

Nov. 22, 1966

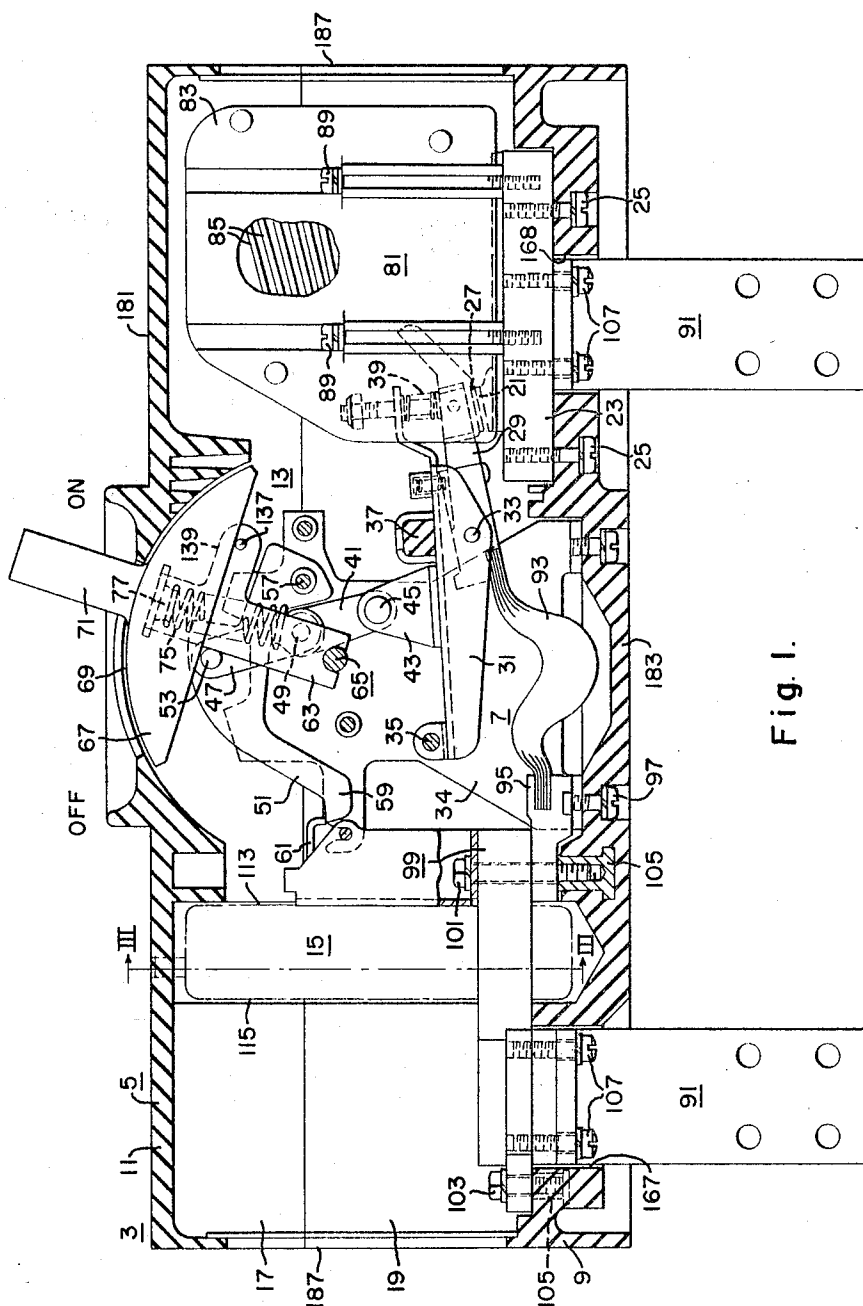
A. R. CELLERINI ET AL

3,287,534

CIRCUIT INTERRUPTER STRUCTURE WITH IMPROVED TERMINAL MEANS

Filed Aug. 30, 1963

4 Sheets-Sheet 1



WITNESSES:

