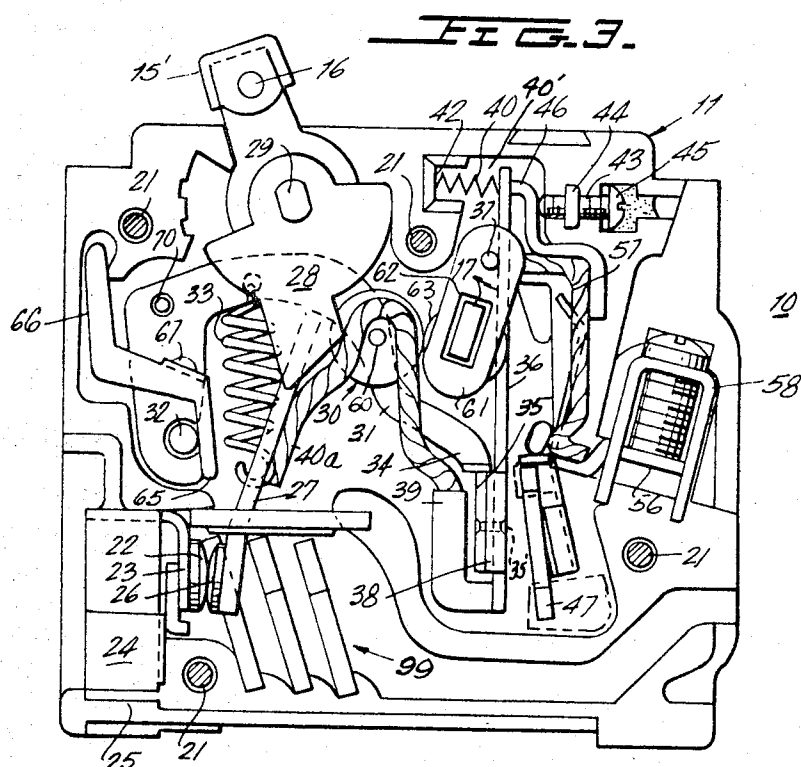
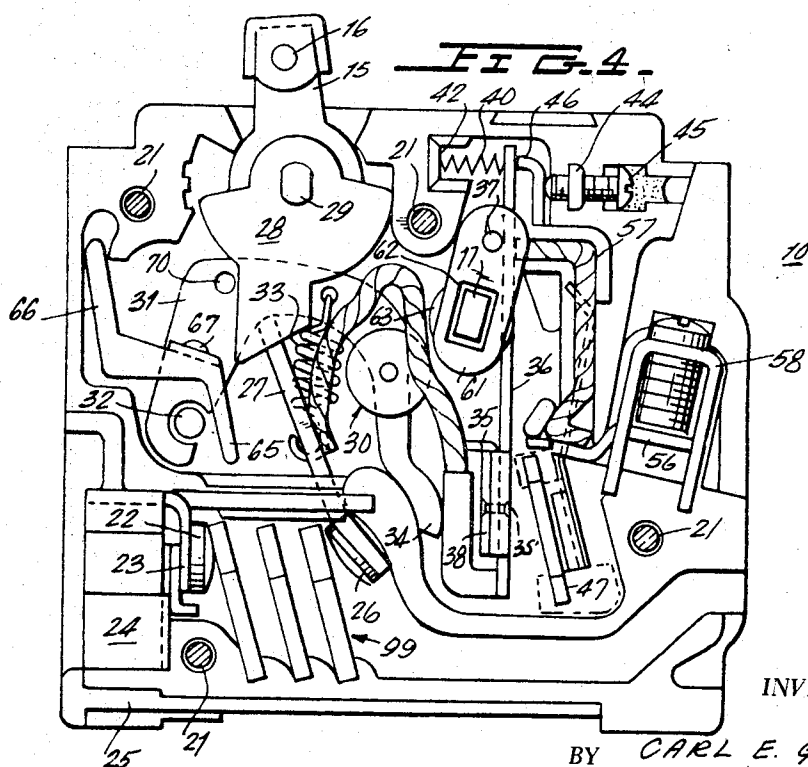
C. E. GRYCTKO

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CIRCUIT BREAKER STACK INCLUDING AUXILIARY ALARM SWITCH

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4 Sheets-Sheet 2



INVENTOR.

