June 2, 1959 R. H KINGDON ET AL 2,889,428

MULTIPOLE CIRCUIT BREAKER

Filed June 8, 1955 3 Sheets-Sheet 1

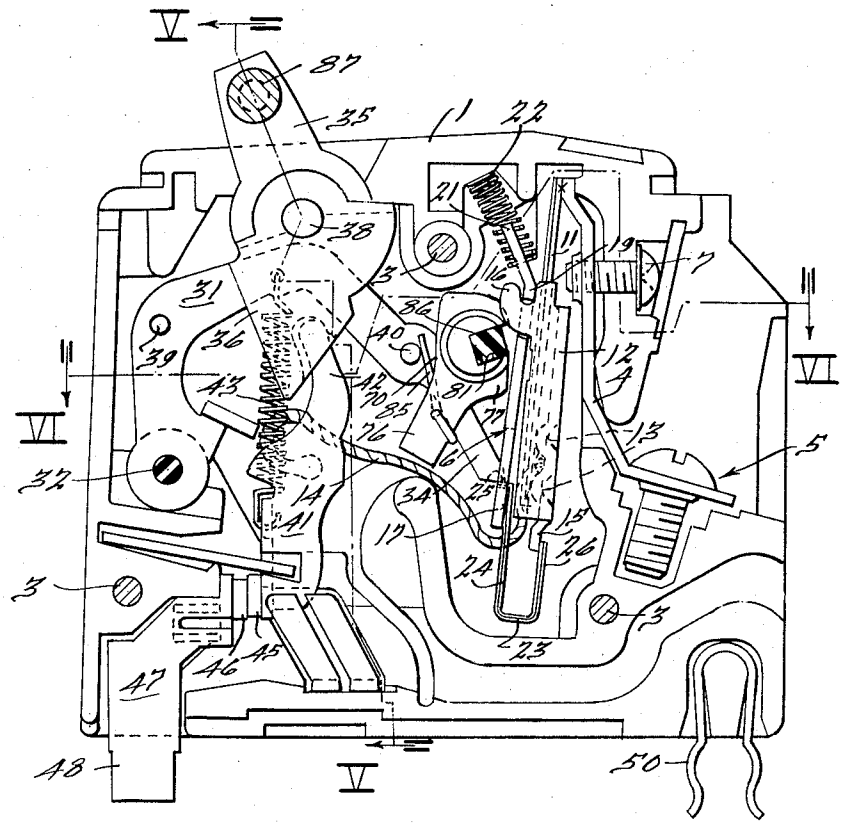


Fig. 1.

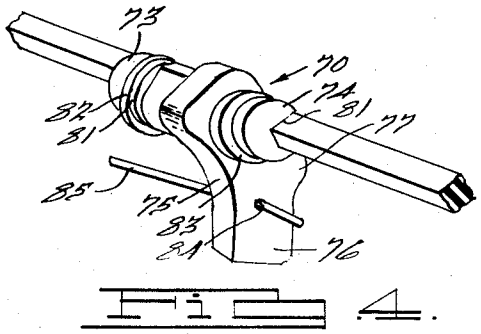


Fig. 4.

INVENTORS
Ralph H. Kingdon
Richard J. Scheich
BY
Myron J. Zeibold
ATTORNEY

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Filed June 8, 1955 3 Sheets-Sheet 2

