

[72] Inventor **Gerald J. DeAngelo**
Monroe, Connecticut
 [21] Appl. No. **715,789**
 [22] Filed **March 25, 1968**
 [45] Patented **Dec. 1, 1970**
 [73] Assignee **Westinghouse Electric Corporation**
Pittsburgh, Pennsylvania
a corporation of Pennsylvania

2,668,895	2/1954	Allenby.....	200/167(A)UX
2,737,557	3/1956	Johnson.....	200/167(AX)
3,120,125	2/1964	Vasel.....	250/227UX
3,177,470	4/1965	Galopin.....	250/227UX
3,211,861	10/1965	Freese.....	337/79(X)
3,238,343	3/1966	Carlson.....	200/167(A)
3,301,988	1/1967	Weitzman.....	200/167(A)
3,409,751	11/1968	Krieger.....	200/167(A)
3,431,410	3/1969	Dolan et al.	350/96(X)

Primary Examiner—H. O. Jones

Attorneys—A. T. Stratton, C. L. Mc Hale and W. A. Elchik

[54] **CIRCUIT INTERRUPTER WITH ILLUMINATED HANDLE**
14 Claims, 6 Drawing Figs.

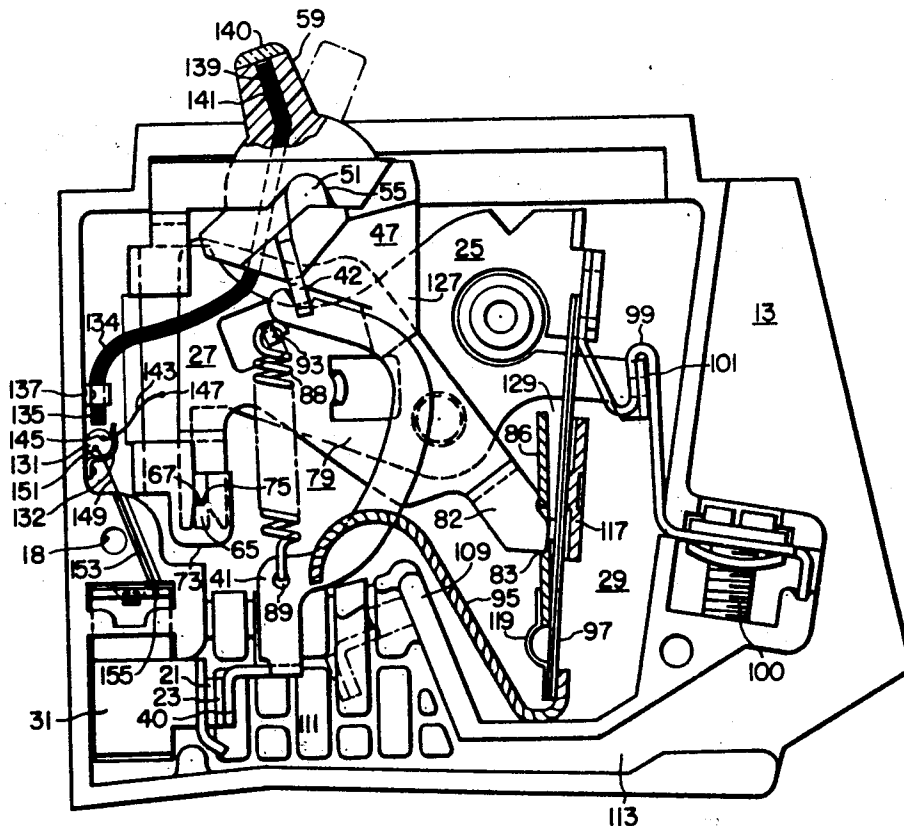
[52] U.S. Cl..... **200/167,**
350/96; 250/227
 [51] Int. Cl..... **H01n 9/18**
 [50] Field of Search..... **200/167(A);**
337/79; 350/96; 250/227

