Oct. 6, 1964 W. H. EDMUNDS 3,152,287

ADAPTATION OF MULTIPOLE CIRCUIT BREAKER FOR DOUBLE CURRENT RATING

Filed Oct. 20, 1958 4 Sheets-Sheet 1

FIG. 1.

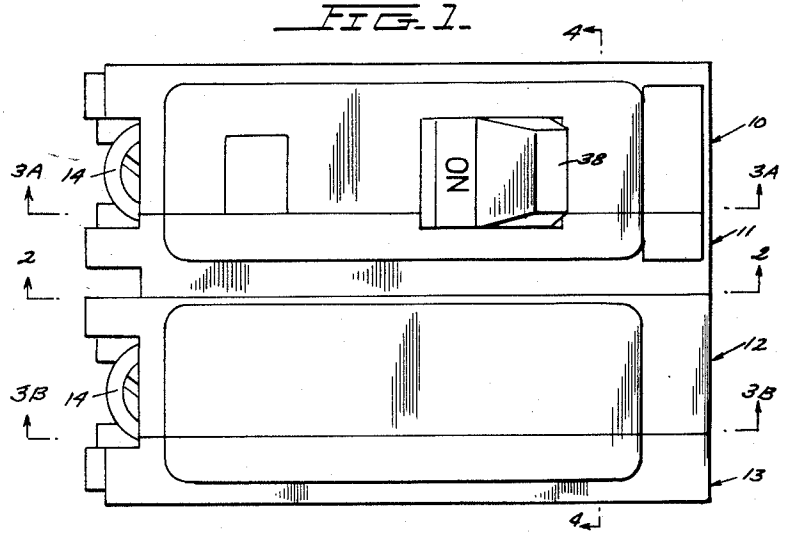
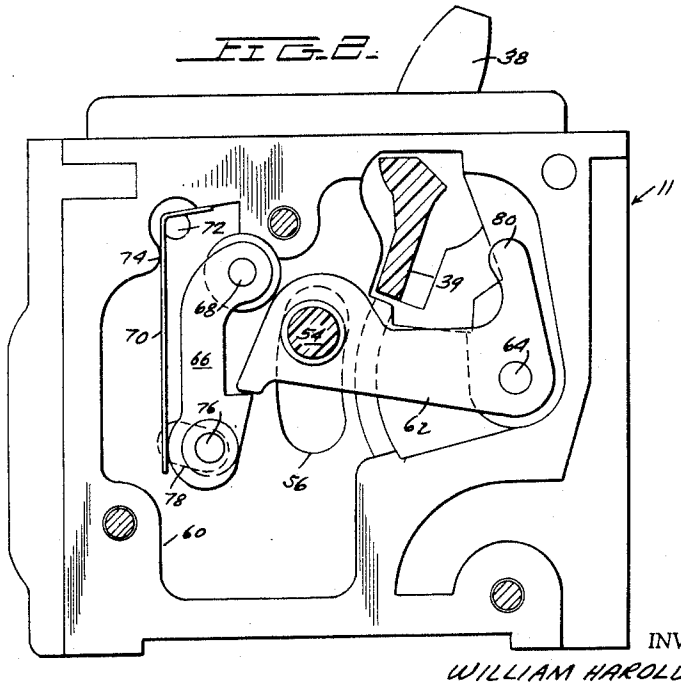


FIG. 2.



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FIG. 3.