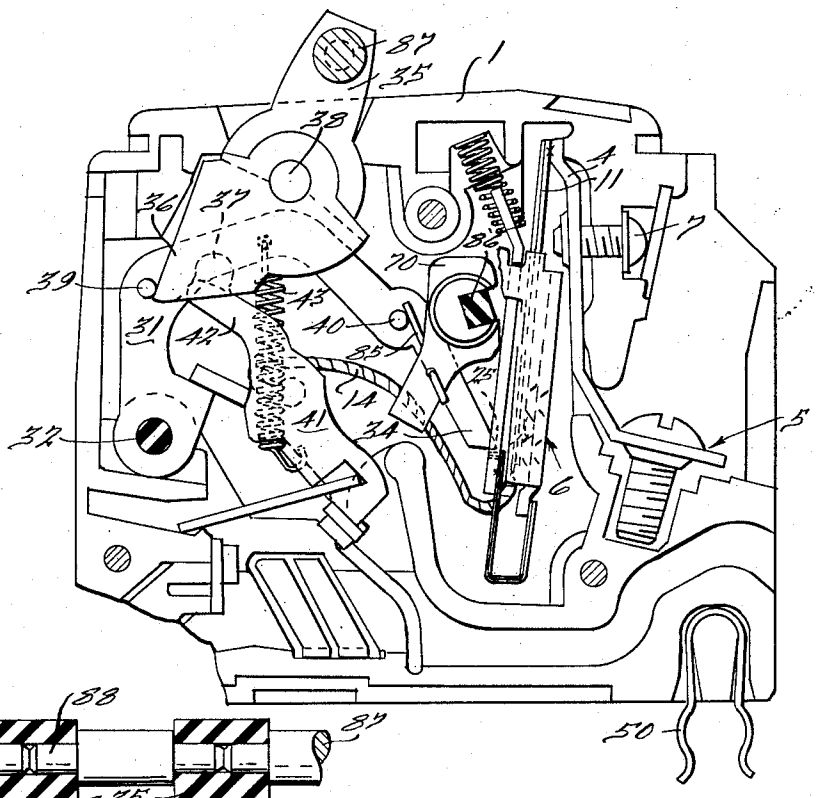


Fig. 2.

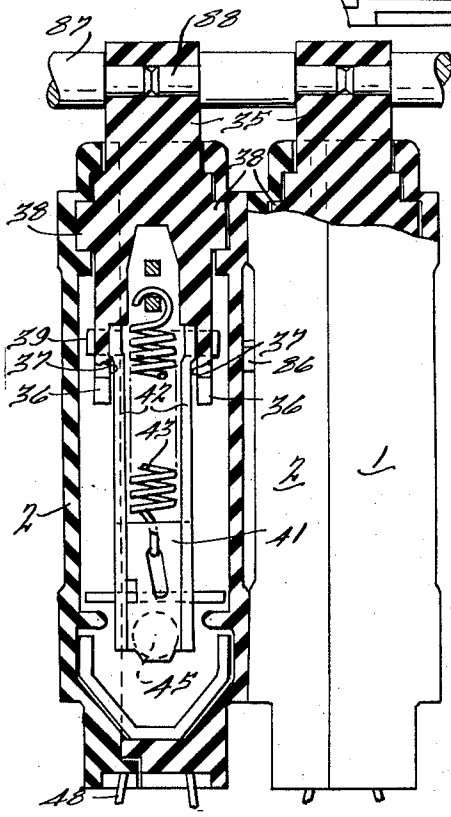


Fig. 3.

INVENTORS
Ralph H. Kingdon
Richard J. Scheick
BY
Myron J. Seibold
ATTORNEY

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Filed June 8, 1955 3 Sheets-Sheet 3

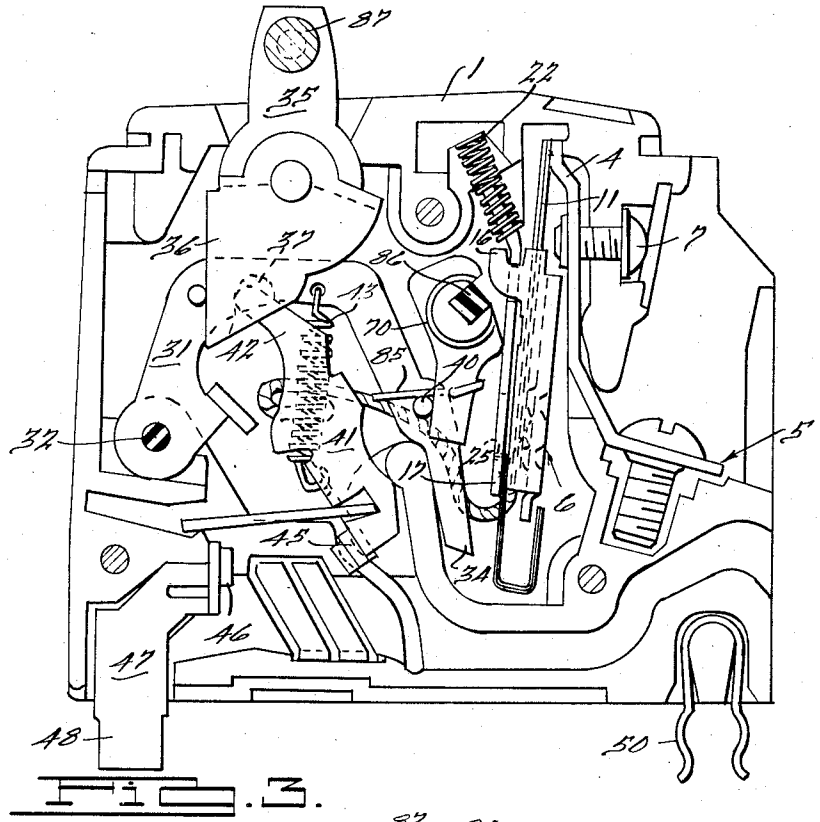


Fig. 3.