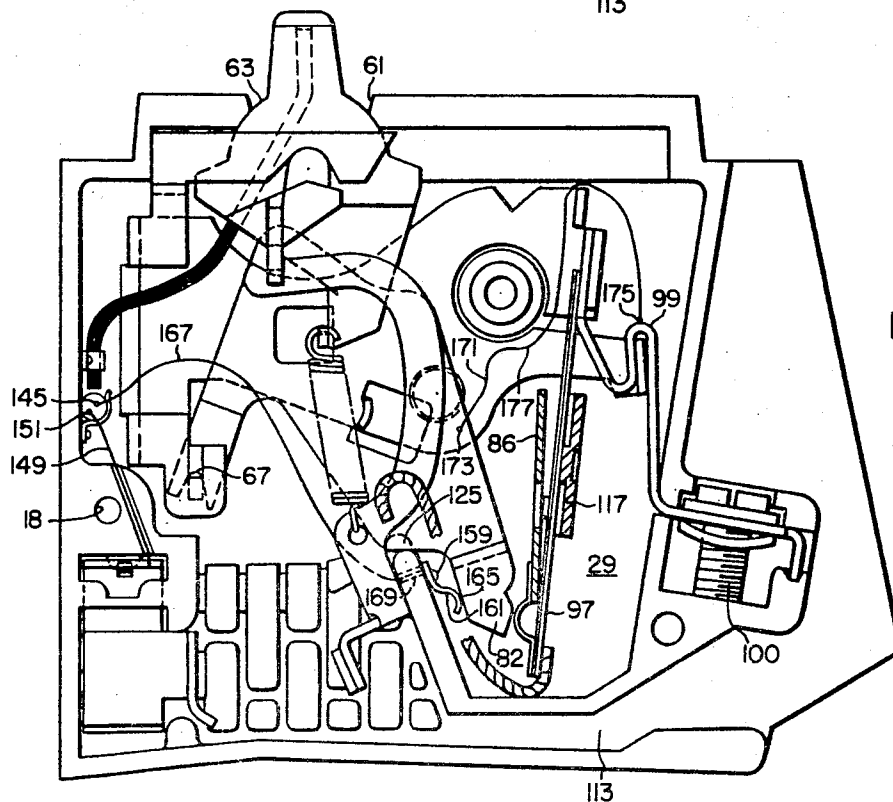
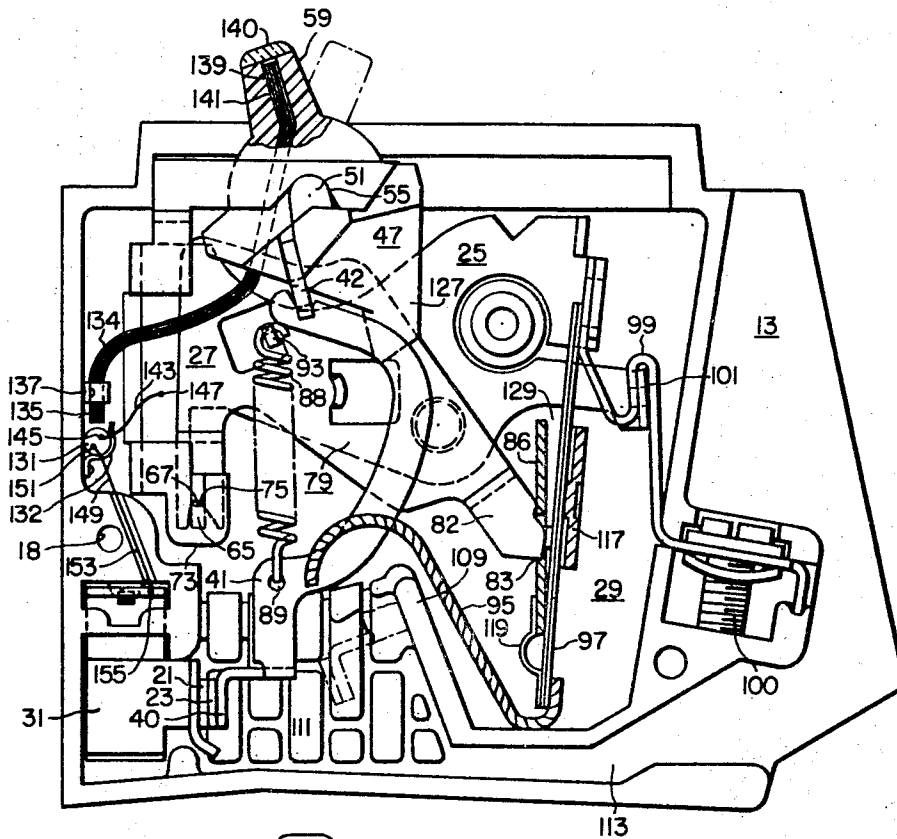
[56] **References Cited**

UNITED STATES PATENTS

2,612,597 9/1952 Sherrard.....200/167(A)UX

ABSTRACT: A circuit interrupter having an operating mechanism including a manually operated handle to open or close the contacts and tripping mechanism for causing automatic opening of the contacts in response to predetermined overload conditions in the circuit. The handle of the circuit breaker is illuminated by a light source within the interrupter arranged to be illuminated only when the circuit interrupter is tripped, or if desired, whenever the contacts are open.