John L. Chopp
James H. Young

INVENTORS
Albert R. Cellerini and
Louis N. Ricci
BY
William A. Elshik
ATTORNEY

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4 Sheets-Sheet 2

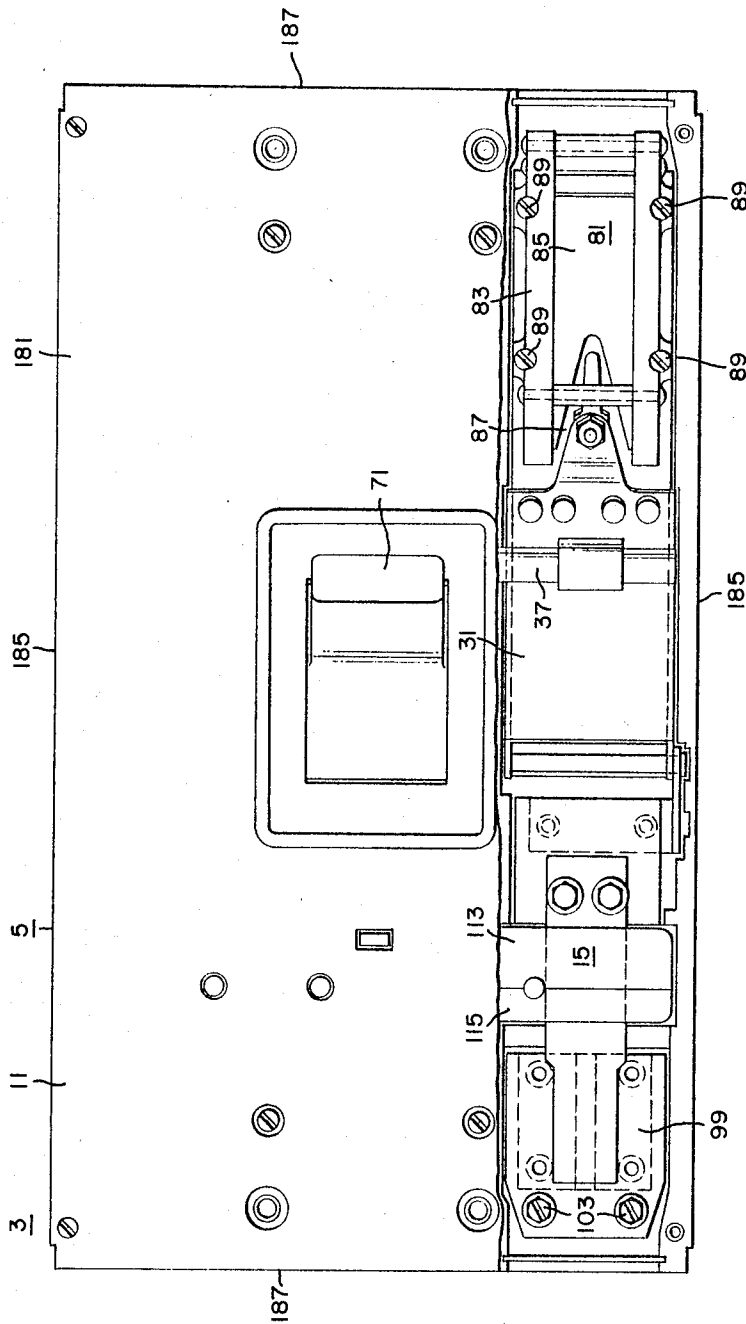


Fig. 2.

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4 Sheets-Sheet 3

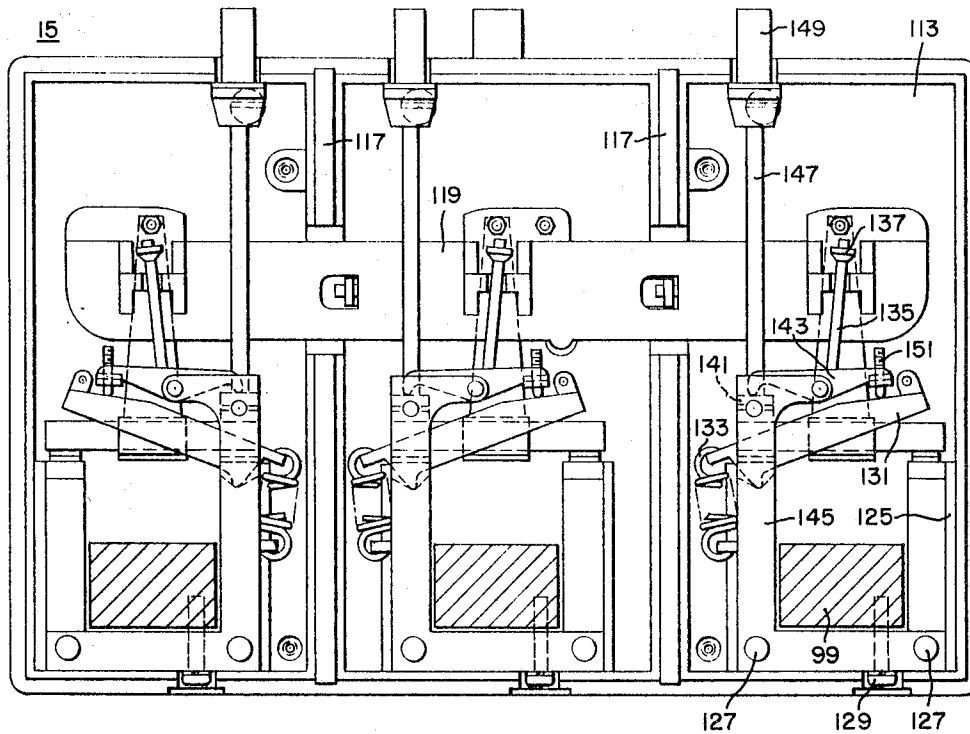


Fig. 3.

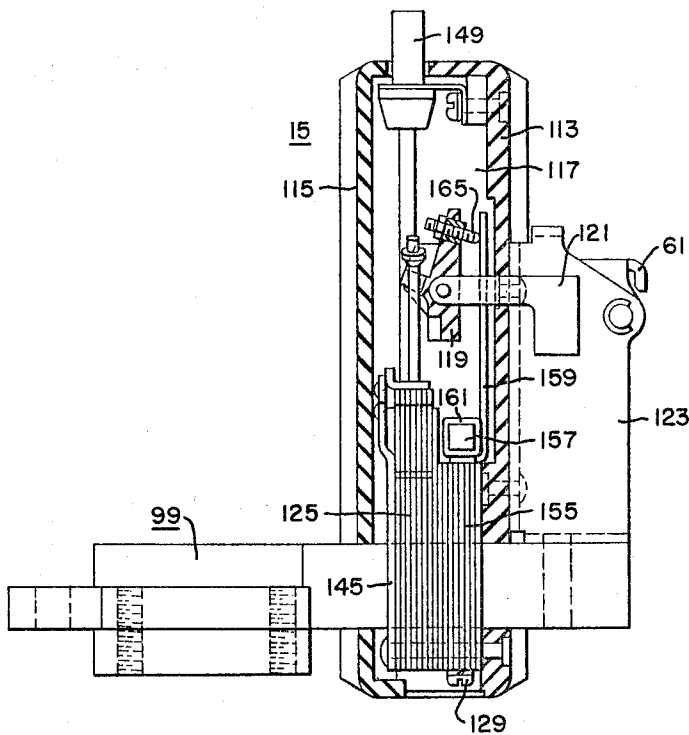


Fig. 4.