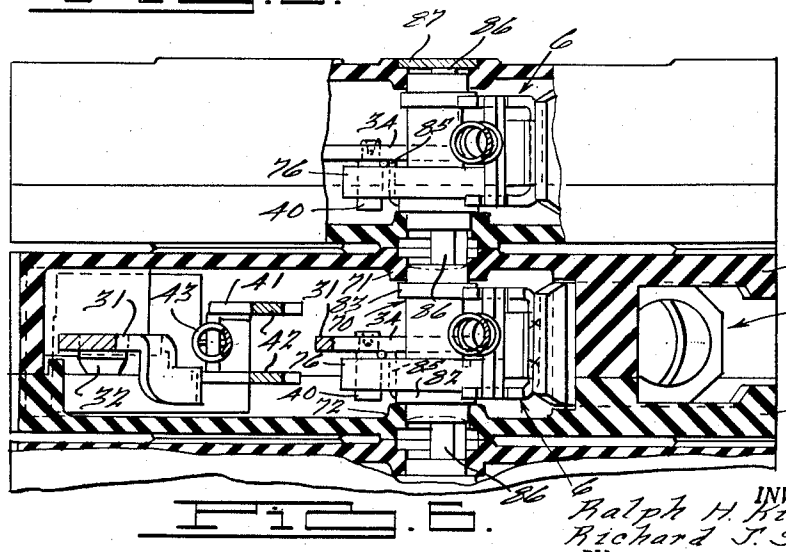


Fig. 5.

INVENTORS
Ralph H. Kingdon
Richard J. Scheich
BY
Myron J. Seibold
ATTORNEY.

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2,889,428

MULTIPOLE CIRCUIT BREAKER

Ralph H. Kingdon, Birmingham, and Richard J. Scheich, Detroit, Mich., assignors to Square D Company, Detroit, Mich., a corporation of Michigan

Application June 8, 1955, Serial No. 513,946

11 Claims. (Cl. 200—116)

This invention relates to apparatus for making and breaking electrical circuits and more particularly to a circuit breaker adapted to be connected with other circuit breakers of a similar construction to develop a multipole circuit breaker.

An object of the present invention is to provide a single pole circuit breaker with internal adaptations whereby the circuit breaker may be connected to circuit breakers of a similar construction to develop a multipole circuit breaker.

A further object of the present invention is to provide a circuit breaker adapted to be joined to circuit breakers of like construction such that operations on or in one of said circuit breakers involves like operation in other joined circuit breakers.

A further object of the present invention is to provide a multipole circuit breaker constructed of a desired plurality of unitary single pole circuit breakers with means interconnecting each of the single pole circuit breakers for common operation.

A further object of the present invention is to provide a circuit breaker of a unitary type construction with a pivoted crossbar within the device and with the crossbar adapted to be connected to crossbars of circuit breakers of the same construction so that the connected circuit breakers operate simultaneously through the medium of the connected crossbars.

A further object of the present invention is the provision of a multipole circuit breaker constructed of a suitable plurality of single pole circuit breakers with means in each of the circuit breakers operated during tripping movement within that circuit breaker and connected to similar means in adjacent circuit breakers whereby tripping movement within one single pole breaker causes tripping of all poles of the multipole breaker.

Further objects and features of the invention will be readily apparent to those skilled in the art from the following specifications and appended drawings illustrating certain embodiments of the invention in which:

Figure 1 is a side view of the circuit breaker with the side cover removed and showing the operating mechanism in the On position.

Figure 2 is a side view of the circuit breaker with the side cover removed and showing the operating mechanism in the Off position.

Figure 3 is a side view of the circuit breaker with the side cover removed and showing the operating mechanism in the Tripped position.

Figure 4 is a perspective view of the crossbar and connecting rod.

Figure 5 is a vertical sectional view of the circuit breaker taken along the lines V—V of Figure 1.

Figure 6 is a horizontal sectional view of the circuit breaker taken along the lines VI—VI of Figure 1.

The circuit breaker of the present invention comprises an open-sided casing 1 of molded insulating material having molded recesses and barriers for the support of

the circuit breaker mechanism and contacts therein. A cover 2 of molded insulating material providing complementary recesses and barriers closes the open side of the casing 1 and is mounted thereon by means of a plurality of rivets 3. Both the casing and cover are provided with top and bottom openings through which extend the operating and connecting members of the circuit breaker mechanism as will be described.