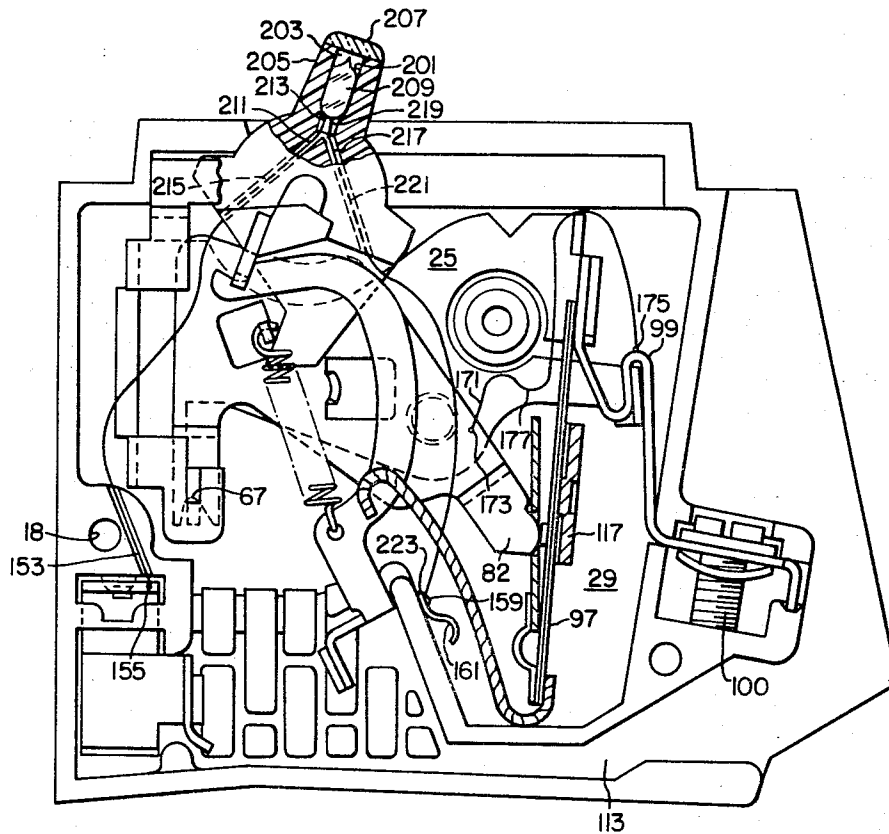


FIG. 3.

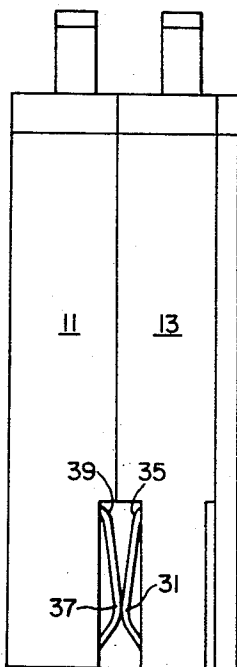


FIG. 4.

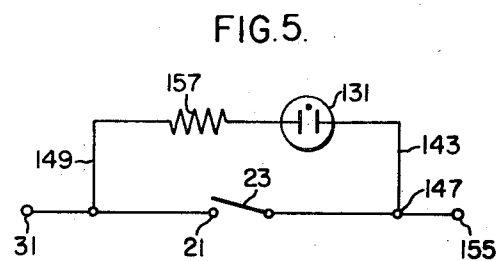


FIG. 5.

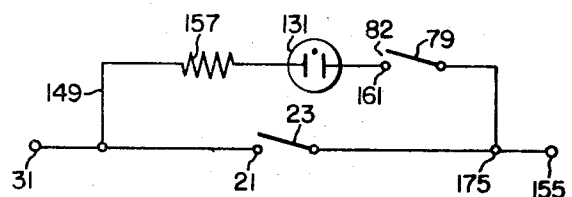


FIG. 6.