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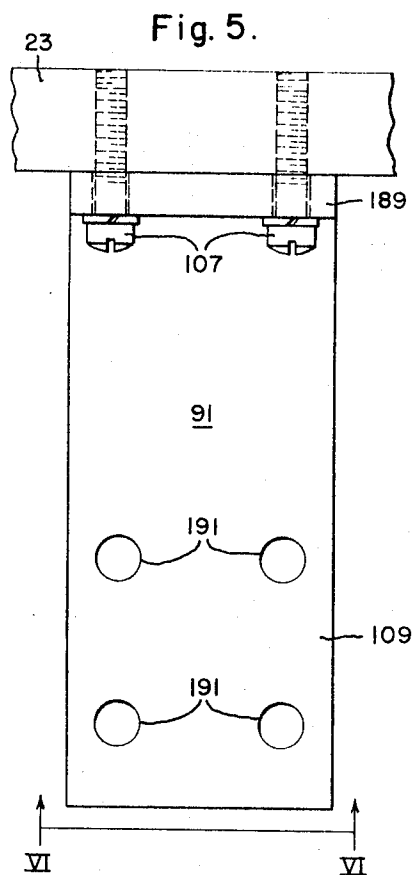
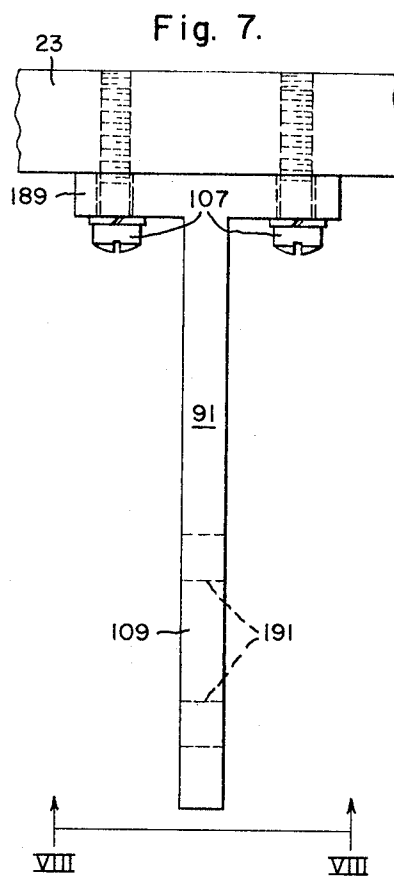
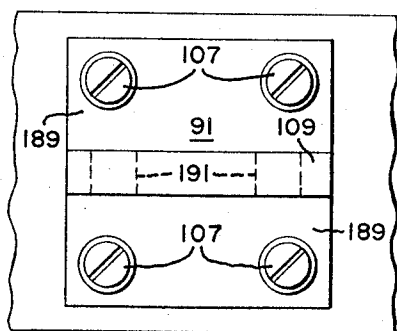


Fig. 6.

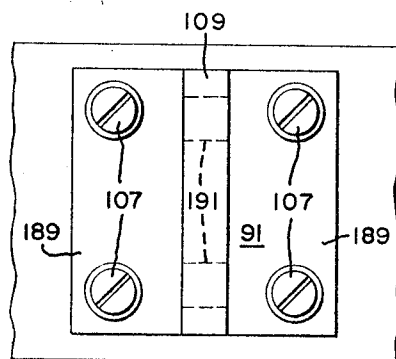


Fig. 8.

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CIRCUIT INTERRUPTER STRUCTURE WITH IMPROVED TERMINAL MEANS

Albert R. Cellerini, Beaver, and Louis N. Ricci, Chippewa Township, Pa., assignors to Westinghouse Electric Corporation, Pittsburgh, Pa., a corporation of Pennsylvania

Filed Aug. 30, 1963, Ser. No. 305,792
15 Claims. (Cl. 200—168)

This invention relates generally to circuit interrupters and more particularly to circuit breakers of the type wherein the circuit-breaker mechanism is disposed within an insulating housing.

In the circuit-interrupter art, it is desirable to provide compactly constructed interrupters having increased current carrying and interrupting ratings. These compact interrupters are not only less expensive to manufacture, but they also save space in control centers. Thus, panel-board and control panel builders can manufacture smaller and less expensive control centers. The industrial market is, therefore, provided with a less expensive installation that takes up less plant space without a sacrifice in power rating or efficiency.

Accordingly, an object of this invention is to provide an improved compactly constructed circuit interrupter.

Another object of this invention is to provide an improved compactly constructed molded-case type circuit breaker.

Another object of this invention is to provide an improved molded-case type circuit breaker that can carry increased current with a minimum of heating.

Another object of this invention is to provide an improved molded-case type circuit breaker comprising a main internal conductor and a rear-type terminal connector that may be secured to the main conductor in either of two planes which are at right angles.

Another object of this invention is to provide an improved relatively inexpensive circuit breaker.

The invention 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 said drawings:

FIGURE 1 is a side sectional view illustrating the internal compartment of a three-pole circuit breaker with certain of the parts being shown in elevation;

FIGURE 2 is a top view, with parts broken away, of the circuit breaker seen in FIGURE 1;

FIGURE 3 is a sectional view taken generally along the line III—III of FIGURE 1 illustrating certain parts of the trip unit of the circuit breaker;

FIGURE 4 is a side sectional view through the center-pole unit of the trip device seen in FIGURES 1—3;

FIGURE 5 is a side elevational view of certain parts of the circuit breaker seen in FIGURE 1;

FIGURE 6 is a view taken generally along the line VI—VI of FIGURE 5;

FIGURE 7 is a side elevational view of the parts shown in FIGURE 5 with the rear terminal connector being rotated 90° from the position in which it is seen in FIGURE 5; and

FIGURE 8 is a view taken generally along the line VIII—VIII of FIGURE 7.

Referring to the drawings there is shown in FIGURES 1 and 2 a circuit interrupter or, more particularly, a circuit breaker 3 comprising an insulating housing 5 and a circuit-breaker mechanism 7 supported within the housing. The housing 5 comprises a base 9 and a cover 11 both of molded insulating material.

The circuit-breaker mechanism 7 comprises an operating mechanism 13 and a trip unit 15. The circuit breaker 3 is a three-pole circuit breaker comprising three compartments disposed in a side-by-side relationship. The center compartment or pole unit is separated from the two outer pole units by an insulating barrier 17 that is molded integrally with the housing over 11 and an insulating barrier means 19 molded integrally with the base 9. The operating mechanism 13 that is disposed in the center pole unit or compartment is a single operating mechanism for operating the contacts of all three pole units.