In one end of the insulating base 1 and supported by barriers established by portions of the base is a conducting terminal strap 4 provided at its outside end with a terminal connector 5 and having secured thereo, at its inside end, a current responsive trip mechanism 6 of the circuit breaker. An adjustable screw 7 extends through a slot in the base 1 and threadedly engages the conducting strip 4 in the interior of the base 1 with the head of the screw operating against the slotted portion of the base to provide an adjustment for the calibration of the circuit breaker. The conducting strap 4 is maintained in place in the circuit breaker casing 1 through cooperation with molded shoulders and barriers within the case so that rotation of the adjustment screw 7 operates to determine the angular position of the trip mechanism 6 within the interior of the base in addition to securing the mechanism within the casing.

The current responsive trip mechanism 6 supported on the interior of the conducting strap 4 constitutes a bimetallic member 11 attached by suitable means, such as welding, to the strap 4 at one end and has a generally U-shaped magnetic yoke member 12 fixed to its other end by means such as welding. The magnetic yoke member is provided with a pair of vertically and laterally disposed nibs 13 at which the weld to the bimetal is made and between which there is welded to the bimetal member 11 and yoke 12, at the same time, a braided conductor or pigtail 14. The magnetic yoke member is provided with an offset lower extension 15 centrally thereof, and at the uppermost end the arms of the U-shaped yoke are formed into supporting pivot arms 16 disposed on opposite sides of the bimetal member 11 from that side on which the yoke member and bimetal are welded together. A movable magnetic armature member 17 having a central cutout 18 is pivotally supported on the pivot arms 16 of the magnetic yoke 12 by outwardly extending shoulders 19 with the armature body formed so as to extend toward the bottom end of the circuit breaker substantially parallel to the magnetic yoke 12. The armature is also formed to provide an arm 21 extending beyond the bimetallic member 11 toward the upper end of the circuit breaker at an offset angle away from the member 11. A helical coil spring 22 engages the magnetic armature member 17 at the shoulders 19 thereof and is disposed about the arm 21 at one end and, at its other end, operates against the insulating base 1 in a suitable recess provided therein.

To the lower end of the armature member 17 a U-shaped ambient temperature responsive bimetal 23 is secured with the upper portion of one end 24 thereof extending along the inner side of the magnetic armature member 17 and bent over at its extreme end at 25 to extend along the lower surface to the cutout 18 in the armature, and with the other leg 26 of the U-shaped bimetal 23 extending into cooperating relationship with the offset extension 15 at the lower end of the magnetic yoke member 12. The specific operation and characteristics of the current responsive trip mechanism 6 is more fully described and explained in a copending application, Serial No. 514,222, filed June 9, 1955, of Harris I. Stanback and Ralph H. Kingdon for Circuit Breaker and assigned to this same assignee.

The operating mechanism of the circuit breaker, con-

stituting those parts which open and close the contacts of the circuit breaker to make and break the circuit through the device, is supported and enclosed within the casing 1 and cover 2 and includes a generally U-shaped cradle member 31 pivotally supported at one end on a hub 32, formed during the molding of the base, and which cooperates at the extremity of the other leg 34 with the bent over portion 25 of the bimetal member 23 within the cutout 18 of the magnetic armature. A manual operator 35, having a handle portion at one end thereof extending outwardly of the circuit breaker insulating casing and cover through the openings provided therefor and a body portion extending inwardly into the central recess of the casing, provides a pair of legs 36 surrounding the cradle member 31 substantially at the center thereof. Each of the legs 36 is provided with inwardly extending recesses 37 for the support of a movable contact carrier as will be described. The manually operable handle 35 is provided with a central trunnion 38 for cooperation with suitable bearing recesses in the casing 1 and cover 2 for the pivotal support thereof. A pair of cylindrical pins 39 and 40 are secured to the cradle member 31 and extend vertically thereto so as to move upon release of the cradle from the latch surface to operate as will be hereinafter described.