CIRCUIT INTERRUPTER WITH ILLUMINATED HANDLE

The present invention relates to circuit interrupters and more particularly to circuit interrupters which are manually and automatically operated.

For many applications it would be desirable to positively and clearly indicate the position of the circuit interrupter handle so as to indicate whether the circuit interrupter is open or tripped. Most circuit interrupters rely solely on the position of the operating handle for such indication but this is not entirely satisfactory and is not sufficiently positive. A few circuit interrupters have been provided with a lamp mounted in a recess in the handle which is illuminated at all times to show the location of the handle. This, however, does not indicate whether the circuit interrupter is open or tripped. Furthermore, excessive heat and impacts to the handle and excess wear of the flexible leads to the lamp are apt to cause failures.

It is accordingly an object of the present invention to provide a circuit interrupter with an illuminated handle which is safe and reliable in operation.

Another object of the invention is to provide a circuit interrupter in which a light source is located within the interrupter casing and the light is transmitted to the handle via a flexible light guide or conductor.

A further object of the invention is to provide a circuit interrupter in which the handle is illuminated only when the interrupter is automatically opened.

In accordance with one embodiment of the invention, the light source is located within the casing of the circuit interrupter. Light from the source is "piped" to the operating handle by a flexible light transmitting tube. Since with this construction it is not necessary to provide flexible electrical conductor leads and a lamp within the operating handle it is obvious that this is a very safe and reliable arrangement.

In accordance with another feature of this invention the circuit interrupter is provided with a switching arrangement whereby the lamp is only illuminated when the circuit interrupter has been automatically tripped open. This is accomplished by providing an auxiliary contact member in series with the light source; this contact being engaged only when the main contacts are automatically opened.

The invention is shown and described for purpose of illustration, as applied to a circuit breaker of the type shown and fully described in U.S. Pat. No. 3,200,217. Similar reference characters have been used in the drawings of this application to identify corresponding parts. For more specific details of construction and operation of the corresponding parts reference may be made to the above mentioned patent. It will be understood, however, that the present invention may be embodied in circuit breakers and switches of other types and constructions than the one shown for purposes of illustration.

The novel features that are considered characteristic of this invention are set forth in particular in the appended claims. The invention itself, however, both as to structure and operation, together with additional objects and advantages thereof, will be best understood from the following detailed description when read in conjunction with the accompanying drawings, in which:

FIG. 1 is a side elevation of a circuit interrupter embodying one form of this invention. The interrupter is shown with the cover removed and the interrupter in the closed position, with the open position of the movable contact and operating handle being shown in dotted lines.

FIG. 2 is a side elevation of a circuit interrupter embodying another form of this invention. The interrupter mechanism in this view being shown in the tripped position.

FIG. 3 is a side elevation of a circuit breaker embodying another form of this invention. The interrupter is shown in the open position.

FIG. 4 is an end view of the circuit breaker shown in FIGS. 1-3.

FIG. 5 shows a schematic circuit diagram of the embodiment shown in FIG. 1.

FIG. 6 shows a schematic circuit diagram of the embodiments shown in FIGS. 2-3.

Referring to FIG. 4 of the drawings, duplex type circuit breaker 9 is shown therein comprising an insulating housing that is composed of two parts, 11 and 13, forming two compartments. Each of the parts 11 and 13 is composed of a back portion molded integrally with four sides forming an open front. The open front of the part 11 is covered by the back portion of the part 13, and open front of the part 13 is covered by a cover 15. The three portions 11, 13 and 15 of the housing are held rigidly together by three rivets (not shown) which extend through three openings 18 (FIGS. 1-3) in each of the three housing parts.

The housing parts 11 and 13 form two independent compartments housing two circuit breaker mechanisms which, except for a line terminal structure that will be hereinafter described, are of identical construction and operation, each operating independently of the other. For this reason, only the mechanism enclosed by the housing part 13 will be specifically described, it being understood that, unless otherwise mentioned, the description applies to both mechanisms of the duplex circuit breaker.

Referring to FIG. 1 of the drawings, the circuit interrupter mechanism which is enclosed by the housing part 13 comprises a stationary contact 21, a cooperating movable contact 23, a supporting metal frame 25, an operating mechanism 27, trip device 29, and operating handle 59.