BY CARL E. GRYCTKO

OSTROLENK, FABER, GERB & OFFEN
ATTORNEYS

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4 Sheets-Sheet 3

FIG. 5.

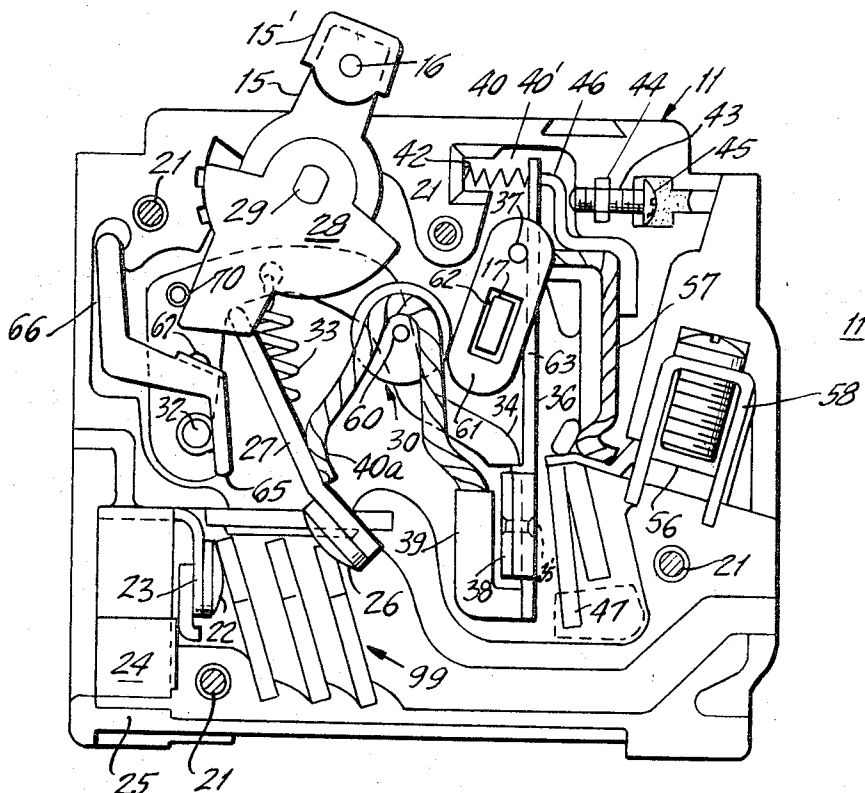
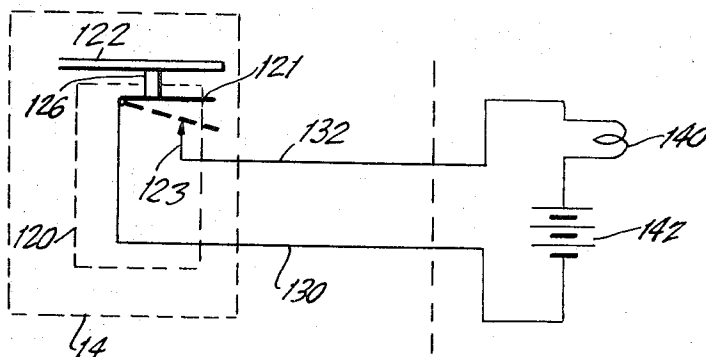


FIG. 6.