Pivotally supported on the manual operator 35 is a movable contact carrier 41 having a generally U-shaped cross section and provided with two upwardly extending legs 42 that cooperate with the internal recesses 37 of the legs 36 of the operator. At the base of the U-shaped cross section of the movable contact member 41, a helical coil spring 43 is hooked with the opposite end of the spring hooked to the cradle member 31 so that the tension of the spring maintains the legs 42 spring biased into engagement with the recesses 37 in the manual operator 35. The helical coil spring 43 also serves to provide a resilient bias to maintain leg 34 of the cradle member 31 in its latched position with the armature member 17 and serves to bias the movable contact member 41 through its overcenter type engagement with the manual operator 35 to either side of the pivotal support. A contact 45 is secured to the lowermost extremity of the movable contact member 41 and at the opposite end of the base of the U-shaped cross section thereof from the side defining legs 42. The movable contact 45 cooperates with a stationary contact 46 secured to the bight of a U-shaped spring jaw clip 47 having the lower end 48 thereof extending beyond the base of the circuit breaker. The flexible conductor or pigtail 14 secured at one end, as has been described, to the bimetallic member 11 is also secured, by means such as welding, at its other end to the movable contact member 41 completing a circuit in closed contact position from the spring jaw clip 47 through the circuit breaker current responsive overload mechanism to the terminal 5. A spring clip jaw 50 is provided at the opposite end of the circuit breaker from clip 47 for support of the breaker in a panelboard or the like, as shown in copending application in the name of Stanback and Kingdon Serial No. 483,048, filed January 20, 1955, and assigned to this same assignee, for Electrical Panelboard.

The circuit breaker of the present invention is constructed as a single pole, totally enclosed circuit breaker and is provided with an internal mechanism whereby the circuit breaker may be joined with other circuit breakers of similar construction to develop a multipole device with common trip features. To adapt the circuit breaker for multiple common trip type operation, a crossbar 70 is pivotally supported in suitable bearing recesses 71 and 72 in the casing and cover 2 respectively. It should be noted that when the insulating base and cover members are molded, they are provided with a removable knockout section in the casing and cover defining

the bearings 71 and 72; reference should be had specifically to Figure 6 wherein is shown, in dotted lines, the removable knockout in the sides of both the casing and cover. This construction enables the insulating base and cover sections, when molded, to be used both in single pole units, with the knockout in place, and in multipole units with the knockout removed, as will be seen hereinafter. Reference should be had to a copending application in the name of Harris I. Stanback and Ralph H. Kingdon for Circuit Breaker, Serial No. 509,135, filed May 18, 1955, and assigned to this same assignee, which shows and describes a single pole circuit breaker of the type herein assembled to constitute a multipole device. The crossbar 70 constitutes a device which is interconnected from pole to pole in the multipole circuit breaker and operated upon tripping of any one pole to cause tripping of all poles of the multipole device and may be of molded insulating material construction to isolate the individual poles constituting the multipole device. The crossbar 70 is provided with circular trunnions 73 and 74 at either end and an L-shaped bell crank portion 75 with an extending leg 76 and a heel portion 77. At each end of the crossbar 70, a pair of annular alignment hubs 82 and 83 are provided at the interior edges of the trunnions 73 and 74. A transverse slot 81 extends along the entire length of the crossbar 70 from the periphery to the center and a hole 84 is provided in the extending leg 76 through which a biasing spring wire 85 passes for a purpose to be more fully described hereinafter.

Referring now to Figures 1 and 6 showing the common trip crossbar mounted within the circuit breaker case and cover, it may be seen that the crossbar 70 is supported so that the leg 76 of the bell crank 75 lies adjacent to leg 34 of the cradle member 31 in alignment with the path of travel of the pin 39 and that the heel portion 77 thereof is adjacent to the central body portion of the magnetic armature 17. In Figure 6 an assembly of a group of circuit breakers constructed for multipole operation is shown, each breaker being provided with a common trip crossbar. The rivets 3 previously described as an enclosing cover against the base 1, in the multipole device, will extend through all of the breakers constituting the multipole unit to develop a composite unit and in assembling the devices into a multipole common trip unit, the individual crossbars 70 of each circuit breaker will be connected together through the cooperation of a bar 86 with the slot 81 in the crossbar of each circuit breaker. In this manner, movement of any of the crossbars 70 of any one circuit breaker of the multipole unit causes coincident movement of the crossbars of each of the circuit breakers assembled in the multipole unit. The spring wire 85 passes through the hole 84 in the extending leg 76 of the bell crank 75 and is secured by a looped end around the leg 76. The free end of the spring wire 85 extends beyond the leg 76 and into alignment with the pin 40 on the cradle member 31. The resiliency of the spring wire 85 maintains the same in constant cooperation with the pin 40 and operates to establish a normal position for the crossbars 70 in each of the circuit breakers. Only one spring wire 85 is needed in the multipole device in that the biasing action on one crossbar effectively biases all through the interconnection by bar 86.