The stationary contact 21 is welded or otherwise attached to a line terminal 31 which is secured in a recess at one end of the housing 13. A portion of the line terminal 31 protrudes through an opening 35 (FIG. 4) in the housing part 13. A similar portion of a symmetrically constructed line terminal 37 protrudes through an opening 39 in the housing part 11. The line terminals 31 and 37 are independent in that each is a part of a separate independently functioning circuit interrupter mechanism. The parts 31 and 37 are resilient and adapted to engage opposite sides of a blade in a load center when the duplex breaker is mounted in operating position.

The stationary contact 21 cooperates with the movable contact 23 that is welded or otherwise attached to a small flange 40 of a flat C-shaped metal switch arm 41. A bearing 42 for the switch arm is mounted by slots (not shown) on the underside of the operating member 47. This bearing transmits motion from the operating member 47, which forms a part of the handle 59, to the movable contact arm 41 when the breaker is manually operated, and from the movable contact arm 41, as will be hereinafter explained, to the operating member 47 when the breaker is tripped automatically in response to predetermined abnormal conditions such as a short circuit or an overload.

The operating member 47 has an arcuate trunnion 51 molded at each side thereof. The trunnions 51 fit and rotatably ride within two arcuate surfaces 55 on the frame 25. The operating member 47 is supported between the surfaces 55 of the frame 25 and the bearing 42 which is supported by the contact arm 41. The operating member 47 has a handle portion 59 molded integral therewith which extends through an opening 61 (FIG. 2) in the housing to permit manual operation of the circuit breaker. Arcuate surfaces 63 (FIG. 2) on opposite sides of the handle 59 substantially close the opening 61 in all positions of the operating member 47.

The frame comprises a flat metal plate secured within the recess in the housing 13. It supports an insulating pivot 65 having shoulders 67 at opposite ends which rest in a slot in the frame and a similar slot in a lateral projection 73 of the frame.

A metallic releasable trip member 79 is pivotally supported at one end by a notch 75 engaging a slot in the center of the pivot 65. The other end 82 of trip member 79 has a latch point 83 which releasably rests on ledge 85 of an armature 86 of the trip device 29 which will be hereinafter described. An over-center spring 88 is connected, under tension, at one end in an opening 89 in the contact arm 41 and at the other end on a projection 93 extending from the trip member 79.

The movable contact arm 41 is electrically connected by means of a flexible conductor 95 to the free end of a bimetal 97 the other end of which is attached to one end of a load ter-

minal conductor 99. A load terminal connecting screw 100 is provided at the other end of the conductor 99. The load terminal conductor is rigidly attached to a projection 101 extending out from the frame 25.

The closed electrical circuit through the breaker extends from the line terminal 31 through the stationary and movable contact 21, 23, the contact arm 41, the flexible conductor 95, the bimetal element 97 and the load terminal conductor 99. Since the movable contact arm 41 extends downwardly from its pivot, the arc is established adjacent the bottom of the housing in an arc chute 111, one end of which is connected by a vent passage 113 to an opening in the end of the housing beneath the load terminal screw 100.

The circuit interrupter may be manually operated to open and close the contacts by operation of the handle 59, which will be described in more detail subsequently. Movement of the handle 59 clockwise from the full line position in FIG. 1 to the dotted line position, carries the upper end of the contact arm 41 to the left of the line of action of the spring 88 whereupon the spring acts to move the contact arm 41 with a snap action to the open position shown by the dotted lines. A projection 109, molded integrally with the housing part 13, acts as a limit stop for the movable contact arm 41 during an opening operation. Movement of the operating handle 59 in a counterclockwise direction, as from the dotted position to the full line position moves the upper end of the movable contact arm 41 to the right of the line of action of the spring 88 which spring thereupon acts to move the contact arm to the closed position with a snap action.

The trip device 29 comprises the armature 86, the bimetal 97, a U-shaped magnet 117 and a spring 119. The upper end of the bimetal 97 is welded or otherwise secured to the terminal conductor 99 which is secured to the projection 101 on the metal frame 25. The flexible conductor 95 is welded or otherwise suitably secured to the lower or free end of the bimetal 97, and it electrically connects the bimetal 97 with the movable contact arm 41. The armature 86 is movably mounted on the bimetal 97 by means of the spring 119 secured to the bimetal 97. Thus, the armature 86 is supported on the spring member 119 which in turn is supported on the bimetal 97. The U-shaped magnet 117 is welded or otherwise suitably attached to the bimetal 97.