INVENTOR
CARL E. GRYCTKO

BY
OSTROLENK, FABER, GERB & SOFFEN
ATTORNEYS

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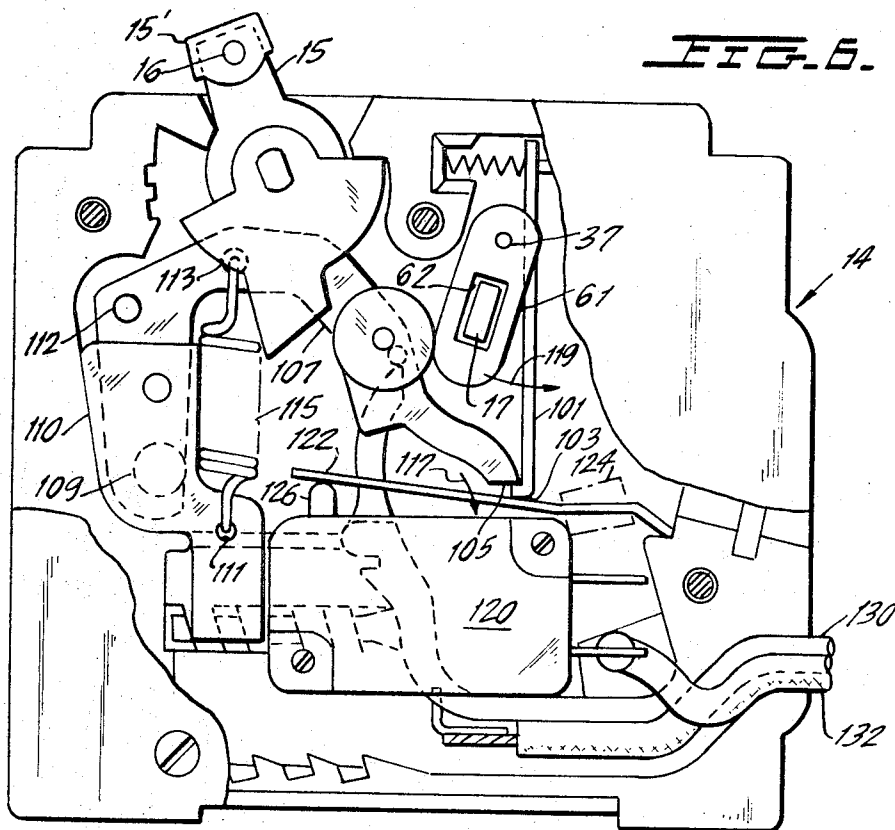
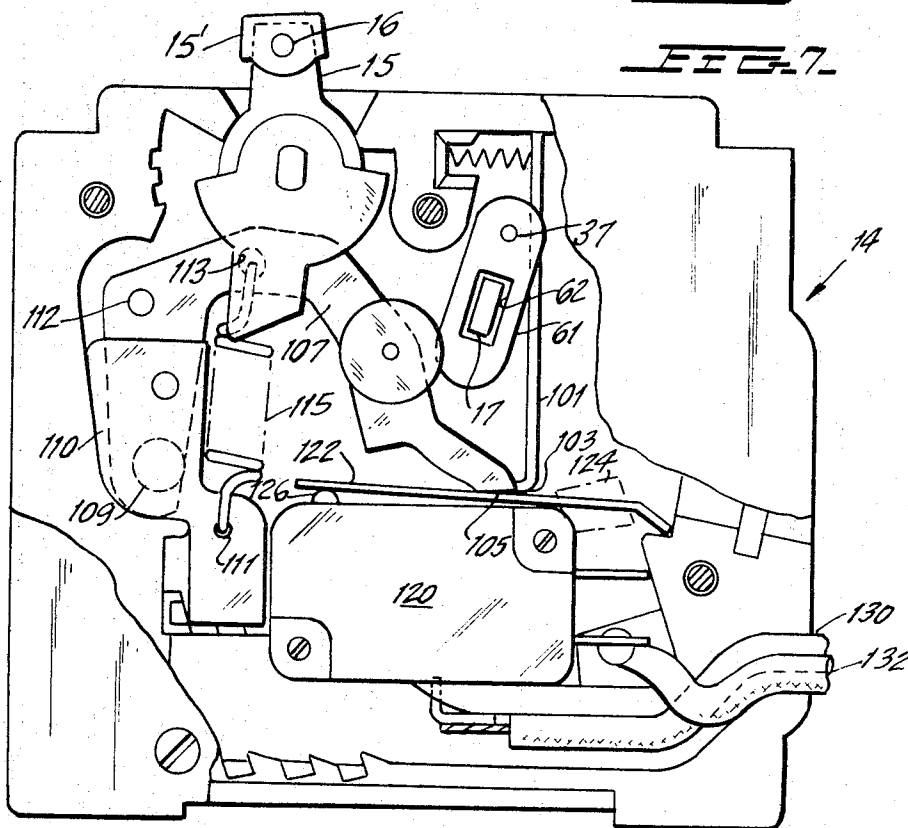
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3,530,412