Each pole unit comprises a stationary contact 21 that is fixedly secured to a rigid main conductor 23 that is secured to the base 9 by means of bolts 25. In each pole unit a movable contact 27 is welded or brazed to a contact arm 29 that is pivotally mounted on a switch arm 31 by means of a pivot pin 33. Each of the switch arms 31 is pivotally supported at one end thereof on a support bracket 34 by means of a separate pivot pin 35. The switch arms 31 for all three of the pole units are connected to move in unison by means of a common tie bar 37 that is rigidly connected to all three of the switch arms. Each of the contact arms 29 is biased about the associated pivot 33 by means of a spring 39 to provide contact pressure in the closed position.

The switch arms 31 are operated to the open and closed positions by means of the operating mechanism 13. The operating mechanism 13 comprises a toggle link 41 that is pivotally connected to an extension 43 of the center-pole switch arms 31 by means of a pivot pin 45. The toggle link 41 is pivotally connected to another toggle link 47 by means of a knee pivot pin 49. The upper end of the toggle link 47 is pivotally connected to a cradle or releasable member 51 by means of a pivot pin 53. The cradle 51 is pivotally supported at one end thereof on the supporting bracket 34 by means of a pivot pin 57. The other end 59 of the releasable member 51 is held in a latched position by means of a latch member 61. The operating mechanism 13 also comprises a generally U-shaped operating lever 63 that is pivotally supported on the bracket 34 by means of pins 65 that engage the inner ends of the legs of the operating lever 63. An actuating insulating shield 67 for substantially closing an opening 69 in the cover 11 is secured to the upper end of the operating lever 63 and it has an integral insulating handle portion 71 extending out through the opening 69 to permit manual operation of the breaker. Two over-center springs 75 (only one being shown in FIG. 1) are connected under tension between the knee pin 49 of the toggle 41, 47 and the upper end of the operating lever 63. Pin means 77 are secured to the upper end of the lever 63 in order to support the upper ends of the springs 75.

In each pole unit, an arc-extinguishing unit 81 is provided to extinguish the arc drawn between the associated contacts 21, 27. Each arc-extinguishing unit comprises an insulating housing 83 and a plurality of magnetic steel plates 85 supported within the housing 83. The moving contact 27 moves within a generally V-shaped opening 87 (FIG. 2) in the stacked plates 85 and the arc drawn between the contacts 21, 27 is magnetically moved to the right (FIGS. 1 and 2) into the plates 85 to be extinguished during circuit interruption. Each of the arc-extinguishing units 81 is secured to the associated main conductor 23 (FIG. 1) by means of four bolts 89 that are threaded into tapped openings in the conductor 23.

For each pole unit, the circuit breaker 3 is provided with two rear-type terminal connectors 91 suitably secured at opposite ends of the circuit breaker. The terminals 91 will be hereinafter more specifically described.

Referring to FIGURE 1, the circuit through each

pole unit of the breaker 3 extends from the right-hand terminal 91 through the conductor 23, the contacts 21, 27, the contact arm 29, flexible conductors 93 that are secured to the contact arm 29, to a terminal member 95 that is secured to the base by means of a screw 97, a unitary rigid main conductor 99 that is connected to the terminal conductor 95 and is secured to the base by means of bolts 101 and 103, to the other rear-type terminal connector 91. The bolts 101 and 103 are threaded into inserts 105 in the base 9 to secure the main conductor 99 to the base. Each of the rear-type terminal connectors 91 is connected to the associated internal conductor (23 or 99) by means of four bolts 107.

The circuit breaker 3 is manually operated to the open position by movement of the handle 71 in a counterclockwise (FIG. 1) direction to the "off" position. During this movement, the line of action of the overcenter spring means 75 is moved to the left to an overcenter position to effect a collapse of the toggle 41, 47 to pivot the switch arm 31 for the center-pole in a counterclockwise direction about the associated pivot 35 to an open position which movement, because of the connection of all of the switch arms 31 by means of the common tie bar 37, simultaneously moves all of the three switch arms 31 to the open position.

The circuit breaker is manually closed by reverse movement of the handle 71 from the off to the "on" position. This movement moves the operating lever 63 to move the line of action of the overcenter spring means 75 to the right to thereby reset the toggle 41, 47 moving all three of the switch arms 31 simultaneously to the closed position.

Referring to FIGURES 1-4, the trip device 15 comprises a molded insulating base 113 and a molded insulating cover 115 cooperable with the base to enclose three thermal and magnetic tripping means which are disposed within three compartments in the housing 113, 115. The compartments are separated by means of insulating barriers 117 (FIG. 3). The trip device 15 includes a molded insulating trip bar 119 that passes through suitable openings in the barriers 117 and is common to all three of the pole units. The trip bar 119 is pivotally supported on a bracket 121 (FIG. 4) that extends out of the base 113 and is supported on a suitable supporting bracket 123 that is secured to the conductor 99. A separate laminated U-shaped magnet 125 for each pole unit is suitably mounted in the associated compartment of the trip device 15 by means of bolts 127 that secure the magnet to the trip-unit base 113. As can be seen in FIGURES 3 and 4, each of the main conductors 99 passes through the opening in the U-shaped magnet 125 and is held in place by means of a bolt 129. A separate movable armature 131 is pivotally supported on one leg of each of the magnets 125 and is biased to an open position by means of a spring 133. A rod 135 is pivotally connected to each armature 131 and it has a head portion 137 for engaging and operating the trip bar 119 upon sufficient energization of the electromagnet 125, 131. The tripping electromagnet is energized by current flowing in the main conductor 99.

The circuit breaker is tripped open instantaneously by operation of any one of the tripping electromagnets. When one of the tripping electromagnets is energized by an overload current above a predetermined value or by means of a short circuit, the armature 131 is attracted and the free end thereof is moved into engagement with the other leg of the magnet yoke 125 during which movement the rod 135 is pulled down, whereupon the head 137 engages the trip bar 119 causing the trip bar to rotate in a counterclockwise (FIG. 4) direction. This movement effects a releasing movement of the latch 61 to disengage the latch 61 from the cradle 51 (FIG. 1). Upon release of the cradle 51 the springs 75 act to rotate the cradle in a clockwise direction about the pivot 57 and to collapse the toggle 41, 47 to thereby pivotally

move the three switch arms 31 in a counterclockwise direction to the open position.

