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CIRCUIT BREAKER

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6 Claims. (Cl. 200—121)

This application discloses a circuit breaker unit and is a division of our copending application Serial No. 649,988, filed January 3, 1933, now Patent No. 1,982,289 of November 27, 1934, class 200, sub-class 116.

One principal object is to provide, in connection with circuit breakers, means for indicating the condition of the breaker and/or condition of the circuit controlled thereby. More specifically, it is aimed to provide novel constructions and combinations including heads for enclosing the circuit breaker proper equipped with indicating devices such as lamps, etc., which may be lit upon changes in the condition of the breaker and/or the controlled circuit.

It is contemplated at the present time to provide for a standard form of circuit breaker, interchangeable and convertible heads which may be made from a single blank, the blank being convertible, as desired, into a simple, breaker-enclosing head, or into a head which not only encloses the breaker parts but which also can be equipped with indicating parts.

In one design, the indicating parts will give one indication when the breaker has been released on overload and will give a different indication under different conditions. In a second design, the indicating parts will produce three different indications, one, for an overload release produced by a short circuit, another, for an overload release produced by a relatively light overload, and a third, for other conditions of the circuit. This type of indicating means is particularly desirable in that it not only indicates the existence of an abnormal condition in the circuit but it also indicates the nature of the abnormal condition.

It is contemplated to have the indicating means in the form of a lamp or tube so connected that it will be dark when the breaker is closed, and glow when it is open, as contra-distinguished from prior art constructions, wherein the lamp or tube is so connected that it will be dark when the breaker is open and glow when it is closed.

Further, in the last mentioned design, the indicating means may be so constructed that though the indications on overloads are different, depending upon the nature of the overload, they are both so different from the indication produced by a normal condition of the circuit, that though they may readily be distinguished from each other, they may also be distinguished from the normal load indication. In a preferred embodiment, following this idea, where the indicating means is in the nature of a neon tube, the design is such that the neon tube will burn brightly on short circuit, dimly on light overload, and not at all on normal load.

Further, the indicating means of the last mentioned design permits the operator to tell at a glance whether it is safe to close the breaker,

once it has tripped. For example, if the lamp burns brightly as on a short circuit overload, the operator will immediately know that it is dangerous to close the breaker. However, if the lamp is burning dimly, as on light overload, the operator will know that it is safe to close the breaker.

A further object is to provide an indicating means wherein a neon tube is employed as the indicating element, this type of indicator permitting novel connections, for results outlined in the foregoing.

Still further objects will be readily apparent to those skilled in the art upon reference to the following detailed description of embodiments of circuit breakers, the same to be read in connection with the appended drawing. Referring to this drawing, it will be seen that

Figures 1 and 2 are cut away elevation views of a circuit breaker provided with an indicating means, the breaker being shown in "On" and overload "Off" positions, respectively.

Figures 2a, 2b and 2c show schematically the device of Figures 1 and 2, and two variations thereof.

Circuit indicating means

In Figures 1 and 2, there is shown a circuit breaker unit like that shown in Figures 11-16 of a prior application, Serial No. 579,482, filed December 7, 1931, now Patent No. 1,952,039, March 20, 1934.

As described in that application the circuit breaker unit includes a base 140 upon which is mounted a breaker proper including a contact 141 connected to the line by a jumper 141a and connectable to the load line by a contact 142 on arm 143, a flexible jumper 143a, a thermal warping element T4, and a jumper 143b. Arm 143 is journaled at 144, to frame 145, and may be moved by links 147-148, connected by an axle pin 149, links 148 being connected by pin 150 to a member 151, journaled in frame 145 at 152.

Pin 144 also journals the operating arm 153 to the upper end of which is secured the arcuate piece 155 formed with a handle 156 by means of which the arm 153 can be moved manually, an upper part 158 of arm 153 is connected by coil springs 159 to pin 149 and these springs form the operating springs of the device.

For holding the pin 149 down, on normal loads, there is provided a pawl 160, journaled at 161 and restrained by the warping element T4. It will be understood that on overload, the latter warps to the right, releasing pawl 160, which in turn releases pin 149, permitting it to be pulled upwardly, and to the left by springs 159.

It will also be understood that when handle 156 is moved to the right, for switch "Off" position, pin 149 is moved to the right and upwardly, but does not move to the left.

The construction thus far described is no part of the present invention, except insofar as it relates to the circuit indicating means provided for the device and now about to be described.

For covering those parts of the breaker proper left exposed by the open top of the base 140, there may be provided one of two interchangeable and convertible heads, one of which may be equipped with circuit indicating means, (the head shown), and the other of which may be nothing more than a closure.

Both of the heads are substantially alike, differing only in details, and are made from a blank in the form of an insulating cupped block 180 provided with end bosses 181 in which are tapped bushings (not shown); a central cut out 182 in which moves the arcuate piece 155 and the handle 156; a boss 183 provided with a bore 184, closed by a "knockout", (not shown), but positioned at the upper end of bore 184; and a "knockout", (not shown), normally closing the opening at 184a.