CIRCUIT BREAKER STACK INCLUDING AUXILIARY ALARM SWITCH

Carl E. Gryctko, Haddon Heights, N.J., assignor to I-T-E
Imperial Corporation, Philadelphia, Pa., a corporation
of Delaware

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U.S. Cl. 335—8

4 Claims

ABSTRACT OF THE DISCLOSURE

In combination with a stack of individually housed single pole circuit breakers, there is provided a similarly housed alarm switch for indicating circuit breaker movement to the TRIPPED OPEN condition.

My invention relates to auxiliary devices for electrical circuit breakers, and more particularly to an alarm switch which may be conveniently added to a standard type of commercial molded case circuit breaker for indicating circuit breaker movement to the TRIPPED OPEN condition. More particularly, the instant invention is directed to a further auxiliary feature which may be added to existing circuit breakers in the same general manner as in my U.S. Pat. No. 3,369,202, issued Feb. 13, 1968, entitled "Circuit Breaker Stack Including Auxiliary Features," and assigned to the assignee of the instant invention.

It is shown in my above-noted patent that, in the smaller frame sizes of circuit breakers of the type generally intended for home and light industrial applications, it is the conventional practice to include a plurality of identically housed individual circuit breaker units. Each of the units includes its own contact operating mechanism associated with both a fault-responsive means and manual operating means. For multi-phase operation, individually housed units are stacked such that the manual operating means of the individual units are interconnected, and a common element extends between the circuit breaker operating mechanism. This operative interconnection of the units will provide that (1) the manual operation of all the circuit breakers will be in unison; and (2) the fault-responsive operation of any of the individual phase units to its TRIP condition will be automatically transmitted to the other phase units for rapid operation thereof in unison to their respective TRIP positions.

In addition to the manual operation and fault sensing trip operation of such circuit breaker units, it is oftentimes desirable to provide additional auxiliary features. My aforementioned U.S. Pat. No. 3,369,202 shows certain auxiliary features; as, for example, a shunt trip and under-voltage device for initiating operation of the circuit breaker unit. These auxiliary features are provided by an additional unit stacked adjacent the circuit breakers. There is also disclosed an adjacently stacked auxiliary switch device to indicate whether the circuit breaker contacts are in their engaged or disengaged condition. Such an auxiliary switch, however, cannot differentiate between the manual OFF and TRIPPED OPEN condition.

It is oftentimes desirable to also provide an alarm switch which will indicate movement of the circuit breaker contacts to the TRIPPED OPEN condition—with such indication usually being provided at a remote indication. While such alarm switches have been available for larger frame size breakers, they have not been previously available for the smaller type of circuit breaker units intended for home or light industrial applications. My invention advantageously provides such an alarm switch, which may be mounted in the same housing as the circuit breaker unit, and is advantageously stacked as in a multi-phase as-

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sembly. The alarm switch is constructed such that it will not respond to manual movement of the circuit breakers to the OFF condition. However, upon the occurrence of an overload trip, the alarm switch will be actuated in order to give the requisite signal.

Basically, the alarm switch of the instant invention includes, in place of the circuit breaker bimetal, a trip lever which engages a latchable means similar to the circuit breaker cradle. A special spring plate is utilized, in place of the circuit breaker contact assembly, for biasing the cradle against the latched tip of the trip lever. Mounted within the housing of the alarm switch, is a switch means of the microswitch variety. A switch actuator is provided, which is normally biased in a first direction. The spring bias cradle will be urged towards engagement with the actuator for movement thereof to a second condition. However, the movement of the cradle is restrained by the latching of the trip lever. Upon the occurrence of a tripping operation, the trip lever will be moved in a direction to defeat the latching engagement of the cradle tip, thereby permitting movement of the cradle tip under the influence of the biasing spring, into engagement with the switch actuator, for moving the microswitch to its other operative condition. A pair of conducting means, electrically connected to the microswitch contacts, extends external of the alarm switch housing, and are electrically connected to a remotely situated alarm.