In the casing and cover members employed in construction of the multipole circuit breaker, the knockout sections are removed before the circuit breaker mechanism is assembled therein necessitating the provision of a sealing means to totally enclose the outside surfaces of the last unit breakers in the multipole combination. For this purpose, a sealing washer 87 is placed in the opening defined by the removed knockout at the outside edges of the multipole unit with the washer being sealed in place by a suitable setting sealing material such as wax or glue.

It should be understood that the knockout must be removed to provide adequate bearing space for the seating of the trunnion of the crossbar, thus necessitating the sealing washer at each end of the common trip section of the multipole circuit breaker.

Reference should be had to the previously mentioned copending application, Stanback and Kingdon for Circuit Breaker, Serial No. 514,222, filed June 9, 1955, describing the operation of a circuit breaker of the type shown herein in tripping operation. For the purposes of this application, it should be apparent that thermal or magnetic overload of any one pole of the multipole unit entails release of leg **34** of the cradle members **31** from its latched position on the latching surface **25** in cutout **18** of the armature member **17**. By comparison of the views of Figure 1 and Figure 3, it may be seen that as cradle member **31** is rotated in a clockwise fashion about its pivot on hub **32** the pin **40** on leg **34** will be carried into cooperating position with leg **76** of the bell crank **75** on the cross bar **70**. On continued movement, the cooperation of the pin **40** and the leg **76** will cause counter-clockwise rotation of the crossbar **70** rotating heel **77** into a cooperating position with the armature member **17** where the heel **77** may cam the armature **17** to move it in a continued counter-clockwise direction. Recalling now that each of the circuit breakers of the multipole unit is provided with a crossbar moved upon movement of the crossbar of any one circuit breaker, it will be seen that each heel **77** of each of the crossbars **70** of the multipole unit will engage its associated armature **17** and cam the same in a counter-clockwise direction to cause tripping of all breakers through release of any one of the cradle legs **34**. In Figure 3 it may be seen that the spring wire **85** rests on the pin **40** of cradle **31** and when the cradle **31** is latched, as in Figures 1 and 2, the crossbar is constantly biased to a normal position with the generally straight line extending from the heel portion **77** parallel to the plane of the armature **17** as shown in Figure 1. Recocking movement of the circuit breakers through cooperation of the extremity of the legs **36** of the manual operator **35** with pin **39** on the cradle **31**, as described in the previously mentioned copending application, replaces the leg **34** onto the latch **25** and permits the spring wire **85** to return the cross bar to the position shown in Figure 1.

In addition to the interconnecting means connecting the circuit breakers together and constituting the rivets through the individual circuit breakers making up the multipole device and the interconnected common trip crossbars, the circuit breakers are also connected together at their handles by a suitable plurality of rigid handle ties **87** having reduced diameter end extensions **88** which cooperate with suitable holes drilled through the external extension of the manual operator **35**. By means of the rigid handle ties, the circuit breakers constituting the multipole device are connected together for unitary manual operation in addition to having the automatic common trip operation as provided by the interconnected crossbars **70**. It should be understood that the handle ties do not cause the several poles of the multipole device to trip with tripping of any one pole as the individual circuit breakers are of the trip-free type allowing the breaker to trip even though the handle of a tripped breaker is held in an On position. The handle ties are provided only for unitary manual operation of all poles of a multipole device with manual operation of a single handle.

While certain preferred embodiments of the invention have been specifically illustrated and disclosed, it is understood that the invention is not limited thereto, as many variations will be readily apparent to those skilled in the art and the invention is to be given its broadest possible interpretation within the terms of the following claims.

What is claimed is:

1. A multipole electric circuit breaker comprising an assembly of a plurality of individual circuit breaker units, each unit constituting an independent device having a current responsive trip mechanism, a cradle member pivotally supported within each unit, said cradle member being releasable in response to overload current flow through said current responsive trip mechanism, a movable contact member, a manual operator, said contact member pivoted in said operator, a spring fixed at one end to said cradle and at the other end to said contact member and biasing the same into said manual operator, and an enclosure for said unit, independent means within each unit operated on tripping movement of said cradle, said independent means being pivotally mounted in said enclosure and having portions thereof accessible through said enclosure, means extending through said multipole circuit breaker and joining said pivotally mounted means at said pivotal mounting, and means on said independent means operative on said trip mechanism to trip all said individual units in response to tripping movement of a cradle member in any unit.