When the blank is not to be equipped with circuit indicating elements, the "knockouts" are left in place, and the blank forms a head that is completely closed, except for cut out 182.

When the blank is to be equipped with the circuit indicating elements, the "knockouts" at bore 184 and opening 184a are removed and a tell-tale lamp 185 is positioned and sealed in bore 184, being visible through the opening left by the removed "knockout". One lead of the lamp is connected to a screw 186 in boss 181 by a flexible lead 187, and the other lead is connected to a screw 188 in boss 183, as shown.

In the boss 181 near boss 183, there is mounted a screw 189 which clamps in place two resilient contact leaves 190 and 191, the former of which has a forked end straddling the sides of the operating arm 153 and the other parts of the breaker, the tines of the forked end having insulation pieces 192 overlying the extended ends of the linkage pin 149, and positioned to be engaged thereby. The spring leaf 191 is bent to engage and make electrical contact with the jumper 141a of the breaker.

A conductor end 193 passed through opening 184a is held in place by screw 186 and connects the lead 187 to that side of the line opposite from the line connected to the jumper 141a.

It will be observed at this time that spring leaf 190 is so tempered that it normally is spaced from the head of screw 188 and accordingly breaks the circuit from contact 191, through lamp 185, lead 187, and conductor end 193. However, leaf 190 may be moved to engage screw 188 and establish the aforementioned circuit from contact 191 to conductor end 193.

A head formed of the blank 180 and equipped with parts 181-183 forms an indicating head which may be utilized to reveal the condition of the circuit through the breaker proper as follows: The head may be fitted onto a breaker-equipped base, with its leaf 190 straddling the breaker parts, and with its leaf 191 engaging jumper 141a, this being accomplished without alteration of the base or the breaker. Under normal load conditions, the pin 149 will not engage the ends 192 of leaf 190 and will not move the latter towards screw 188, this being true even as the pin 149 is moved to and from its "On" and "Off" positions.

When an overload occurs, however, pin 149 will move upwardly and to the left and will engage ends 192 of leaf 190, moving the latter upwardly so that it will engage screw head 188. Lamp 185 will thus be placed in circuit with the line con-

ductors and will light, indicating that the circuit breaker has been released on overload.

It will be observed that the lamp is not in series with the breaker-load circuit, but is in multiple therewith, and is mechanically, rather than electrically, connected to the breaker.

In Figure 2a, which shows the device of Figures 1-2 schematically, it will be seen that the circuit through lamp 185 is closed when the breaker trips, as an overload, due to the engagement of pin 149 and leaf 190. At all other times the lamp circuit is open and the lamp does not light.

Different visual indicating arrangements are contemplated, as alternative uses of the devices and mechanisms disclosed in Figures 1-2, and these are schematically indicated in Figures 2b and 2c.

In Figure 2b, the lamp 300 is shown as of the neon tube type and it is shown as connected in series with the load line through the medium of a spring contact 301, secured to boss 181 by screw 186 and adapted to engage jumper 143b when the head is placed on the base. Otherwise, the parts are like those shown in Figure 2a. It will be seen that the lamp circuit is closed only when the breaker is tripped by an overload or short circuit, the lamp circuit in this case including the load device whose short circuit caused breaker trip.

In Figure 2c, the lamp 300 is also shown as of the neon tube type and it is also shown as connected in series with the load line through a contact 301, etc. The leaf 310, however, is bent downwardly as shown, to be engaged by contact arm 143, rather than by pin 149, and is insulated from arm 143. Accordingly, the lamp circuit is closed when the breaker is opened, whether by a normal switch opening operation, or by an abnormal short circuit condition.

From the foregoing, it can be seen that it is possible to obtain a novel visual indicating effect from the device. For example, assume the lamp to be so designed as to burn brightly when in series with an extremely low resistance (short circuit), to burn dimly when in series with a resistance of medium strength (light overload), and not to burn at all when in series with a high resistance (normal load), or an infinitely great resistance (open circuit). Under such conditions the lamp will burn brightly on switch opening due to a short circuit; will burn dimly on switch opening due to a light overload, and will not burn at all on normal switch opening. A glance at a lighted lamp will therefore reveal not only the fact that the breaker has tripped, but also the cause of the breaker trip, that is to say, will reveal not only that the breaker has tripped, but will also reveal whether a short circuit (bright) or a light overload (dim) caused the breaker to trip.

Further, a construction of this character may be used to indicate to the operator whether or not it is safe to close the breaker after trip. If the breaker has tripped, but the lamp is out, the operator will know that the circuit back of the breaker was opened after the event that caused trip, and that it is safe to close the breaker. Also, if the breaker has tripped, and the lamp is burning dimly, the operator will know that the circuit contains a light overload, and that the breaker may be closed safely. But if the breaker has tripped, and the lamp is burning brightly, the operator will know that the circuit contains a short circuit or a heavy overload and that it would be unsafe to close the breaker.