It is, therefore, seen that my invention permits the addition of an alarm switch to existing commercially available circuit breaker devices merely by stacking an additional unit adjacent thereto. This is accomplished in the same manner that such individual units are presently stacked for multi-pole operation, and the alarm switch is interconnected to the circuit breakers with the same common element utilized for coordinating the circuit breaker units for multi-phase operation. Furthermore, my invention may also be utilized in conjunction with one or more of the auxiliary devices, as described in my aforementioned U.S. Pat. No. 3,369,202.

It is, therefore, a primary object of my invention to provide an alarm switch which may be easily added to existing stacked assemblies of circuit breaker units.

Another object of my invention is to provide an alarm switch may be mounted in the same type of housing as presently used for existing commercial-type of circuit breakers, and may be conveniently stack-assembled with such circuit breaker units.

A further object of my invention is to provide, in conjunction with a stacked array of individual circuit breaker pole units, an alarm switch for indicating circuit breaker movement to the TRIPPED OPEN condition, but does not respond to circuit breaker movement to the manual OFF condition.

An additional object of my invention is to provide the combination of first and second types of switching devices stacked alongside; the first type of switching device being a circuit breaker; and the second type of switching device being an alarm switch, operatively responsive to movement of the circuit breaker to the TRIPPED OPEN condition, but insensitive to circuit breaker movement to the manual ON condition.

These as well as other objects of my invention will become readily apparent after reading the following description of the accompanying drawings, in which:

FIG. 1 is an end view of a stack of three single-phase circuit breakers, and the auxiliary alarm device of the instant invention, looking towards the load terminals thereof.

FIG. 2 is a plan view of FIG. 1.

FIG. 3 is a cross-sectional view along line 3—3 of FIG. 1 (intermediate the housing and cover of one of

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the circuit breaker units) and showing the mechanism thereof in the ON condition.

FIG. 4 is similar to FIG. 3, with the circuit breaker being shown in the TRIPPED OPEN condition.

FIG. 5 is similar to FIGS. 3 and 4, with the circuit breaker being shown in the manual OFF position.

FIG. 6 is a cross-sectional view along the line 6-6 of FIG. 1, intermediate the housing and front cover of the alarm switch of the instant invention, and showing the alarm switch in the OFF (or non-actuated) condition.

FIG. 7 corresponds to FIG. 6, but shows the actuation of the alarm switch responsive to the tripping of the associated circuit breaker units.

FIG. 8 shows a typical electrical circuit which may be used in conjunction with the instant invention to indicate circuit breaker tripping at a remote location.

Now referring to the figures, the stacked array of switching devices 10, illustrated in FIG. 1, comprises three single-phase circuit breakers 11, 12 and 13, mounted side-by-side, and interconnected in the general manner shown in aforementioned U.S. Pat. No. 3,369,202 and U.S. Pat. No. 2,996,589. Also stacked adjacent thereto is an alarm switch 14 constructed in accordance with the instant invention. If desired, additional auxiliary switching devices (not shown) may be added to the stacked array, with such auxiliary devices including the features described in U.S. Pat. No. 3,369,202. Also, the instant invention may be stacked adjacent a single circuit breaker unit for remotely indicating single-phase operation.

It will be initially noted that the external housings of both the circuit breaker units 11, 12, 13 and the auxiliary device 14 are of substantially identical configuration. In fact, in practice, the identical housing moldings may advantageously be used for both devices.

The manual operating handles 15 of all three circuit breaker units 11, 12, 13 are tied together by an elongated cap 15' and pin 16 so that the manual operation of all the circuit breaker units occurs simultaneously. The auxiliary alarm 14 is also shown as having an operating handle 15 connected to cap 15'. However, handle 15 of the alarm switch is provided to seal the housing opening and reset the alarm switch after its actuation, and does not serve to move the alarm switch to the actuated condition inasmuch as such movement will not alter the operative condition of the alarm switch 14. If desired, the handle may be deleted and other means employed to seal the housing opening and reset the unit.

