ABSTRACT: A circuit interrupter comprises a molded insulating housing molded to form means for insulating mounting bolts from live parts of the circuit interrupter mechanism.
CIRCUIT INTERRUPTER WITH IMPROVED MOLDED INSULATING HOUSING

BACKGROUND OF THE INVENTION

1. Field of the Invention
Circuit interrupters of the type comprising a molded insulating housing and a circuit interrupter mechanism supported in the molded insulating housing.

2. Description of The Prior Art
It is old in the circuit interrupter art to mold the interrupter insulating housing base and cover with aligned openings therein for receiving mounting bolts and to provide an additional insulating tube that fits into the aligned openings to receive the mounting bolts to insulate the mounting bolts from the internal live parts of the circuit interrupter mechanism. This invention is an improvement over the prior art in that the insulating base and insulating cover are molded to insulate the mounting bolts from live parts of the circuit interrupter mechanism without requiring separate insulating tubes.

SUMMARY OF THE INVENTION
An improved circuit interrupter comprises a molded insulating housing and a circuit interrupter mechanism supported in the insulating housing. The insulating housing comprises a molded insulating base and a molded insulating cover cooperating with the base to form the housing. The insulating material of the base and cover is provided with a plurality of mounting bolt openings therethrough for receiving mounting bolts that are used at the installation to secure the circuit interrupter to a support. The insulating cover is molded to form a plurality of insulating tube parts concentric with the mounting bolt openings and molded integral with the cover. The insulating base is molded to receive the tube parts which nest therein to insulate the mounting bolts from internal live parts of the circuit interrupter mechanism.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a top plan view of a circuit interrupter constructed in accordance with the principles of this invention;
FIG. 2 is a side sectional view taken generally along the line II—II of FIG. 1;
FIG. 3 is a partial sectional view taken generally along the line III—III of FIG. 1;
FIG. 4 is an end view looking in the direction of the IV—IV arrows in FIG. 1;
FIG. 5 is a top plan view of the insulating base of the housing seen in FIGS. 1, 4;
FIGS. 6 is a bottom plan view of the insulating cover of the housing seen in FIGS. 1, 4;
FIG. 7 is a sectional view taken generally along the line VII—VII of FIG. 6; and
FIG. 8 is a partial sectional view taken generally along the line VIII—VIII of FIG. 7.

BRIEF DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings, there is shown, in FIGS. 1 and 2, a multipole molded-case or insulating housing type circuit interrupter 3. The circuit interrupter 3 is a circuit breaker of the type that is more specifically described in the coending application of Nick Vorgin et al. U.S. Pat. No. 3,460,075 issued Aug. 5, 1969. Thus, only a brief description of the circuit interrupter is provided herein. The circuit interrupter comprises an insulating housing 5 and a circuit interrupter mechanism 7 supported in the housing 5. The housing 5 comprises a molded insulating base 9 and a molded insulated cover 11 secured to the base 9 to enclose the circuit interrupter mechanism that is mounted on the base 9. The insulating housing 5 will be hereinafter more specifically described.

The circuit interrupter mechanism 7 comprises an operating mechanism 15, a latch mechanism 15 and a trip device 17.

A stationary contact 19, a movable contact 21 and an arc-extinguishing unit 23 are provided for each pole of the circuit interrupter. The movable contact 21 is mounted on a movable contact arm 25 that is connected to a switch arm 26 that is secured to an insulating common tie bar 27. The tie bar 27 is supported for pivotal movement about an axis thereof. A toggle, comprising a toggle link 29 and a toggle link 31, is pivotally connected at one end thereof to the movable switch arm 26 of the center pole unit and at the other end thereof to a latched trip member 33 that is pivotally supported on a pin 35 that is mounted between a pair of supporting plates 37. An operating tension spring 39 is connected at one end thereof to the latching pivot 41 of the toggle and at the other end thereof to the right portion of an inverted generally U-shaped operating member 43. A handle 45 extends from the lever 43 through an opening in the front of the housing cover 11 to permit manual operation of the interrupter. The releasable trip member 33 is latched at one end thereof by means of a roller latch member 47 that is in turn latched by an elongated insulated trip bar 49 that is mounted for pivotal movement about the elongated axis thereof. The operating lever 43 is an inverted U-shaped lever that is mounted at the ends of the legs thereof in U-shaped notches in the supporting plates 37.

The circuit interrupter is manually operated by operation of the handle 45 from the open position seen in FIG. 2 clockwise to the closed position during which movement the line of action of the spring 39 is moved to the right to erect the toggle 29, 31 to pivot the movable switch arm 26 in a clockwise direction to the closed position.