2. A multipole circuit breaker comprising an assembly of a plurality of individual circuit breaker units, each unit constituting an independent device having a current responsive trip mechanism, a cradle member pivotally supported within said unit and releasable in response to overload current flow through said current responsive trip mechanism, a movable contact member, a manual operator, said contact member being pivoted in said operator, and a spring fixed to said cradle and contact member and biasing the latter into said manual operator, pivotally mounted independent trip members within each unit being operated upon tripping movement of said cradle, means extending through all poles of said multipole circuit breaker at the pivotal mounting of said trip members and joining said trip members for unitary operation, and means on said trip members operative upon said trip mechanisms to trip all said individual units in response to tripping movement of said cradle in any unit.

3. A multipole electric circuit breaker comprising an assembly of a plurality of individual circuit breaker units, each unit being an independent device having a current responsive trip mechanism, a cradle member pivotally supported within said unit and releasable in response to overload current flow through said trip mechanism, a movable contact member, a manual operator, said contact member being pivoted in said operator, a spring fixed to said cradle and biasing said contact member into said manual operator, and a pin extending from said cradle member parallel to the pivotal axis thereof, an independent trip means pivotally mounted within each individual circuit breaker, said trip means having a radial extension, said pin engaging said extension to rotate said trip means on tripping movement of said cradle, means extending through said individual circuit breakers and said trip means at said pivotal mounting thereof and joining individual independent trip means of adjacent individual circuit breakers for unitary operation, and means on said trip means operative upon said trip mechanism in each individual unit in response to overload movement in any one individual circuit breaker.

4. A multipole electric circuit breaker comprising an assembly of a plurality of individual circuit breaker units, each unit being an independent device having a current responsive trip mechanism, a cradle member pivotally supported within said unit and releasable in response to overload current flow through said current responsive trip mechanism, a stationary contact, a movable contact member, a manual operator, said contact member being pivoted in said operator, and a spring fixed to said cradle and biasing said movable contact member into said manual operator, a pin extending from said cradle member parallel to the pivotal axis thereof, independent trip means pivotally supported within each unit, said trip means having a radial extension with a heel portion thereon, said pin engaging said extension to

rotate said trip means upon release movement of said cradle, keying means passing through said units and said trip means at the pivotal support thereof and joining individual independent trip means of adjacent individual circuit breaker units, said heel portion camming said trip mechanism in each unit on rotation thereof to trip each unit in response to current overload in any one unit.

5. A multipole electric circuit breaker comprising a plurality of single pole individual circuit breakers having individual casings and covers, means extending through said individual casings and covers to enclose said individual circuit breakers and join the same into said multipole device, individual cross bars adapted to be supported in portions of said casings and covers constituting bearing surfaces therefor, said cross bars being accessible to the exterior of said casings and covers, means extending through all of said individual circuit breakers and eccentrically connecting said cross bars at said pivotal support thereof for unitary operation, means in each individual circuit breaker adapted to be moved in response to current overload therethrough and operative upon said individual cross bars associated therewith, and means on each cross bar operative within its associated individual circuit breaker to trip all poles of said multipole device in response to current overload in any one individual circuit breaker.

6. A single pole automatic electric circuit breaker adapted to be assembled with other circuit breakers of the same construction to produce a multipole electric circuit breaker having a common tripping mechanism, said circuit breaker comprising a casing and a cover, a stationary contact, a movable contact, means releasable to effect separation of said contacts, current responsive means for effecting the release of said releasable means, means pivotally supported within said circuit breaker and having a portion thereof accessible through said casing and cover, said pivoted means having a slot therein at said pivotal support and transverse of said circuit breaker parallel to the axis of the pivotal support of said means, said pivoted means adapted to be operated by said releasable means to effect rotation thereof in response to current overload through said circuit breaker, means inserted in said slot in said pivoted means and in similar slots in pivoted means in adjacent circuit breakers assembled to constitute said multipole circuit breaker, and means on said pivoted means operative to cam said current responsive means to release said releasable means whereby release of said releasable means in any one circuit breaker will cause release of said releasable means in adjacent circuit breakers joined by said inserted means.