During the automatic opening operation the line of force of the spring means 75 operates to move the operating lever 63 and handle 71 to an intermediate position between the on and off position in a well-known manner to thereby provide a visual indication that the circuit breaker has automatically been tripped.

Following an automatic opening operation, it is necessary to reset and relatch the circuit-breaker mechanism before the contacts can be closed. This is effected by moving the handle 71 to the full off position. During this movement, a pin 137 that is supported on the operating lever 63, engages a shoulder 139 on the cradle 51 moving the cradle in a counterclockwise direction about the pivot 57. Near the end of this movement, the free or latching end 59 of the cradle 51 cams the latch 61 to the left against the bias of spring means (not shown) and moves below the latching end of the latch 61 whereupon the latch is biased back to the latching position seen in FIGURE 1 to relatch the cradle 51 in a well-known manner. The breaker contacts are then closed in the previously described manner by movement of the handle to the on position.

An adjusting mechanism is provided for adjusting the position of each armature 131 to thereby permit selection of the minimum overload current that will be required to instantaneously trip the circuit breaker. The adjusting mechanism is specifically described in the patent to G. F. Thomas et al. Patent No. 3,073,925, issued January 15, 1963. For this reason, only a brief description of the adjusting mechanism is given herein.

The adjusting mechanism comprises a cam member 141 having an upper cam surface that is engaged by one end of a lever 143 that is pivotally supported intermediate its ends on a supporting bracket 145, that is attached to the yoke 125. A rod 147 extends from the cam 141 to an adjusting knob 149 that passes out through a suitable opening in the trip-unit housing 113, 115. Rotation of the adjusting knob 149 rotates the cam 141 to thereby pivot the lever 143 whereupon an adjusting screw 151 on one end of the lever 143 moves against the side of the associated armature 131 to pivot the armature 131 varying the magnetic air gap and therefore the minimum overload current which is required to magnetically trip the circuit breaker.

Thermal tripping means is provided to effect automatic tripping of the circuit breaker with a time delay upon the occurrence of lower overload current conditions. The thermal tripping means comprises another U-shaped laminated magnet yoke 155 (FIG. 4) through which the main conductor 99 passes. An unlaminated magnetic bar 157 connects the upper legs of the magnet yoke 155. A bimetal member 159 is supported on a short circuit conducting coil 161 that is disposed over the bar 157. Upon the occurrence of an overload current below a predetermined value the hysteresis losses in the bar 157 which occur in the form of heat will be conducted to the bimetal 159 and heat generated by eddy currents in the coil 161 will be conducted to the bimetal 159 to heat the bimetal whereupon the bimetal will bend to the left (FIG. 4) to engage an adjusting screw 165 that is supported on the trip bar 119 to thereby rotate the trip bar 119 counterclockwise after a time delay to effect a tripping operation of the circuit breaker in the same manner as was hereinbefore described.

As can be seen in FIG. 1, the trip device 15 is secured to the circuit breaker by means of the bolts 101 and 103 that secure the associated rigid main conductor 99 to the base 9. The trip device 15 and main conductor 99 comprise a unitary removable structure as seen in FIGURE 4. Thus, the trip units are interchangeable so that the breaker can accommodate other trip units having different current carrying capacities. It can be seen in FIGURE 3 that there are three conductors 99 extending through the

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trip device 15 for the three pole units of the trip device. Each of the main conductors 99 conducts the current in the associated pole unit along the length of the circuit breaker. In each pole unit, a rear-type terminal connector 91 is supported on and directly connected to the associated main conductor 99 by means of four bolts 107. In each pole unit an opening 167 is provided in the housing base 9 to receive the conductors 91 and 99 to permit connection of these members. In each pole unit, the rear-type terminal connector 91 on the right (FIG. 1) passes through a separate opening 168 in the housing base 9 and is connected directly to the rigid internal main conductor 23 by means of four bolts 107.

As can be seen in FIGURES 1 and 2, the circuit breaker housing 5 comprises a front or top 181, a back or bottom 183, and sidewall means comprising two side walls 185 and two end walls 187. The handle 71 extends through the opening 69 in the front of the housing and the openings 167 and 168 in the back of the housing permit the connections between the terminals 91 and the main conductors 23 and 99. The arc-extinguishing units 81 extend substantially to the adjacent end wall 187.

Referring to FIGURES 5-8, it will be seen that the terminal connector 91 is a generally T-shaped conductor wherein the arm parts 189 receive the bolts 107 that are screwed into tapped openings in the conductor 23 to fasten the conductor 91 to the conductor 23 with a generally flat upper face of the terminal connector 91 engaging a generally flat lower face of the conductor 23. The leg 109 of the terminal connector 91 extends in a direction generally normal to the upper flat connecting surfaces of the terminal connector 91 and there are four openings 191 near the lower end thereof to receive suitable bolts for connecting the leg portion 109 to a bus bar that would be disposed below the circuit breaker.

The openings in the arms 189 of each terminal connector 91 are disposed at the four corners of an imaginary square and the tapped openings in the associated main conductor are disposed at the four corners of an imaginary square. Thus, each terminal connector 91 is connectable to the associated main conductor in either of two positions depending upon the orientation of the bus bar to which the connector 91 is to be connected. If the bus bars are disposed in a generally longitudinal relationship relative to the length (FIG. 1) of the circuit breaker 3, the conducting connectors will be mounted in the position seen in FIGS. 5 and 6. If the bus bars are disposed transverse to the circuit breaker, the connectors 91 will be rotated 90° and secured to the main conductors in the position seen in FIGS. 7 and 8. Each of the six rear-type terminal connectors 91 is connectable to the associated internal rigid main conductor 23 or 99 in either of the two positions in the same manner described with reference to FIGS. 5-8.