In further explanation of the foregoing, the

following discussion as to the characteristics of neon tubes will be given. The successful operation of a neon tube or lamp requires that a resistance be interposed in series therewith. Now, by varying the interposed series resistance, the sensitivity and lighting characteristics of the lamp can be varied to a considerable extent. For example, the lamp can be designed to operate in the manner described above by determining properly the interposed resistance.

Further, where the range between the load circuit resistance on short circuit and the load circuit resistance on light overhead, etc., for the above described operation is not great, it is contemplated to use, in conjunction with the neon tube, a well known bridge type circuit, in which case the tube would indicate, by its different lightings, not the differences in the load circuit resistances, but the difference in ratios of the load circuit resistances. This arrangement offers an extreme sensitivity to the indicating neon tube.

Further, while it is preferred to use as the indicating means, a neon tube, which offers the advantages of low cost, long life, and low current consumption, it is possible to use ordinary incandescent lamps, with relatively satisfactory results.

It is further contemplated to combine the neon tube with the breaker in such a way that one of the terminals of the tube is connected to the live conductor on the live side of the breaker. In such a combination, the neon tube will glow dimly in the event that the breaker is open, or in the event that there is an open circuit on the load side of the breaker, and the neon tube will burn brightly in the event of a short circuit or heavy overload. The difference in glowings of the tube will indicate the nature of the circuit line back of the breaker, as can be observed.

It will also be seen that in the constructions shown, the tube or lamp is dark when the circuit is closed or live, and glows when the load circuit is open or dead, as contra-distinguished from constructions of the prior art, wherein the lamp is connected across the breaker so as to be dark when the load circuit is open or "dead", and glow when the load circuit is closed or "live". In the last mentioned type of construction, an operator, seeing the lamp dark, will rely upon it as an indication that the circuit is open or dead. This may, however, be a misreliance, since the lamp may be dark, due to the lamp having been burnt out or become disconnected, even though the circuit be alive, and this misreliance may lead to serious injury. In our construction, however, an operator, seeing the lamp dark, will believe the circuit to be closed or alive, and will act accordingly. Thus, even if the lamp be dark because of lamp failure, etc., rather than because of the circuit being alive, the operator, though he be misled as to the cause, will not be misled to his injury. He will determine the cause of the lamp's being dark and, having satisfied himself, may then proceed to work on the circuit.

Now, having described embodiments of circuit breakers, selected by way of example, reference will be had to the appended drawing which determines the scope of the monopoly desired, it being understood that, except as set out in the claims, the monopoly is not to be limited to the embodiments disclosed.

We claim:

1. A combined switch and circuit breaker device of the operating type manually operable for nor-

mal switching and operating automatically for overload release, the breaker having a line shunting the breaker controlled line and containing an auxiliary switch and an indicator energizable by the breaker controlled line energy when the auxiliary switch is closed, the auxiliary switch being constructed and arranged to be open normally and during manual switching operation and being constructed and arranged to be closed automatically by and upon release operation of the breaker and only then to energize the indicator.

2. A combined switch and circuit breaker device of the operating type manually operable for normal switching and operating automatically for overload release, the breaker having a line shunting the breaker controlled line and containing an auxiliary switch and an indicator energizable by the breaker controlled line energy when the auxiliary switch is closed, the auxiliary switch being constructed and arranged to be open normally and during manual switching operation and being constructed and arranged to be closed automatically by and upon release operation of the breaker and only then to energize the indicator, the shunt line, the switch, and the indicator being formed as part of a removable cover of the device.

3. The combined switch and circuit breaker device of the operating type manually operable for normal switching and operating automatically for overload release, the breaker having an indicator energizable by the breaker controlled line energy, the indicator being constructed and arranged to be deenergized normally and during manual switching operation and being constructed and arranged to be energized automatically by and upon release operation of the breaker and only then.

4. A construction of the character described in claim 3 wherein the indicator is formed as part of a removable cover of the device.

5. A combined switch and circuit breaker device of the operating type manually operable for normal switching and operating automatically for overload release, the breaker having a line shunting the breaker controlled line and containing an auxiliary switch and an indicator energizable by the breaker controlled line energy when the auxiliary switch is closed, the auxiliary switch being constructed and arranged to be open normally and during manual switching operation and being constructed and arranged to be closed automatically by and upon release operation of the breaker and only then to energize the indicator, the latter being arranged to give a different indication when energized by breaker release following moderate overload from what it gives when energized by breaker release following excessive overload.

6. A combined switch and circuit breaker device of the operating type manually operable for normal switching and operating automatically for overload release, the breaker having an indicator energizable by the breaker controlled line energy, the indicator being constructed and arranged to be deenergized normally and during manual switching operation and being constructed and arranged to be energized automatically by and upon release operation of the breaker and only then, the latter being arranged to give a different indication when energized by breaker release following moderate overload from what it gives when energized by breaker release following excessive overload.

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