7. A single pole automatic electric circuit breaker adapted to be assembled with other circuit breakers of the same construction to produce a multipole electric circuit breaker having a common tripping mechanism, said circuit breaker comprising a casing and a cover, a stationary contact, a movable contact, means releasable to effect separation of said contacts, current responsive means for effecting the release of said releasable means, means pivotally supported within said circuit breaker and having a portion thereof accessible through said casing and cover, said pivoted means having a slot therein at said pivotal support and transverse of said circuit breaker parallel to the axis of the pivotal support of said means, said pivoted means adapted to be operated by said releasable means to effect rotation thereof in response to current overload through said circuit breaker, a continuous strip bar inserted in said slot in said pivoted means and in similar slots in pivoted means in adjacent circuit breakers assembled to constitute said multipole circuit breaker, and means on said pivoted means operative to cam said current responsive means to release said releasable means whereby release of said releasable means in any one circuit breaker will cause release of said releasable means in adjacent circuit breakers joined by said continuous strip bar.

8. A single pole automatic electric circuit breaker adapted to be assembled with other circuit breakers of the same construction to produce a multipole electric circuit breaker having a common tripping mechanism, said circuit breaker comprising a casing and a cover, a stationary contact, a movable contact, means releasable to effect separation of said contacts, current responsive means for effecting the release of said releasable means, means pivotally supported within said circuit breaker and having a portion thereof accessible through said casing and cover, said pivoted means having an eccentric slot therein at said pivotal support and transverse of said circuit breaker parallel to the axis of the pivotal support of said means, said pivoted means adapted to be operated by said releasable means to effect rotation thereof in response to current overload through said circuit breaker, a continuous strip bar inserted in said slot in said means and in similar slots in pivoted means in adjacent circuit breakers assembled to constitute said multipole circuit breaker, and means on said pivoted means operative to cam said current responsive means to release said releasable means whereby release of said releasable means in any one circuit breaker will cause release of said releasable means in adjacent circuit breakers joined by said continuous strip bar.

9. A multipole electric circuit breaker comprising a plurality of individual circuit breaker mechanisms each having separable contacts, releasable means operative upon release to effect separation of the contacts of its associated circuit breaker mechanism and an enclosure electrically isolating each of the individual circuit breaker mechanisms of said multipole circuit breaker from the others of said mechanisms and including spaced-apart side walls, pivoted means in said enclosures, respectively, each of said pivoted means being rotatably supported by bearing surfaces defined by circular openings in said side walls, respectively, of its associated enclosure, an axially directed non-circular hole in each of the said pivoted means aligned generally with said openings of its associated sidewalls, each of said pivoted means being operative upon its rotation to release its associated releasable means, and a non-circular shaft complementary to said non-circular openings insertable through all of said circular openings in said sidewalls and through all of said non-circular holes in all of said pivoted means, and, when inserted into all of said non-circular holes and openings, operative upon rotation of one of said pivoted means to cause rotation of another of said pivoted means.

10. A multipole electric circuit breaker comprising a plurality of individual circuit breaker mechanisms each having an enclosure electrically isolating each of the individual mechanisms of said multipole circuit breaker, said enclosures including spaced-apart side walls, trip members in said enclosures, respectively, a circular portion of each of said trip members being rotatably received in complementary circular openings in said side walls of its associated enclosure, means for retaining said sidewalls in side-by-side relation with said openings coaligned, an axially directed non-circular hole extending through each of said trip members axially aligned generally with the openings in its associated side walls, current responsive means in each individual circuit breaker operative upon flow of an excessive current therethrough to rotate the trip member therein, each of said trip members including means operative upon its rotation for effecting operation of the current responsive means associated therewith, and a unitary non-circular trip bar complementary to said non-circular openings insertable through an outer one of said circular openings and into said non-circular holes in all of said trip members and, when so inserted, operative upon rotation of one of said trip members to cause rotation of the other of said trip members.

11. A multipole electric circuit breaker comprising a plurality of individual single pole circuit breaker mechanisms each having an enclosure to electrically isolate it

from each of the other individual mechanisms of said multipole circuit breaker and including spaced-apart side walls, trip members in said enclosures, respectively, each of said trip members having coaligned circular trunnions on opposite sides thereof rotatably received in and substantially filling respective complementary circular openings in said side walls, respectively, of its associated circuit breaker enclosure, means for retaining said individual circuit breaker enclosures in side-by-side relation with said circular openings coaxially aligned, an axially directed non-circular hole in each of said trip members extending axially through its trunnions, current responsive means associated with each of said individual circuit breaker mechanisms operative upon flow of an excessive current therethrough to rotate the trip member associated therewith, each of said trip members including means operative upon its rotation for effecting operation of the current responsive means associated therewith, and non-

circular means complementary to said non-circular openings insertable through an outer one of said circular openings and into said non-circular holes in all of said trip members and, when so inserted, operative upon rotation of one of said trip members to cause rotation of the other of said trip members.

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