Upon the occurrence of an overload current below a predetermined value, the bimetal element 97 becomes heated and when heated a predetermined amount deflects to the right as seen in FIG. 1 to release the trip member, thus effecting a time delayed thermal tripping operation. The armature 86 is carried to the right with the bimetal to release the trip member 79. When the trip member 79 is released the spring 88 acts to rotate the trip member clockwise about the pivot 65 until this motion is arrested when a stop or portion on the trip member 79 strikes the projection 109 of the housing part 13 (FIG. 2). During this movement, the line of action of the spring 88 moves to the right of the pivot 44 of the contact arm 41 whereupon the spring biases the contact arm in an opening direction and moves it so that the line of action of the force exerted by the spring on the operating member 47 shifts across the pivot 51, whereupon the spring 88 actuates both the contact arm 41 and the operating member 47 to the tripped position in which these parts are shown in FIG. 2. The movements of the trip member 79 and contact arm 41 are arrested by the projection 109. Movement of the operating member 47 is stopped in an intermediate position (FIG. 2) when a projection 127, molded integrally with the operating member 47, strikes the projection 93 which extends from the trip member 79. The circuit breaker is trip-free in that the breaker will trip upon the occurrence of an overload even if the handle 59 is held in the "on" or closed position.

The circuit breaker is magnetically tripped automatically and instantaneously in response to overload currents above the predetermined value. Upon the flow of current through the bimetal 97, a magnetic flux, which is induced around the bimetal, takes the path of least reluctance through a magnet

117, across an air gap 129, and through the armature 86. When an overload current above the predetermined value occurs, the pull of the magnetic flux is of such strength that the armature 86 is attracted to the magnet 117 whereupon the spring 119 flexes permitting the armature to move laterally as well as pivotally toward the magnet 117. This movement releases trip member 79 and the contacts are opened in the same manner hereinbefore described with respect to the thermal tripping operation.

Before the contacts can be closed following an automatic opening operation, it is necessary to reset and relatch the mechanism. This is accomplished by moving the operating handle 59 clockwise from the tripped position (FIG. 2) to a position slightly beyond the full open position in which it is shown in dot-and-dash lines in FIG. 1. During this movement, due to the engagement of the projection 127 of the operating member 47 with the projection 93 of the trip member 79, the trip member is moved counterclockwise until the latch point 83 is again supported in the latched position on the ledge 85 of the armature 86.

In accordance with the invention, means are provided for illuminating the handle to indicate the position of the handle. Referring to FIG. 1, the illuminating means comprises a small lamp 131, either of the conventional filament or neon type, having two terminals 145 and 151, mounted to the housing part 13 by suitable mounting means such as a clip 132. Instead of the clip, a socket may be mounted in the housing to receive and support the lamp. A flexible light conducting, fiber optical light guide 133 is attached at one end 135 by a clip 137 to the housing part 13 so as to be in proximity with the lamp 131. The other end 139 of the fiber optical light guide extends within a recess or hole 141 provided in the handle 59 and is secured by friction or a suitable adhesive to the wall of the recess in close proximity with a light transmitting lens 140 on the outermost part of the handle 59.

The lens 140 may be constructed of either transparent or translucent glass or plastic or other similar material. It should also be noted that the entire handle 59 or operating member 47 including the handle and lens may be integrally formed of a translucent or transparent molded material, thereby making the use of a separate lens unnecessary. The fiber optic light guide 133 is well known in the art. It may consist of an individual glass or plastic drawn fiber having a relatively high index of refraction. The sidewalls of the fibers are smooth for reflecting the internal light being transmitted from one end of the guide to the other. The outer surface of the fiber is covered with an opaque plastic sheath to prevent external light from entering the fiber. The light guide may also consist of a bundle of individual fibers, such as described in the O'Brien U.S. Pat. No. 2,825,260.

A lead wire 143 extends from one of the terminals 145 to the frame 27 where it is attached at 147. A second lead wire 149 extends from the lamp terminal 151 through a channel 153 in the housing part 113 and is attached at its other end to the line terminal 31 at 155. Since the frame 25 is metal and therefore conducting, and since the frame is in an electrically conductive relationship with load terminal conductor 99 at 101, it can be seen that there exists a parallel path across the line terminal 31 and the load terminal 99 by way of the lead wire 149, the lamp 131, lead wire 147, and frame 27.