The interrupter is manually opened by reverse movement of the handle 45 in a counterclockwise direction to the open position during which movement the line of action of the spring 39 is moved to the left to collapse the toggle 29, 31 to thereby move the switch arm 26 of the center pole unit to the open position seen in FIG. 2.

Since all three of the switch arms 26 for the three pole units of the three-pole circuit interrupter are fixed to the common tie bar 27, operation of the center-pole switch arm 26 simultaneously operates all three of the switch arms 26.

The circuit interrupter is thermally tripped by operation of the trip device 17 which comprises an elongated current carrying bimetal 51, having an actuating screws 53 mounted thereon. The generally L-shaped bimetal 51 is secured to base 9 by means of a bolt 45. The circuit in each pole unit of the multipole circuit interrupter extends from a terminal connector 57 through a conductor 59, the contact 19, the contact 21, contact arm 25, a flexible conductor 59, the bimetal 51, a flexible conductor 61, a conducting member 63, to a terminal connector 65.

Upon the occurrence of an overload above a first predetermined value, the bimetal 51 becomes heated and flexes to the right (FIG. 2) by which means the screw 53 engages the trip bar 49 to rotate the trip bar 49 in a counterclockwise direction by which means the trip bar 49 releases the latch 47. Upon release of the latch 47, the spring 39, operating through the toggle 29, 31, pivots the trip member 33 in a clockwise direction with the latch 47 moving in a clockwise direction about its pivot 71. This movement changes the line of action of the spring 39 whereupon the spring collapses the toggle 29, 31 to move the movable switch arm 26 to the open position. During the tripping operation, the spring 39 moves the handle 45 to a position intermediate the "ON" and "OFF" positions to provide a visual indication that the interrupter has tripped. Following a tripping operation, the interrupter is reset by movement of the handle 45 in a counterclockwise direction to a position slightly past the full "OFF" position. During this movement, a projection 73 on the operating member 43 engages a shoulder on the trip member 33 to rotate the trip member 33 in a counterclockwise direction during which movement the trip member 33 engages the latch 47 to move the latch to the latching position, and a spring 77 moves the trip bar 49 to the latching position to that upon release of the handle 45 the interrupter will be latched in the reset position.
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3,632,939

seen in FIG. 2. Thereafter, the circuit interrupter can be manually operated in the same manner as was hereinafter described.

The circuit interrupter is magnetically tripped by operation of an electromagnet that comprises a stationary magnetic member 83 and a movable magnetic member 85 that is supported for pivotal movement by means of a pair of pivot arm supports 85. The current in the bimetal 51 energizes the magnetic members 81, 83. Upon the occurrence of the severe overload above a second predetermined value the armature 83 is attracted to the magnetic member 81 whereupon a part of the armature above the pivot supported 85 thereof engages the trip bar 49 to rotate the trip bar 49 in a counterclockwise direction to effect an instantaneous magnetic tripping operation. A shunt conductor 86 on the armature 83 is utilized to shunt current through the stationary magnetic member 81 to the conductor 63 to thereby shunt current past the bimetal upon the occurrence of a magnetic tripping operation to protect the bimetal against excessive heating. The circuit interrupter is reset following an instantaneous magnetic tripping operation in the same manner as was hereinafter described following a time delay thermal tripping operation.

The insulating base 9 (FIGS. 2 and 5) is a molded insulating member molded with integral barriers 87 that cooperate with barriers 89 (FIGS. 2, 6 and 7), that are molded integral with the insulating cover 11, to separate the housing 5 into three adjacent pole unit compartments. The barriers, 87, 89 are formed to provide parts that overlap in order to prevent the passage of gases between adjacent pole units. The base and cover, however, engage each other at a generally planar engagement as shown by the line 90 (FIGS. 2 and 4). As can be understood with reference to FIG. 2, there is a single operating mechanism 17 and single latch mechanism 17 in the center pole unit compartment. The circuit in each pole unit is the same as that hereinafter described with regard to the center pole unit, and there is a separate trip device 17 in each pole unit for operating the common trip bar 49 to trip the interrupter upon the occurrence of an overload in any of the pole units. The insulating cover 11 is formed with four openings 91 therethrough which align with tapped openings 93 in the insulating base 9 to receive four screws 95 (FIG. 3) which serve to secure the cover 11 to the base 9. The insulating base 9 is formed with four openings 97 therethrough which align with four openings 99 in the insulating cover 11 for receiving mounting bolts that extend through the openings 97, 99 in the base and cover to secure the circuit interrupter 3 to a part of the installations. It is necessary to insulate the mounting bolts from the internal live parts of the circuit-interrupter at the area where the cover 11 engages the base 9. For example, when there is a circuit interruption, pressure generated by the arcs can blow the cover and base slightly apart and the ionized gasses could cause a flashover from one of the poles to ground through a mounting bolt that would be grounded at the installation. In order to adequately insulate the mounting bolts from internal live parts of the circuit interrupter, the cover is molded with four insulating tube portions 101 that are molded integral with the cover, which tube portions 101 nest within larger diameter opening portions 103 of the openings 97 in the insulating base 9. The tube portions 101, nesting within the openings 103 of the base 9, extend through the plane of the generally planar engagement 90 between the base and cover to insulate the mounting bolts from the internal live parts of the circuit interrupter at the area where the insulating cover 11 engages the insulating base 9.