Since each of the circuit breakers 11-13 is of an identical construction, both internal and external, only circuit breaker 11 will be described in detail, it being understood that circuit breakers 12 and 13 have the same construction.

Referring to FIGS. 1, 3 and 5, circuit breaker 11 comprises a base 18 of molded insulating material having an open side capped by removable cover 20, which is also constructed of molded insulating material, with cover 20 being secured to base 18 by rivets 21 which pass through all three circuit breakers 11-13 and auxiliary switching device 14. Stationary contact 22 is mounted to extension 23 of female stab-type line terminal 24 which is disposed in a suitably shaped base recess. The lower end 25 of the line terminal 24 is accessible through a suitable slot formed by the cooperation of cover 20 and base 18 for receiving the connecting line terminal stab.

Cooperating with stationary contact 22 is movable contact 26 which is mounted at the lower end of movable contact arm 27 whose upper end abuts a suitable pivot forming formation in portion 28 of manual operating member 15. Parallel plate slotted arc extinguishing means 99 is operatively positioned to receive and extinguish electric current arcs drawn between contacts 22, 26. Manual operating member 15 is pivoted about protrusions 29 thereof which is entered into suitable recesses (not shown) of cover 20 and base 18.

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Operating mechanism 30, for bringing about the engagement and disengagement of cooperating contacts 22, 26 comprises latchable cradle 31 which is pivoted at one end thereof at base protrusion 32. One end of operating spring 33 is tied to cradle 31 at a point intermediate the ends thereof while the other end of spring 33 is tied to contact arm 27. Operating spring 33 is always tensioned, thereby urging contact arm 27 upward into engagement with its pivot or manual operating member 15. The other end of cradle 31 comprises latch tip 34 which is engageable by latch 35 secured to control member 36.

Control member 36 comprises an elongated bimetallic element which is mounted near the upper end thereof to pivot pin 37. Magnet 38 is secured to control member 36 near the lower end thereof by rivet 35'. Bifurcated member 39 is secured to control member 36 below magnet 38. A pair of conducting braids 40a extend from a pair of legs (not shown) of bifurcated member 39 to contact arm 27 and provide dual electrical paths between contact arm 27 and bimetallic element 36.

Control member 36 is biased in a clockwise direction by pivot spring 40 which is disposed in recess 40' of base 18 with one end of spring 40 abutting wall 42 of recess 40' and the other end of spring 40 abutting the portion of control member 36 positioned above pivot 37. The normal position of control member 36 is set by adjusting screw 43 which extends through an opening in base 18, and is received by nut 44 disposed in a suitable recess in base 18. The end of screw 43 opposite head 45 thereof abuts one leg of tensioning member 46, thereby forcing tensioning member 46 against control member 36 to bodily move control member 36 about pivot 37.

When magnet 38 is energized sufficiently by current flowing through control member 36, magnet 38 is attracted to armature 47.

Thus, the current-carrying path through circuit breaker 11, beginning at the load side thereof, comprises terminal 58, braid 57 to the upper end of bimetallic control member 36, through control member 36 and bifurcated member 39, through the parallel paths formed by braids 40a, 40b to contact arm 27, and through engaged cooperating contacts 26, 22 to line terminal 24.

Roller 30, pivoted at 60 to cradle 31, engages trip member 61 upon operation of cradle 31 between its latched position (FIG. 3) and its TRIPPED position (FIG. 4). Engagement of trip member 61 by roller 30 forces trip member 61 counterclockwise about pivot 37 into engagement with control 36, thereby causing member 36 to pivot counterclockwise about pivot 37 against the force of spring 40.

When cradle 31 moves from the circuit breaker ON position of FIG. 3 to the TRIPPED position of FIG. 4, the end 65 of kicker 66 which is pivoted at 67 to cradle 31 now engages contact arm 27 with a hammerlike blow, thereby assuring separation of contacts 22, 26 even though there is a tendency for these contacts to weld.