From the foregoing, it can be understood that there is provided by this invention an improved compactly constructed molded-case type circuit breaker. The described circuit breaker is a 1600 ampere molded-case type circuit breaker that is capable of interrupting short circuits or overloads of up to 150,000 amperes under 240-volt A.-C. operation, 100,000 amperes under 480-volt A.-C. operation and 75,000 amperes under 600-volt A.-C. operation. The breaker is 22 inches long, 12 inches wide and 9 inches deep. It is supplied to the industrial market to protect systems that previously required the larger and more expensive metal-enclosed type circuit breakers. Moreover, the over-all switchboard installation of the molded-case type circuit breaker takes up less space and is less expensive than the switchboard installation of a metal-enclosed type circuit breaker. Furthermore, molded-case type circuit breakers can be mounted either horizontally or vertically as opposed to metal-enclosed type circuit breakers that can generally be mounted only in a vertical position.

The rear-type terminals 91 are removably connected

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directly to the internal main conductors 23 and 99. Thus, the breaker is provided with fewer parts and also with fewer undesirable bolted connections whereby the breaker can carry higher currents with less heat rise. The T-shaped rear-type terminals 91 are connected to the main conductors 99 and 23 by means of a face-to-face engagement, with the flat upper connecting surfaces of the terminals 91 engaging the flat under connecting surfaces of the main conductors 23 and 99. This type of connection is particularly advantageous at the arc-extinguishing end of the breaker. Thus, the conductors 23 can be kept generally solid and unbroken to provide sufficient cross-sectional area and current-carrying capacity in a limited space. Moreover, this type of connection leaves enough space above the conductors 23 so that the arc-extinguishing units 81 which are mounted on and connected to the conductors 23 can be constructed with a greater height and with more arc-extinguishing plates to provide increased arc-extinguishing capacity. Moreover, with the provision of the improved terminal connection whereby the terminals 91 are connected directly to the flat under surface of the main conductors 23, the arc-extinguishing units 81 can be constructed with increased length while the over-all length of the circuit breaker can be kept reduced because the arc-extinguishing units 81 extend substantially to the adjacent end wall of the circuit breaker. The rear-type terminal connectors 91 can be rotated 90° between the different positions in order to permit connection of the circuit breaker to bus bars that may be oriented in either of two right-angle positions.

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 arrangement 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 as the prior art permits.

We claim as our invention:

1. A circuit interrupter comprising an insulating housing, said housing comprising a front, a back and side wall means, said housing having a first opening in the front thereof, a circuit-interrupter mechanism disposed within said housing and comprising an operating handle extending from said first opening, such mechanism comprising a pair of contacts, said handle being manually operable to open and close said contacts, an arc-extinguishing unit for extinguishing arcs drawn between said contacts, said back having a second opening therein under said arc-extinguishing unit, a main conductor supported within said housing in proximity to said second opening and between said second opening and said arc-extinguishing unit, one of said contacts being fixedly supported on said main conductor, a unitary terminal conductor, and means connecting said unitary terminal conductor directly to said internal main conductor at said second opening with said unitary external terminal conductor extending away from said housing beyond the back of said housing whereby said unitary external terminal conductor is accessible for direct connection to a bus bar.

2. A circuit interrupter comprising an insulating housing, said housing comprising a front, a back and side wall means, said housing having a first opening in the front thereof, a circuit-interrupter mechanism disposed within said housing and comprising an operating handle extending from said first opening, said mechanism comprising a pair of contacts, said handle being operable to open and close said contacts, said back having a second opening through the insulating material thereof, a generally flat internal main conductor supported within said insulating housing on said back and having a back face over said second opening close to said back, an arc-extinguishing unit over said generally flat internal main conductor, an external terminal conductor extending into

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said second opening through the insulating material of said back and having a generally flat face engaging the back face of said internal main conductor, said external terminal conductor being positioned generally under said arc-extinguishing unit, and means securing said external terminal conductor to said internal main conductor.

3. A circuit breaker comprising an insulating housing, said insulating housing comprising a front, a back wall and side wall means, said side wall means comprising two side walls and two end walls, said circuit breaker housing having a first opening in the front thereof, a circuit-breaker mechanism disposed within said housing and comprising an operating handle extending from said first opening, said mechanism comprising a pair of contacts and means releasable to effect opening of said contacts, trip means operable upon the occurrence of certain overload current conditions to automatically effect release of said releasable means, an arc-extinguishing unit operable upon the occurrence of tripping operations to extinguish the arcs drawn between said contacts, an internal main conductor supported within said housing on said back wall of insulating material and under said arc-extinguishing unit, said arc-extinguishing unit being disposed at one end of said housing and extending substantially to one of said end walls, said housing having an opening in the back wall thereof in proximity to said main conductor and under said arc-extinguishing unit, an external terminal conductor, and means connecting said external terminal conductor directly to said internal main conductor at said opening in the back wall of insulating material.

4. A circuit breaker comprising an insulating housing, said housing comprising a front, a back wall and side wall means, said side wall means comprising two side walls and two end walls, said housing having a first opening in the front thereof, a circuit-breaker mechanism disposed within said housing and comprising an operating handle extending from said opening, said mechanism comprising a stationary contact and a movable contact co-operable therewith to open and close a circuit, trip means automatically operable upon the occurrence of certain overload current conditions to effect opening of said contacts, an internal main conductor supported within said housing on said back wall, said stationary contact being fixedly supported on said internal main conductor, said housing having a second opening in the back wall thereof in proximity to said internal main conductor, an arc-extinguishing unit comprising an insulating enclosure and a plurality of spaced magnetic plates for effecting extinction of the arc drawn between said contacts during a tripping operation, said arc-extinguishing unit being disposed over said internal main conductor and extending substantially to one of said end walls, said second opening being positioned under said arc-extinguishing unit, an external terminal conductor, and means removably connecting said external terminal conductor to said internal main conductor at said second opening through the back wall of insulating material under the arc-extinguishing unit.