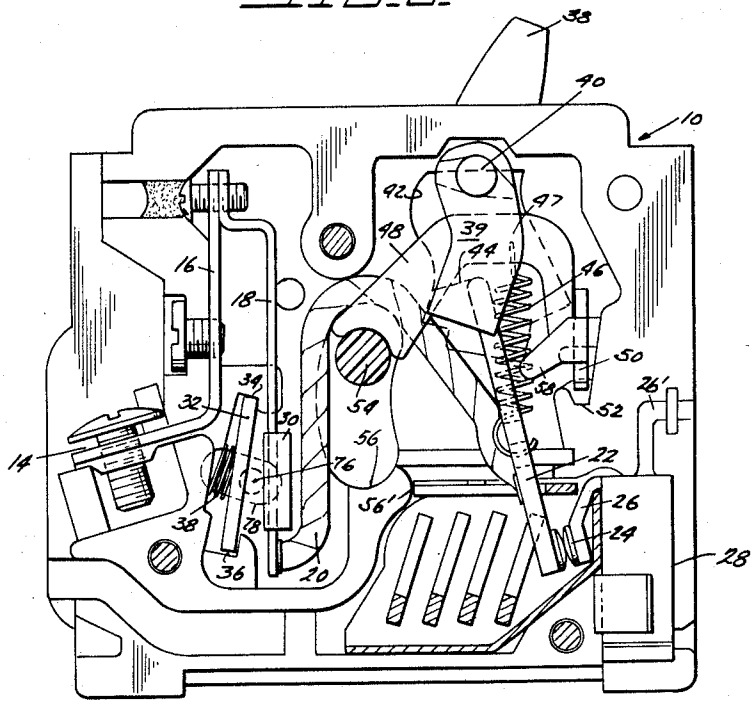


FIG. 4.

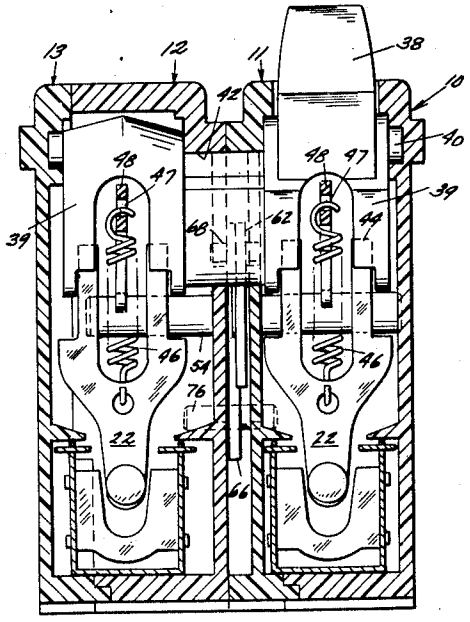
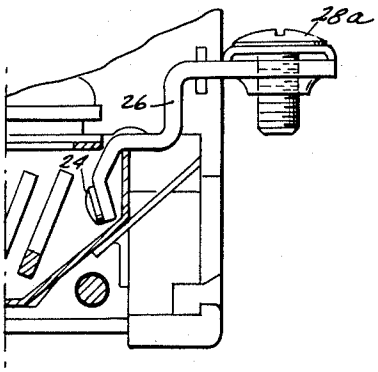


FIG. 3a.



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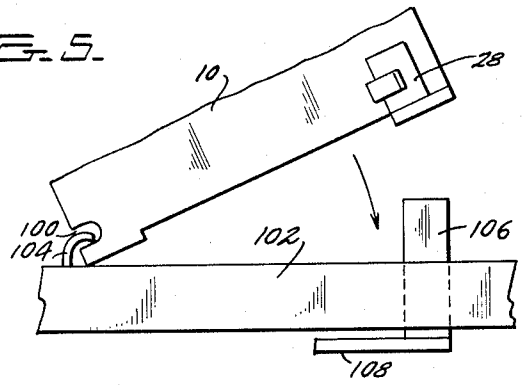
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FIG. 5.



PRIOR ART

FIG. 6.

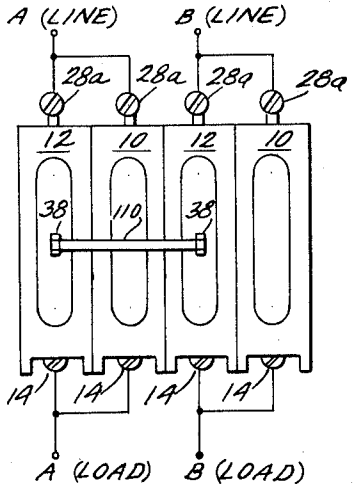
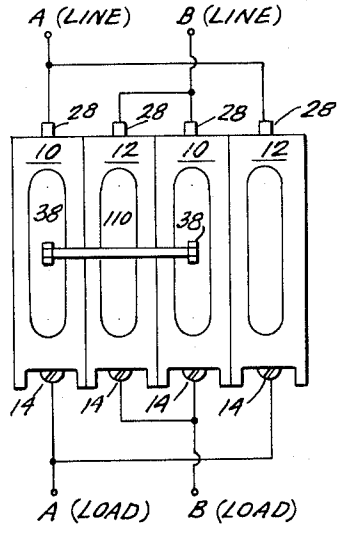


FIG. 7.



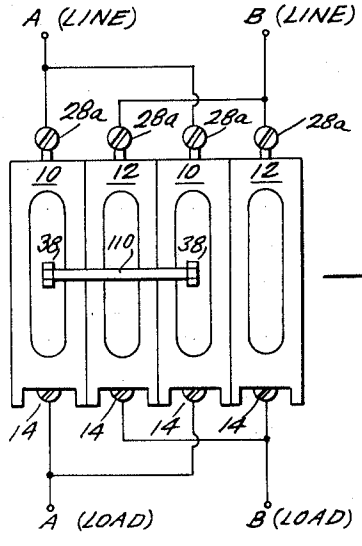


FIG. 8.

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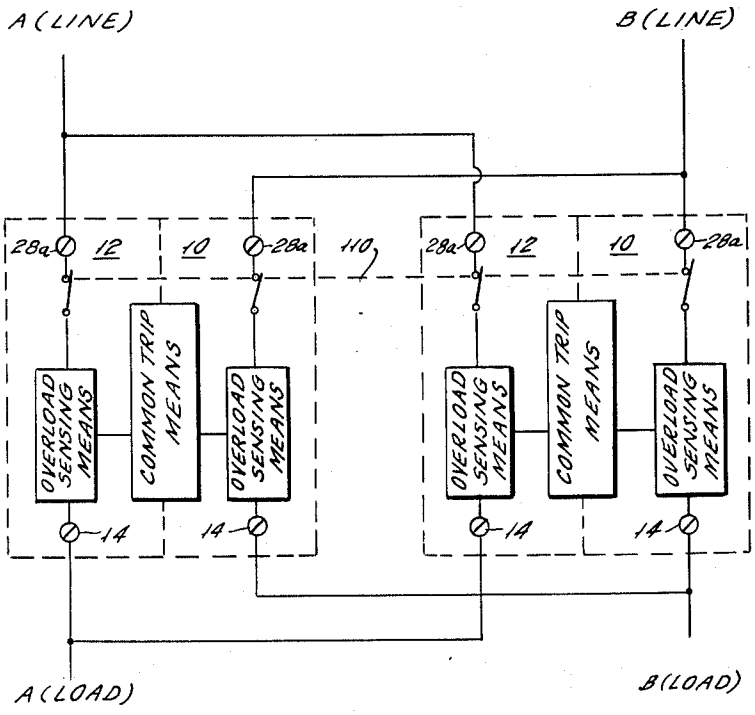


FIG. 9

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United States Patent Office 3,152,287 Patented Oct. 6, 1964

3,152,287

ADAPTATION OF MULTIPOLE CIRCUIT BREAKER FOR DOUBLE CURRENT RATING

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Filed Oct. 20, 1958, Ser. No. 768,160
8 Claims. (Cl. 317—46)

My invention relates to a novel interconnection between first and second multiphase circuit breaker for connecting the circuit breakers in parallel to protect a circuit having a higher current rating than the rating of either circuit breaker while still providing a common trip between each of the multipole units without requiring a mechanical connection between their trip units.

It is desirable in many applications to be able to protect a relatively high rated current circuit although provision is made only for relatively low rated interrupting equipment. Thus, in panel boards which receive two pole circuit breakers, the plug-in terminals of the panel board may only be rated for 50 amperes per pole and will receive two pole circuit breakers rated at 50 amperes per pole. In order to energize a 100 ampere circuit from the panel board, two plug-in type circuit breakers are connected side by side or one below and the other above on the panel board.

In the past, the two poles of the first breaker were connected in parallel to form a first pole of the high current circuit while the two poles of the second unit were connected in parallel to form the second pole of the new circuit.

Each of the two internal poles of the individual breakers may have common trip means so that both internal poles operate responsive to a fault. However, there is no mechanical connection between the two breaker units, and the operation of one of the units which operates as one pole will not cause operation of the second unit which operates as a second pole. Accordingly, if there is a fault on one of the poles, only one-half of the panel board will be de-energized and the unfaulted pole will remain closed. In order to cause both units to operate, a common mechanical linkage is required between the two units.

The principle of my invention is to electrically connect the various poles of the two units so that operation of one of the units will cause operation of the other unit without a mechanical common trip means.

More specifically, I form the first high rated current pole by electrically connecting the first pole of the first unit in parallel with a first pole of the second unit and form the second high current rated pole by electrically connecting the second pole of the first unit and the second pole of the second unit in parallel. Accordingly, if a fault occurs on the phase including the first high rated current pole, one internal pole of each of the two units will be operated. The first internal pole of each unit is mechanically connected to the second internal pole of each respective unit so that each of the second internal poles will also be operated. Therefore, the second high rated current pole will be opened responsive to operation of the first high rated current pole without any mechanical linkage for interconnecting the two units.

My inventive concept is illustrated above for two pole circuit breaker units which are interconnected to serve a circuit having twice the rating of any pole. This can be extended to a three pole unit where one pole of one unit and two poles of a second unit are connected in parallel to form a two pole unit for a two phase circuit having a current rating which is three times the rating of any pole and the two breakers will have common trip

in the absence of a mechanical connection between the two.

Accordingly, a primary object of my invention is to adapt a plurality of multiphase circuit breakers for increased current rating.

Another object of my invention is to provide common trip characteristics between a plurality of multiphase breakers connected to have an increased current rating without mechanical connections between them.

Another object of my invention is to achieve common trip characteristics for a plurality of multiphase circuit breakers by connecting a pole of one circuit breaker in parallel with a pole of another circuit breaker.

These and other objects of my invention will become apparent from the following description when taken in conjunction with the drawings, in which:

FIGURE 1 shows a top plan view of a two pole circuit breaker.

FIGURE 2 shows a side cross-sectional view of FIGURE 1 taken across the lines 2—2 and illustrates the latch mechanism in the latched position.

FIGURE 3 is a side cross-sectional view of FIGURE 1 taken across the lines 3A—3A as well as 3B—3B with the circuit breaker contacts engaged and a plug-in type terminal at the right of the figure.

FIGURE 3A is a partial view of the terminal structure of the device of FIGURE 3 where the terminal is of the wire type.

FIGURE 4 is an end cross-sectional view across lines 4—4 of FIGURE 1.

FIGURE 5 illustrates how the two pole circuit breaker of FIGURES 1 through 4 cooperates with a panel board.

FIGURE 6 shows how a pair of two pole circuit breakers have been previously connected to protect a relatively high rated current circuit.

FIGURE 7 shows one manner in which two, two pole circuit breakers may be connected in accordance with my novel invention.

FIGURE 8 is a second embodiment of my invention.

FIGURE 9 schematically illustrates the manner in which the individual pole units are electrically interconnected to cooperate in conjunction with the common trip means of their respective circuit breaker units to achieve the objectives of the instant invention.

FIGURES 1 through 4 illustrate one type of multiphase circuit breaker to which my invention may be applied.

Referring now to FIGURES 1, 3 and 4, the circuit breaker is comprised of a first pole **10** and a second pole **12**, which are mounted within individual moulded housings and are, as may be seen from FIGURE 3 of substantially identical construction.

Each of the poles, as best seen in FIGURE 3 forms a current path including terminal **14**, conductor **16**, bimetal **18**, pigtail **20**, movable contact arm **22** terminated by a movable contact, stationary contact **24**, conductor **26**, and terminal **28**. Note that while FIGURE 3 shows terminal **28** as being of the plug-in type, that terminal **28** could be of the wire connected type **28***a* as shown in FIGURE 3A. The various current carrying members are removably carried by the moulded housing associated therewith to facilitate assembly and maintenance of the poles.

Bimetal **18** has a magnetic armature **30** riveted thereto by a round head rivet **31** in FIGURE 3 which cooperates with a relatively stationary magnetic structure **32** which is slidably mounted within moulding depressions **34** and **36** and is outwardly biased by spring **38**.

Accordingly, bimetal **18** will deflect to the left responsive to heating thereof by a prolonged overload, or by

interaction between armature 30 and magnetic structure 32 during short circuit current conditions. This leftward motion of bimetal 18 of either pole will, as will be seen hereinafter, initiate automatic interruption of both circuit breaker poles.

The operating mechanism for each of the poles includes a single operating handle 38 protruding from the housing of pole 10. The lower portion 39 of operating handle is pivotally mounted on pivot 40 which, as seen in FIGURE 4 extends through apertures in the adjacent housing walls such as aperture 42 of FIGURE 3 and seats in depressions 41 and 43 of walls 10 and 13 respectively. Operating handle portion 39 further has a depression 44 in the base thereof for seating the top of the movable contact arm 22 of each of the poles.

Movable contact arms 22 are urged into depressions 44 of the lower portion 39 of the moulded operating handle by means of individual toggle springs 46 which have one end thereof connected to a central portion of their respective contact arm 22 and their other end connected to a point 47 on cradle 48.

Cradle 48 is then pivotally supported at end 50 in moulding depression 52 while its other end is supported by a latchable connector bar 54 which is common to each pole and extends through apertures such as aperture 56 (FIGURE 3) in the adjacent housing walls. It is to be noted that cradle 48 has an integral kicker member 58 fastened thereto at end 50. The operation of kicker member 58 will be more fully discussed hereinafter.

When the operating handle 38 is in the right hand position of FIGURE 3, the toggle linkage comprised of cradle 48, contact arm 22 and spring 46 will be overcentered to force the movable contact portion of arm 22 into engagement with stationary contact 24.

If the operating handle 10 is manually moved to the left and to an "off" position, the upper pivotal point of engagement between depression 44 and contact arm 22 will move to the right until this pivot point is to the right of a line connecting point 47 on cradle 48 and the point at which spring 46 is fastened to arm 22. The toggle linkage will then be overcenter in the opposite direction and the contact arm 22 will then quickly snap to a disengaged position limited by moulded housing portion 55.

Accordingly, the contacts of each circuit breaker pole may be manually operated through identical operating mechanisms by a single operating handle 38.

For automatic operation of the cooperable contacts of each pole, the connecting member 54 which is normally latched in the upper position of FIGURE 3 will be unlatched by the novel latch mechanism to be described hereinafter whereby connector 54 can move downwardly.

Since, as best seen in FIGURE 4, the connector 54 supports the ends of cradles 48 of each of the poles, when connector bar 54 is unlatched, the biasing force of springs 46 will cause cradles 48 to move counter-clockwise about their pivots 52. This motion will bring point 47 to the left of a line formed by pivot point 44 and the point at which spring 46 connects to contact arm 22 whereby the contact arm will be snapped to its disengaged position.

During this operation, kicker member 58 will hit the contact arm 22 if the contacts do not disengage, thus assuring rapid contact disengagement of the contacts even though they may be lightly welded. Furthermore, the handle 38 will show a tripped position since spring 46 will pull the contact arm to urge the bottom of the operating handle to engage extension 80 of cradle 62.

In order to reclose the breaker, the operating handle is first moved to the off position where the latch mechanism is reset as described hereinafter and then to the on position.

The latch structure is best seen in FIGURE 2 as being carried within a depression 60 in the side wall of the housing of pole 10 which is sealed by the adjacent side wall of pole 12 to thereby form a third housing interposed between the two pole housings.

The latching unit consists of a latching cradle 62 which is pivotally mounted to the moulded housing by pin 64 and cooperates with a latch lever 66 which is pivotally mounted to the housing by pin 68. A latch return spring 70 bears against latch lever 66 and biases it in a counter-clockwise direction. The latch return spring 70 is mounted within the moulded body by a moulded pin 72 and a moulded fulcrum point 74.

The lower end of latch lever 66 has a trip rod 76 which extends through apertures in the adjacent housing walls such as aperture 78 and into an engageable position with respect to the thermal-magnetic responsive unit 18 of each of the poles (FIGURE 3).

Thus, either of the bimetals 18 may engage the trip rod 76 in an identical manner responsive to deflection of either bimetal.

The above described connector member 54 is shown in FIGURE 2 to be staked to the latch cradle 62. So long as latch lever 66 latches latch cradle 62, connector member 54 will be held in the position of FIGURES 2 and 3 and the circuit breaker contacts will be maintained in the engaged position. If, however, either of the thermal-magnetic units 18 are deflected to the left (FIGURE 3), the deflected unit will engage trip rod 76 to rotate latch lever clockwise against the biasing force of spring 70. This motion will eventually cause defeat of the latch engagement between cooperating latch member 62 which will rotate counter-clockwise and connector bar 54 will drop to allow automatic disengagement of the contacts of each pole.

To reset the breaker, the operating handle 38 is moved first to the off position. This motion will cause bottom portion 39 of the breaker handle to pick up extension 80 of latch member 62 (which has rotated counter-clockwise during the automatic operation) and rotate it clockwise to latch mechanism to reset in the position of FIGURE 2. The breaker may thereafter be operated to its on position through operating handle 38.

As best seen in FIGURES 3 and 5, the left hand side of the circuit breaker is adapted to have a depression 100 therein which permits the breaker to be mounted on a panel board. FIGURE 5 shows a lower portion of housing 10, and illustrates the manner in which a panel board 102 may mechanically receive and be electrically connected to the circuit breaker. The panel board 102 has a protruding mechanical connecting member 104 which is adapted to receive depression 100. The panel board 102 is further equipped with a male stab type of terminal 106 which is electrically connected within the panel board to an electrical bus 108. Male stab 106 energizes plug-in type terminal 28 in the well known manner when the breaker is placed in the panel board as shown in FIGURE 5 and then rotated downwardly in the direction of the arrow.

In the past, when it was desired to utilize two parallel connected two pole breakers to protect the relatively high rated current line, the two poles of the first breaker were connected in parallel to form a first new pole and the two poles of the second breaker were connected in parallel to form the second new pole. Thus, as seen in FIGURE 6, two circuit breaker units of identical construction to that illustrated in FIGURES 1 through 5 were placed side by side with a common tie bar 110 connecting their operating handles 38.

The breakers of FIGURE 6 have the terminal construction shown in FIGURE 3A and the terminals 28*a* and 14 of the left hand unit are respectively connected in parallel to form one pole for phase A while a similar parallel connection is made for the right hand breaker to form the pole for phase B.

In this construction, additional common trip means would be required if the poles of phase B are required to trip responsive to automatic operation of the poles of phase A. That is to say, if there is a fault in phase A of FIGURE 6, the poles 10 and 12 of the left hand

breaker would operate while the poles of phase B would not be affected and only one-half of the system would be de-energized.

My novel electrical connection which achieves common trip for the two phases without any required mechanical common trip between the two units is shown in FIGURE 7. In FIGURE 7, the terminals **28** are of the plug-in type as seen in FIGURES 3 and 5 although they can be of any desired type such as the wire type shown in FIGURES 3A and 6.

In accordance with the invention, one pole **10** of the left hand breaker unit is connected in parallel with pole **12** of the right hand breaker unit to form the new pole for phase A. Similarly, pole **12** of the left hand breaker and pole **10** of the right hand breaker are connected in parallel to form the new pole for phase B.

Accordingly, if there is a fault on phase A, pole **10** of the left hand unit or pole **12** of the right hand unit will first operate depending upon which pole is most sensitive. Once the most sensitive pole operates, the remaining pole conducts a substantial current so it will now operate. Because of the common trip mechanism between poles **10** and **12** of the left hand unit, pole **12** of the left hand unit will operate and similarly because of the common trip between the two poles of the right hand breaker, pole **10** of the right hand breaker will operate when pole **12** of the right hand breaker operates. Therefore, each pole of the system of FIGURE 7 is operated responsive to a fault in either phase A or phase B. Furthermore, this common trip characteristic between the two breaker units is achieved in the absence of a common trip mechanism between the two units.

In FIGURE 7, I have shown the two inner poles of the adjacent units and the two output poles of adjacent units as being respectively connected in parallel. Clearly, other combinations are possible. Thus, in FIGURES 8 and 9 which illustrate the invention in connection with wire type terminals **28***a*, adjacent pairs of poles are placed in parallel so that pole **10** of the left hand breaker is in parallel with pole **10** of the right hand breaker while pole **12** of the left hand breaker is in parallel with pole **10** of the right hand breaker.

In the most general case, it is only necessary in accordance with my invention that each phase includes at least one pole of each of the circuit breaker units which are combined to increase their current rating in accordance with the rating of the line.

In the foregoing, I have described my invention only in connection with preferred embodiments thereof. Many variations and modifications of the principles of my invention within the scope of the description herein are obvious. Accordingly, I prefer to be bound not by the specific disclosure herein but only by the appending claims.

I claim:

1. A first and second circuit breaker unit for protecting a circuit having first and second phase circuits; each of said first and second circuit breaker units comprising a first and second pole, each having separable contacts and a trip means; a first integrally contained common trip mechanism interconnecting the trip means of the first and second poles of said first circuit breaker unit, and a second integrally contained common trip mechanism interconnecting the trip means of the first and second poles of said second circuit breaker unit; said first integrally contained common trip mechanism providing substantially simultaneous disengagement of said separable contacts of said first and second poles of said first circuit breaker unit, responsive to operation of either of said poles, and said second integrally contained common trip mechanism providing substantially simultaneous disengagement of said separable contacts of said first and second poles of said second circuit breaker unit responsive to operation of either of said poles; said first pole of said first circuit breaker unit being connected in parallel with said first pole of said second circuit breaker unit within said first phase circuit; said second pole of said first circuit breaker unit being connected in parallel with said second pole of said second circuit breaker unit within said second phase circuit.

2. A first and second circuit breaker unit for protecting a circuit having first and second phase circuits; each of said first and second circuit breaker units comprising a first and second pole, each having separable contacts and a trip means; a first integrally contained common trip mechanism interconnecting the trip means of the first and second poles of said first circuit breaker unit, and a second integrally contained common trip mechanism interconnecting the trip means of the first and second poles of said second circuit breaker unit; said first integrally contained common trip mechanism providing substantially simultaneous disengagement of said separable contacts of said first and second poles of said first circuit breaker unit, responsive to operation of either of said poles, and said second integrally contained common trip mechanism providing substantially simultaneous disengagement of said separable contacts of said first and second poles of said second circuit breaker unit responsive to operation of either of said poles; said first pole of said first circuit breaker unit being connected in parallel with said first pole of said second circuit breaker unit within said first phase circuit; said second pole of said first circuit breaker unit being connected in parallel with said second pole of said second circuit breaker unit within said second phase circuit; said electrical connections between said first poles of said first and second circuit breaker units and said second poles of said first and second circuit breaker units rendering said first and second circuit breaker units interlocked for operation of all poles responsive to operation of any one of any of said first or second poles.

3. A first and second circuit breaker unit for protecting a circuit having first and second phase circuits; each of said first and second circuit breaker units comprising a first and second pole, each having separable contacts and a trip means; a first integrally contained common trip mechanism interconnecting the trip means of the first and second poles of said first circuit breaker unit, and a second integrally contained common trip mechanism interconnecting the trip means of the first and second poles of said second circuit breaker unit; said first integrally contained common trip mechanism providing substantially simultaneous disengagement of said separable contacts of said first and second poles of said first circuit breaker unit, responsive to operation of either of said poles, and said second integrally contained common trip mechanism providing substantially simultaneous disengagement of said separable contacts of said first and second poles of said second circuit breaker unit responsive to operation of either of said poles; said first pole of said first circuit breaker unit being connected in parallel with said first pole of said second circuit breaker unit within said first phase circuit; said second pole of said first circuit breaker unit being connected in parallel with said second pole of said second circuit breaker unit within said second phase circuit; said circuit being protected having a current rating up to twice the current rating of any of said first or second poles.

4. In combination; a multiphase circuit and a first and second multiphase circuit breaker; each of said multiphase circuit breakers including a plurality of individual pole units, and an integrally contained common trip mechanism interconnecting all of the individual pole units thereof; each phase of said multiphase circuit being connected through a parallel circuit arrangement of at least one pole unit of each of said first and second multiphase circuit breakers.

5. In combination; a multiphase circuit and a first and second multiphase circuit breaker; each of said multiphase circuit breakers including a plurality of individual pole units, and an integrally contained common trip mech-

anism interconnecting all of the individual pole units thereof; each phase of said multiphase circuit being capable of carrying a current in excess of the current rating of any of the poles of either of said first or second multiphase circuit interrupters; each phase of said multiphase circuit being connected through a parallel circuit arrangement of at least one pole unit of each of said first and second multiphase circuit breakers.

6. In combination; a multiphase circuit and a first and second multiphase circuit breaker; each of said multiphase circuit breakers including a plurality of individual pole units, and an integrally contained common trip mechanism interconnecting all of the individual pole units thereof; each phase of said multiphase circuit being capable of carrying a current in excess of the current rating of any of the poles of either of said first or second multiphase circuit interrupters; each phase of said multiphase circuit being connected through a parallel circuit arrangement of at least one pole unit of each of said first and second multiphase circuit breakers whereby said first and second multiphase circuit breakers are interlocked with one another for simultaneous operation responsive to a fault in any phase of said multiphase circuit.

7. In combination, a two phase circuit and a first and second circuit breaker each having two poles, with an individual trip means for each of said poles and a common trip means for simultaneous operation of the two poles of the respective circuit breaker; the first pole of said first circuit breaker being connected in parallel with the first pole of said second circuit breaker; the second pole of said first circuit breaker being connected in parallel with the second pole of said second circuit breaker; said first and second poles of each of one phase of said two phase circuit being connected in series with said parallel connected first poles; the other phase of said two phase circuit being connected in series with said parallel connected second poles.

8. A circuit arrangement for imparting common trip characteristics to a first and second multiphase circuit breaker unit; each of said first and second multiphase circuit breakers having a plurality of poles, with an individual trip means for each of said poles, and internal common trip mechanism for simultaneous operation of all the poles of the respective circuit breaker unit responsive to tripping of any of its said poles; a first pole of said first circuit breaker unit being electrically connected in parallel with a first pole of said second circuit breaker unit; a second pole of said first circuit breaker unit being electrically connected in parallel with a second pole of said second circuit breaker unit; means connecting said first poles of said first and second circuit breaker units in series with a first electrical circuit; means connecting said second poles of said first and second circuit breaker units in series with a second electrical circuit; each of said first and second poles being automatically operated responsive to predetermined conditions in their respective first or second electrical circuits to completely operate each of said first and second poles of each of said first and second circuit breaker units.

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