Common tie bar 17 is an elongated member of uniform cross-section which is disposed within openings 62 of each of the trip levers 61 of circuit breakers 11-13, as well as the auxiliary device 14, as will be subsequently described. For this purpose, a round opening 63 is formed in the closed side of base 18, and an aligned similar round opening (not shown) is formed in cover 20.

With all the circuit breakers in the closed position of FIG. 3, should an overload condition occur in any of the circuit breakers 11-13, the latch 35 of the overloaded circuit breaker will move to the right, thereby releasing its associated latch tip 34 so that operating spring 33 will force cradle 31 to rotate clockwise about pivot 32 to the TRIPPED position of FIG. 4.

During this movement of cradle 31, roller 30 carried thereby will engage trip lever 61, causing a counterclockwise movement thereof about pin 37. This counterclockwise movement of the trip lever 61 of the overloaded phase is transmitted through tie bar 17 so that the trip

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levers 61 of the circuit breakers which are not overloaded will also move counterclockwise about their pivots 37 into engagement with their respective control members 36. These respective control members 36 will in this manner be pivoted in a counterclockwise direction about pivot 37 and the latches 35 carried thereby will release their associated latch tips 34, thereby bringing about the automatic tripping of the phases which have not been subjected to the overload conditions.

The circuit breaker may also be moved to the manual OFF position, shown in FIG. 5, by operating handle 15. Operating handle 15 moves about 29 to move the upper end of the movable contact arm in pivot formation 28 overcenter with respect to operating spring 33. It is to be noted that during this movement the latched engagement of cradle tip 34 remains, and there is no movement of trip member 61 or common tie bar 17.

Reference is now made to FIGS. 6 and 7, which show the auxiliary alarm switch 14 of the instant invention. Auxiliary alarm switch 14 is mounted within the same housing consisting of molded base 18 and cover 20. The common tie bar 17 extends into the alarm switch 14 and a rectangular aperture of trip lever 61 which is pivotally mounted at 37. Thus, the tripping of the circuit breaker to the condition of FIG. 4 will move the tie bar 17 in a direction to effect counterclockwise movement of trip lever 61, within the alarm switch 14, corresponding to the similar movement of the trip levers located within the individual phase circuit breakers 11-13.

In place of the bimetal, the alarm switch 14 includes a trip lever 101. The trip lever includes a latching portion 103 which engages the latching tip 105 of a cradle member 107. Cradle member 107 is pivotally mounted at 109, to the suitable protrusions of the circuit breaker housing. A pin 112 is provided on the cradle to reset the alarm switch, in conjunction with the resetting of the associated circuit breaker units, after a tripping operation and the actuation of the alarm switch. In place of a contact arm found in the circuit breaker of FIGS. 3-5, the alarm switch includes a spring plate member 110. A biasing spring means 115 has one end located within aperture 111 of the spring plate 110 and the other end located within aperture 113 of the cradle member 107. Biasing spring 115 tends to urge the cradle clockwise about its pivot 109, such that cradle tip 105 is urged downwardly, as shown in the direction of arrow 117.

There is also located within the alarm switch 114 a switching means 120 in the form of a conventional type of microswitch. A switch actuator 122 is shown pivotally mounted at 124. Switch actuator 122 is normally urged upwardly, as shown in FIG. 6, by the resiliently mounted plunger 126 of the microswitch. A pair of externally extending conducting leads 130, 132 are connected to the microswitch terminals.

Upon the occurrence of circuit breaker tripping (as shown in FIG. 4), the trip levers 61 of all the switching devices, including the alarm switch 14, will be moved in the direction of arrow 119, as shown in FIG. 6. This will serve to rotate elongated lever 101 counterclockwise about its pivot 37, thereby releasing the latched engagement of cradle tip 105. This condition is shown in FIG. 7. When the cradle tip is released, the cradle 107 rotates clockwise under the force of biasing spring 115 (as shown by arrow 117), to bring about engagement between the cradle tip 105 and switch actuator 122. This serves to move the switch actuator downwardly, urging the microswitch plunger 126 inwardly. This inward movement of the plunger 126 serves to change the operative conditions of the microswitch 120, in a manner which will provide an output signal capable of actuating a remotely situated alarm.