As can be seen in FIG. 5, the insulating base 9 is molded with slot means 105 therein at each pole unit compartment at one end of the base 9. The insulating cover is molded with slot means 107 therein at each pole unit compartment, which slot means 107 aligns with the associated slot means 105 of the base 9. During assembly of the circuit interrupter, an insulating member 113 (FIG. 2) is positioned in the associated slot means 105, 107 of each pole unit to close off end wall openings in the insulating housing 5 at the arc-extinguishing end of the insulating housing 5. The base 9 is formed with slot means 117 therein at each pole unit compartment thereof at the opposite end of the base 9. During assembly of the circuit interrupter, an insulating member 119 (FIG. 2) is positioned in the slot means 117 before the cover 11 is mounted on the base. The top of the barriers 119 engage the bottom surface of the cover end wall 123 when the cover is mounted on the base. As can be seen in FIG. 6, the insulating cover 11 is molded to provide an end wall part 123 at the one end of the housing with projections 125 extending from the end wall 123 to cooperate with similar projections 126 on the base 9 to provide three cavities 127 for the three terminal connectors 65 at the one end of the interrupter. The projections 125, 126 insulate the adjacent externally accessible terminal connectors 65 from each other. As can be seen in FIG. 6, the end wall portion 123 of the cover 11 comprises an internal generally planar wall surface 129 and an external generally planar wall surface 131 at opposite sides of the thickness of the end wall portion 123. The projections 125 provide side wall surfaces 133 at each cavity 127 which sidewall surfaces 133 are generally parallel to each other and generally normal to the wall surfaces 129, 131 of the end wall portion 123. The insulating cover 11 is molded with two vent passages 137 at each pole unit thereof which vent passages 137 diverge from the internal wall surface 129 through the thickness of the end wall portion 123 to the external wall surface 131 in directions toward the sidewalls 133.

The vent passages 137 in each pole unit vent arc gases out of the associated pole unit. As can be understood with reference to FIGS. 6 and 8, with the vent passages 137 diverging outward toward the cavity sidewall surfaces 133, a wire, for example, cannot easily be moved from the external end of the housing into the internal compartment of the housing through the vent passages.

By molding the vent passages and insulating tubes integral with the housing, additional parts are eliminated, inventory control is facilitated and time is saved during assembly thereby providing a cost saving in the manufacture of the circuit interrupter. Moreover, there is a more reliable fitting of parts and reliability control is enhanced since there is less chance for human error during assembly of the circuit interrupter.

We claim as our invention:

1. A circuit interrupter comprising a molded insulating housing, a circuit-interrupter mechanism supported in said insulating housing, said circuit-interrupter mechanism comprising a pair of cooperating contacts operable to open and close an electric circuit, said insulating housing comprising a pair of housing parts, said pair of housing parts comprising a molded insulating back base and a molded insulating front cover secured to said base at the front end of said base, securing means securing said base and cover together, said base and cover being formed with a plurality of mounting-bolt openings through the insulating material of said base and cover for receiving a plurality of mounting bolts therethrough for providing for mounting of said circuit interrupter on a support panel by means of said mounting bolts, said plurality of mounting bolt openings being spaced from and separate from said securing means, a first of said housing parts comprising a molded insulating tube part at each of said plurality of mounting bolt openings molded integral with said first housing part, the second of said housing parts being molded to receive said tube parts which nest therein to insulate said mounting bolts from internal live parts of said circuit-interrupter mechanism.

2. A circuit interrupter according to claim 1, said housing parts engaging each other along a generally planar engagement, and said tube parts extending through the plane of said generally planar engagement.

3. A circuit interrupter according to claim 1, said housing part being said cover and said second housing part being said base.
4. A circuit interrupter according to claim 3, said cover and said base engaging each other along a generally planar engagement, and said tube parts molded integral with said cover extending through the plane of said generally planar engagement.