When the circuit interrupter is closed current flows from the line terminal 31 to the load terminal 99 as hereinbefore described. Substantially no current flows through the parallel lamp circuit since the resistance of the lamp 131 is much greater than the resistance through the interrupter and therefore the lamp will not be illuminated. However, when the interrupter is opened, either manually or as the result of an abnormal condition, current will pass through the parallel lamp circuit and illuminate the lamp 131. The light from the lamp is then transmitted through the fiber optical light guide 133 to the lens of the handle 140 and thereby illuminating a part of the handle. An observer can then easily identify an interrupter which has been opened either manually or as a result of an abnormal condition.

FIG. 5 shows a schematic diagram of the electrical circuit hereinabove described. The circuit has been numbered to correspond, where appropriate, to the physical parts of the interrupter. Where the lamp 131 is a neon lamp an additional resistance 157 is needed in the lamp circuit. A neon lamp when illuminated presents little resistance to current flow, and therefore an exterior resistance is necessary. If an ordinary filament lamp is used the internal resistance of the lamp will normally provide enough resistance to current flow. The circuit as shown represents the interrupter in the open or tripped position.

FIG. 2 shows another embodiment of my invention. The circuit interrupter is shown in the tripped position. In accordance with this embodiment, the lamp and consequently the handle are arranged to be illuminated only when the circuit interrupter has operated automatically to open the contacts, i.e. when it has been tripped by the operation of the trip device. For this purpose additional contacts are provided in series with the lamp circuit which are arranged to be closed only when the circuit interrupter is tripped open in response to predetermined abnormal conditions. The structure of the circuit interrupter and means for illuminating the handle are identical to structure shown in FIG. 1 except of the provision of the above mentioned additional contacts and like parts have been identified by the same reference characters in this FIG. Referring to FIG. 2, one of the additional contacts is a contact 161 which is mounted on the stop projection 109 of the insulating housing 13. The other cooperating contact for simplicity and economy is latch end portion 82 of the releasable trip member 79.

The contact 161 which is of resilient conducting material may be secured to the projection 109 by any suitable means such as the rivet 159, and it is provided with a curved projecting end 165 which is in the path of movement of the trip member 79 when the latter moves clockwise upon release. The contact 161 is electrically connected by a conductor 167 to one terminal 145 of the lamp 131. The end of this conductor extends through a hole 169 in the projection 109 which serves to anchor it in place. A lead wire 149 connects the other lamp terminal 151 and line terminal 31 as in FIG. 1. Another conductor 171 may be attached at 173 to the releasable member 27 and to the terminal 99. It should be understood, however, that if releasable member 27 is in sufficient electrical contact with load terminal 99 this conductor is not necessary.

When the releasable trip member 79 is released by operation of the trip device it moves clockwise until its free end portion engages contact 161. This completes the lamp circuit across the line terminal 31 and the load terminal 99 as follows: From the line terminal 31 to the lamp 131 via lead wire 149; from the lamp via lead wire 167 to the contact 161; from the contact 161 through the releasable member 79, and finally to the load terminal 99 via wire 171. Note that there is provided some slack in wire 171 at 177 to allow for movement of releasable member 27.

This parallel circuit may be more easily recognized by reference to FIG. 6. This FIG. is a schematic representation of the circuit breaker shown in FIG. 2 wherein the same numbers have been used to designate the same physical parts. Thus lamp 131 will only be illuminated when the interrupter has been tripped due to some abnormal condition. When the interrupter is manually opened the parallel lamp circuit is open since the contacts 82-161 are open. However, when the circuit interrupter is tripped, the releasable trip member 79 completes the lamp circuit by contacting contact 161 and thereby causing the lamp 131 to be illuminated as well as the handle 59 will be illuminated only when tripped. Of course, when the circuit interrupter is in the closed position, the lamp circuit will effectively be shorted out due to its high resistance of the lamp compared with the resistance of the electrical path through the circuit interrupter.

FIG. 3 shows another embodiment of the invention. The interrupter is shown here in the open position. In accordance with this embodiment the flexible light transmitting guide is

eliminated by mounting the lamp directly in the handle instead of in the housing as in FIG. 2. The structure of this embodiment is substantially the same as that described in FIG. 2, except as above indicated. Like parts are designated by the same reference numerals. Referring to FIG. 3, within the handle 59 is a recess 201 with an opening 205 to the exterior portion of the free end 205 of the handle. A light transmitting lens 207 is mounted on the handle over the opening 203. Within the recess 201 is mounted a small lamp 209. A lead wire 211 extends from one of the terminals 213 of the lamp through one portion 215 of recess 201, through the channel 153 in part 13 and is connected to the line terminal 31 at 155. A second lead wire 217 extends from the other terminal 219 of lamp 209, through a second portion 221 of recess 201 to contact terminal 161 where it is fastened at one end 223 thereon.