5. A circuit breaker comprising an insulating housing, said housing comprising a front, a back and side wall means, said side wall means comprising two side walls and two end walls, said housing having a first opening in the front thereof, a circuit-breaker mechanism disposed within said housing and comprising an operating handle extending from said first opening, said mechanism comprising a stationary contact and a movable contact co-operable with said stationary contact to open and close an electric circuit, said mechanism comprising trip means automatically operable upon the occurrence of certain overload current conditions to effect opening of said contacts, a generally rigid main conductor supported within said housing on said back, said stationary contact being fixedly supported on the front side of said main conductor, an arc-extinguishing unit, means fixedly securing said arc-extinguishing unit to said main conductor on the front side

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of said main conductor, said main conductor having a generally flat undersurface, said back having a second opening therein in proximity to said main conductor under said arc-extinguishing unit, an external terminal conductor having a generally flat connecting surface engaging said generally flat undersurface of said main conductor, and means removably securing said external terminal conductor to said internal main conductor at said second opening.

6. A circuit breaker comprising a housing comprising an insulating back, a circuit breaker mechanism disposed within said housing, said mechanism comprising a stationary contact and a movable contact co-operable with said stationary contact to open and close an electric circuit, said mechanism comprising trip means automatically operable upon the occurrence of certain overload current conditions to effect opening of said contacts, a main conductor supported within said housing on said insulating back, said stationary contact being supported on the front side of said main conductor, an arc-extinguishing unit supported over the front side of said main conductor, said main conductor having a generally flat undersurface, said insulating back having an opening therein in proximity to said main conductor under said arc-extinguishing unit, an external terminal conductor having a generally flat connecting surface engaging said generally flat undersurface of said main conductor, securing means removably securing said external terminal conductor to said internal main conductor in a first position at said opening under said arc-extinguishing unit, said external terminal conductor, said internal main conductor and said securing means being constructed and arranged such that said external terminal conductor may be removably secured to said internal main conductor in a second position rotated 90° from said first position with said external connecting surface of said terminal conductor engaging said undersurface of said internal main conductor.

7. A circuit breaker comprising an insulating housing, said housing comprising a front, a back and side wall means, said side wall means comprising two side walls and two end walls, said housing having a first opening in the front thereof, a circuit breaker mechanism disposed within said housing and comprising an operating handle extending from said first opening, said mechanism comprising a stationary contact and a movable contact co-operable with said stationary contact to open and close an electric circuit, said mechanism comprising trip means automatically operable upon the occurrence of certain overload current conditions to effect opening of said contacts, a main conductor supported within said housing on said back, said stationary contact being supported on the front side of said main conductor, an arc-extinguishing unit supported over the front side of said main conductor and extending substantially to one of said end walls, said main conductor having a generally flat undersurface, said back having a second opening therein under said main conductor in a position under said arc-extinguishing unit, said main conductor having four tapped openings therein at said generally flat undersurface, an external generally T-shaped terminal conductor having a generally flat top surface engaging said generally flat undersurface of said main conductor at said second opening, said external generally T-shaped terminal conductor having four openings therein in arms thereof, four bolts passing through said four openings in the arms of said external generally T-shaped terminal conductor and being threaded into said four tapped openings in said main conductor to removably connect said external generally T-shaped terminal conductor to said main conductor in a first position, and said four openings in said arms and said four tapped openings being disposed at the four corners of an imaginary square whereby said external generally T-shaped terminal conductor is connectable to said main conductor by means of said four bolts in a position rotated 90° from said first position.

8. A circuit breaker comprising an insulating housing, said insulating housing comprising a front, a back and side wall means, said housing having a first opening in the front thereof, a circuit breaker mechanism disposed within said housing and comprising an operating handle extending from said first opening, said mechanism comprising a pair of contacts and latch means releasable to effect automatic opening of said contacts, an electromagnetic trip device, said housing having a second opening in the back thereof, a unitary main conductor positioned within said housing in proximity to said second opening and disposed to energize said electromagnetic trip device, said electromagnetic trip device when energized by predetermined tripping overload currents operating to release said latch means to thereby effect automatic opening of said contacts, and an external terminal conductor removably connected directly to said main conductor at said second opening.

9. A circuit breaker comprising an insulating housing, said insulating housing comprising a front, a back and side wall means, said housing having a first opening in the front thereof, a circuit-breaker mechanism disposed within said housing and comprising an operating handle extending from said first opening, said mechanism comprising a pair of contacts and releasable means releasable to effect automatic opening of said contacts, a trip device comprising an insulating enclosure, an electromagnetic trip-device mechanism supported in said insulating enclosure, a unitary main conductor extending through said insulating enclosure to energize said electromagnetic trip device mechanism, said trip device being removably mounted as a unit within said insulating housing, said electromagnetic trip device mechanism when energized by overload currents above a predetermined amount automatically operating to effect release of said releasable means, said housing having a second opening in the base thereof, said unitary main conductor being positioned in proximity to said second opening and having a generally flat undersurface, an external rear-type terminal conductor having a generally flat connecting surface engaging said generally flat undersurface of said main conductor at said second opening, and means removably connecting said external rear-type terminal conductor directly to said main conductor.

10. A circuit breaker comprising a housing comprising an insulating back, a circuit-breaker mechanism disposed within said housing and comprising a pair of contacts and releasable means releasable to effect automatic opening of said contacts, a trip device, a unitary main conductor positioned to energize said trip device, said trip device when energized by overload currents above a predetermined amount automatically operating to effect release of said releasable means, said insulating back having an opening therein, said unitary main conductor being positioned on said insulating back at said opening and having a generally flat undersurface, an external rear-type terminal conductor extending into said opening in said insulating back and having a generally flat top connecting surface directly engaging said generally flat undersurface of said main conductor, bolt means symmetrically arranged to removably connect said external rear-type terminal conductor to said main conductor at said external rear-type opening, and said terminal conductor being rotatable through 90° and still connectable to said main conductor by means of said symmetrically arranged bolt means with said generally flat top surface engaging said generally flat undersurface.