A typical electrical circuit for such alarm indication is shown in FIG. 8. Microswitch 120 is of the normally open type and includes movable contact 121 and stationary contact 123, connected to conductors 130, 132 re-

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spectively. Upon inward movement of plunger 126 by the switch actuator 122, the contact 121 is moved to the dotted position to make electrical contact with cooperating contact 123. In the illustrative example shown, an alarm in the form of the light 140 energized by a battery source 142 is shown. The closing of the contacts 121 and 123 serves to complete the energizing circuit for light 140, thereby giving an indication of circuit breaker tripping. It should be naturally understood that light 140 is only shown for illustrative purposes, and any other suitable alarm device may be used.

It is therefore seen that my invention provides a simplified alarm switch, having a convenient application in conjunction with presently available single pole circuit breaker devices, which are typically stacked and interconnected for multi-phase operation.

The embodiments of the invention in which an exclusive privilege or property is claimed are defined as follows:

1. The combination comprising a plurality of individual switching devices stacked side by side, including switching devices of a first and second type;

and a first common element extending between said plurality of switching devices, whereby the movement of any one of said plurality of switching devices from a first to a second condition causes the remaining ones of said switching devices to move to said second condition;

each of said switching devices including an operating mechanism having a latchable means;

latch means for maintaining said latchable means in its latched condition, whereby its respective switching device is maintained in said first condition;

said latch means movable to a tripped condition, whereby said latchable means is unlatched and its respective switching device is moved to a second condition;

said first type of switching devices being a circuit breaker including a pair of cooperating contacts;

said contacts being ON in said first condition and

TRIPPED OPEN in said second condition;

a fault sensing trip means operatively connected to the circuit breaker latch means to effect movement of said latch means to its tripped condition responsive to a predetermined overload condition;

a trip member operatively connected between said latch means and said common element of said first type of switching device, such that movement of the latch means of one of said first type of switching devices to its tripped condition moves its trip member in a direction moving said common element in a tripping direction, and moving the trip members of all of the remaining switching devices in said direction, such that all of said remaining trip members move in unison to trip their respective switching devices;

each of said circuit breakers including a manual operating means for moving its operating mechanism to a third, MANUAL OFF, condition;

a second common element interconnecting the manual operating means of all of said circuit breakers, such that all of said manual operating means move in unison for moving their respective operating mechanism to the MANUAL OFF condition;

said second common element being devoid of an operative connection to said second type of switching device, such that said second type of switching device remains in said first condition when said circuit breakers are moved to the MANUAL OFF condition, and movement of said second type of switching device to said second condition is responsive only to circuit breaker movement to the TRIPPED OPEN condition;

said second type of switching device including switch means responsive to movement thereof to said second condition, and providing a remote indication of circuit breaker tripping;

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said second type of switching device including a switch actuator;

means normally biasing said switch actuator towards a first position, such that said switch means is in a first condition;

means biasing said latchable means of said second type of switching device towards engagement with said switch actuator for movement thereof to a second position with the latched engagement of said latch means and latchable means preventing said engagement;

the tripped movement of said latch means out of engagement with said latchable means permitting movement thereof, under the force of said biasing means, into engagement with said switch actuator for moving said switch means to a second condition.

2. The combination as set forth in claim 1:

said switch means including conductor means connected to the contacts thereof and extending external of its housing;

said conductor means providing a signal responsive to switch conditions for indicating circuit breaker tripping.

3. The combination as set forth in claim 1:

said latchable means of said second type of switching device comprising a pivotable cradle, normally biased

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to pivot toward engagement with said switch actuator, and said latch means for said latchable means preventing said pivoting of said cradle when said latch means and said cradle are in engagement.

4. The combination as set forth in claim 3:

said latch means of said second type of switching device is in position to be engaged by said first common element extending between said plurality of switching devices when the latter element is operated by a said trip member of a said first type of switching device, and is in position to be operated by said first common element out of engagement with said cradle, to permit the pivoting of said cradle.

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BERNARD A. GILHEANY, Primary Examiner

H. BROOME, Assistant Examiner

U.S. Cl. X.R.

335—173