It can be seen that although the lamp 209 is located in a different position within the circuit interrupter from the lamp 145 in FIG. 2, the electrical circuit and the operation remains the same as that described in FIGS. 2 and 6. Thus, the circuit interrupter in FIG. 3 will operate in the same manner as the circuit interrupter in FIG. 2.

While the invention has been disclosed in accordance with the provisions of the patent statutes, it is to be understood that various changes in the structural details and arrangements of parts thereof may be made without departing from some of the essential features of the invention. It is desired, therefore, that the language of the appended claims be given as reasonably broad an interpretation permitted by the prior art.

I claim:

1. A circuit breaker comprising a casing, a pair of cooperating contacts within the casing, an operating handle supported on the casing having a free end projecting from said casing, said operating handle being manually movable to open and close the contacts, trip means operable to automatically disengage the contacts in response to predetermined abnormal conditions, means illuminating at least a portion of said operating handle only when the contacts are automatically disengaged.

2. A circuit breaker as in claim 1 wherein the illuminating means comprises a light source mounted within the operating handle.

3. A circuit breaker as in claim 1 wherein said operating handle has a recess therein communicating with an opening extending within the free end of the operating handle, and said illuminating means comprises a source of light mounted in the recess and a light transmitting lens in said opening in the manually operable end of the operating handle.

4. A circuit breaker as in claim 1 wherein the illuminating means comprises a light source mounted within the casing, and a flexible light-transmitting element which extends from the light source into the operating handle for transmitting light thereto.

5. A circuit breaker as in claim 1 wherein said trip means comprises a member releasable to cause disengagement of said contacts and wherein said illuminating means comprises a light source in said casing and circuit connections for energizing said light source including additional contact means closed by the releasable member when the releasable member is released.

6. A circuit breaker as in claim 1 wherein said trip means comprises a releasable member responsive to the said predetermined abnormal conditions, and wherein said illuminating means comprises a light source mounted within the casing, and a flexible light-transmitting element which extends from the light source into the operating handle for transmitting light thereto.

7. A circuit interrupter comprising a casing, separable contacts in said casing, an operating handle at least a part of which is light transmissive, said operating handle movably mounted substantially in said casing and having the light transmissive part extending through an opening in the casing so as to be manually operable from the exterior, said operating handle being movable to open and to close said contacts, a light source mounted within the casing, means illuminating the light

7

source when the contacts are disengaged, an elongated flexible light-transmitting fiber optical light guide one end of which is located in proximity with the light source and the other end located so as to illuminate said operating handle whenever said contacts are disengaged.

8. A circuit interrupter as in claim 7 wherein tripping means is provided for automatically disengaging said contacts in response to predetermined abnormal conditions.

9. A circuit breaker as in claim 8 wherein the means illuminating the light source when the contacts are disengaged comprises a circuit in said casing including said light source and a pair of normally open auxiliary contacts which are closed by the operation of said tripping means.

10. A circuit interrupter as in claim 7 wherein the elongated flexible light-transmitting fiber optical light guide is comprised of a bundle of light conducting fibers, and wherein a recess is provided in the operating handle to receive the operating handle-illuminating end of said light conducting fibers.

11. A circuit interrupter as in claim 7 wherein the elongated flexible light-transmitting fiber optical light guide is comprised of a bundle of light conducting fibers one end of which ex-

8

tends into a recess in the operating handle, and wherein additional means are provided for automatically disengaging said contacts in response to predetermined abnormal current conditions.

12. A circuit breaker as in claim 7 wherein the illuminating means comprises a circuit including the light source connected across the contacts, said circuit having a sufficiently high value of resistance that when the contacts are in the closed position insufficient current will flow through the light source to illuminate the operating handle.

13. A circuit interrupter as in claim 7 wherein the light source is positioned within the casing such that the operating handle when illuminated is illuminated substantially solely from the light transmitted through said elongated flexible light-transmitting fiber optical light guide.

14. A circuit interrupter as in claim 4 wherein the light source is positioned within the casing such that the operating handle when illuminated is illuminated substantially solely from the light transmitted through said light-transmitting element.

25

30

35

40

45

50

55

60

65

70

75