11. A circuit breaker comprising an insulating housing, said insulating housing comprising a front, a back and side wall means, said housing having a first opening in the front thereof, a circuit-breaker mechanism disposed within said housing and comprising an operating handle extending from said first opening, said mechanism comprising a pair of contacts and means releasable to effect automatic opening of said contacts, a trip device, a uni-

tary main conductor passing through said trip device and being positioned to energize said trip device, said trip device when energized by overload currents above a predetermined amount automatically operating to effect release of said releasable means, said housing having a second opening in the base thereof, said unitary main conductor being positioned in proximity to said second opening and having a generally flat undersurface, an external generally T-shaped rear-type terminal conductor having a generally flat top connecting surface directly engaging said generally flat undersurface of said main conductor, four bolts passing through four openings in arms of said external generally T-shaped rear-type terminal conductor and being disposed at the four corners of an imaginary square, and said four bolts being threaded into four tapped openings in said main conductor to removably connect said external generally T-shaped rear-type terminal conductor to said main conductor at said second opening.

12. A trip device for a circuit breaker, said trip device comprising an insulating enclosure and an electromagnetic trip mechanism supported within said enclosure, said electromagnetic trip mechanism comprising a core member having opening means therein, an armature supported for movement relative to said core member, a trip bar supported for movement, said enclosure having opening means therein, an energizing conductor comprising a first part extending through said opening means in said enclosure and through said opening means in said core member, when said energizing conductor is energized by overload currents above a predetermined amount, said armature being attracted to said core member to move said trip bar to a tripping position, said energizing conductor comprising an enlarged part at an end thereof external of said trip device enclosure, said enlarged part having a generally flat undersurface for engaging a generally flat connecting surface of a terminal conductor, and said enlarged part at said generally flat undersurface having means for receiving securing means to permit connection of said terminal conductor to said enlarged part.

13. A trip device for a circuit breaker, said trip device comprising an insulating enclosure and a magnetic trip mechanism supported within the enclosure, said magnetic trip mechanism comprising a generally U-shaped core member, an armature supported for movement relative to said core member, a trip bar supported for tripping movement, said trip device enclosure having opening means therein, a rigid energizing conductor comprising a first part extending through said opening means in said trip device enclosure and through said opening means in said core member, said energizing conductor being external of said trip device enclosure at the opposite ends thereof, and an external part of said energizing conductor comprising an enlarged part formed with a widthwise dimension greater than the dimension between the legs of the associated U-shaped core member which enlarged part is formed with a generally flat undersurface for receiving connection thereto of a generally flat connecting surface of a terminal conductor, and said enlarged part having tapped opening means therein at said generally flat undersurface for receiving threaded connecting means that may be used to connect said terminal conductor to said enlarged part.

14. A multipole trip device for a circuit breaker, said trip device comprising an insulating enclosure and a plurality of electromagnetic trip mechanisms supported within the enclosure in a side-by-side relationship, each of said electromagnetic trip mechanisms comprising a generally U-shaped core member and an armature supported for movement relative to the core member, a trip bar common to said pole units and supported for tripping movement, said trip device enclosure having opening means therein at each of said pole units, a separate energizing conductor for each of said pole units, each of said energizing conductors extending through the associ-

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ated opening means in said trip device enclosure and extending between the legs of the associated core member, means supporting said energizing conductors in said trip device enclosure in a relationship spaced from said core members, each of said energizing conductors comprising a first part having a first widthwise dimension permitting the energizing conductor to pass through the legs of the associated U-shaped core member, each of said energizing conductors comprising a part external of said trip device enclosure formed with a widthwise dimension greater than the dimension between the legs of the associated U-shaped core member, each of said enlarged external parts comprising a generally flat undersurface for receiving connection thereto of a generally flat surface of an external terminal conductor, and each of said enlarged external parts having a plurality of openings therein at the generally flat undersurface thereof for receiving a plurality of threaded members that may be used to connect said external terminal conductor to the energizing conductor.

15. A circuit breaker comprising housing means comprising an insulating back having an opening therein, a circuit-breaker mechanism disposed within said housing means and comprising a pair of contacts and means releasable to effect automatic opening of said contacts, a trip device supported on said insulating back and comprising an insulating enclosure, a magnetic trip mechanism supported within said trip device enclosure and comprising a generally U-shaped core member and an armature supported for operative movement relative to said core member, a trip bar supported within said trip device enclosure for movement upon operation of said armature, said trip device enclosure having opening means therein, a rigid energizing conductor extending through said opening means in said trip device enclosure and between the legs of said core member, said rigid energizing conductor comprising end parts external of said trip device enclosure, said rigid energizing conductor comprising a first

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part having a widthwise dimension less than the dimension between the legs of said core member to permit said rigid energizing conductor to extend through the legs of said core member without engaging said core member, said rigid energizing conductor having means at opposite ends thereof for receiving securing means for securing said rigid energizing conductor to said insulating back, said rigid energizing conductor comprising an enlarged part external of said trip device enclosure, said enlarged part having a widthwise dimension greater than the dimension between the legs of said core member, said enlarged part comprising a generally flat undersurface disposed over said opening in said insulating back, said enlarged part having tapped opening means therein at said generally flat undersurface, an external rear-type terminal conductor having a generally flat connecting surface engaging said generally flat undersurface of said energizing conductor at said opening in said insulating back, said external rear-type terminal conductor having opening means therein, and threaded connecting means passing through said opening means in said external rear-type terminal conductor and being threaded into said tapped opening means to secure said external rear-type terminal conductor to said energizing conductor.

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ROBERT K. SCHAEFER, *Primary Examiner.*KATHLEEN H. CLAFFY, *Examiner.*H. O. JONES, *Assistant Examiner.*

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,287,534

November 22, 1966

Albert R. Cellerini et al.

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 61, "connector" should read -- connector --.
Column 2, line 7, "over" should read -- cover --; line 31, "arms" should read -- arm --. Column 4, line 6, "on and off" should read -- "on and off" --; line 12, "off" should read -- "off" --; line 24, "on" should read -- "on" --; line 45, "overlod" should read -- overload --; line 52, "pases" should read -- passes --. Column 6, line 3, "indesirable" should read -- undesirable --; lines 55 and 56, after "unitary", each occurrence, insert -- external --. Column 8, line 31, "conductor," should read -- conductor --; line 35, cancel "external"; line 36, "said terminal" should read -- said external terminal --.

Signed and sealed this 17th day of March 1970.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents