Feb. 2, 1954 W. H. EDMUNDS 2,668,206

ASSEMBLY OF TWO AND THREE POLE CIRCUIT BREAKERS

Filed Nov. 28, 1951 5 Sheets-Sheet 1

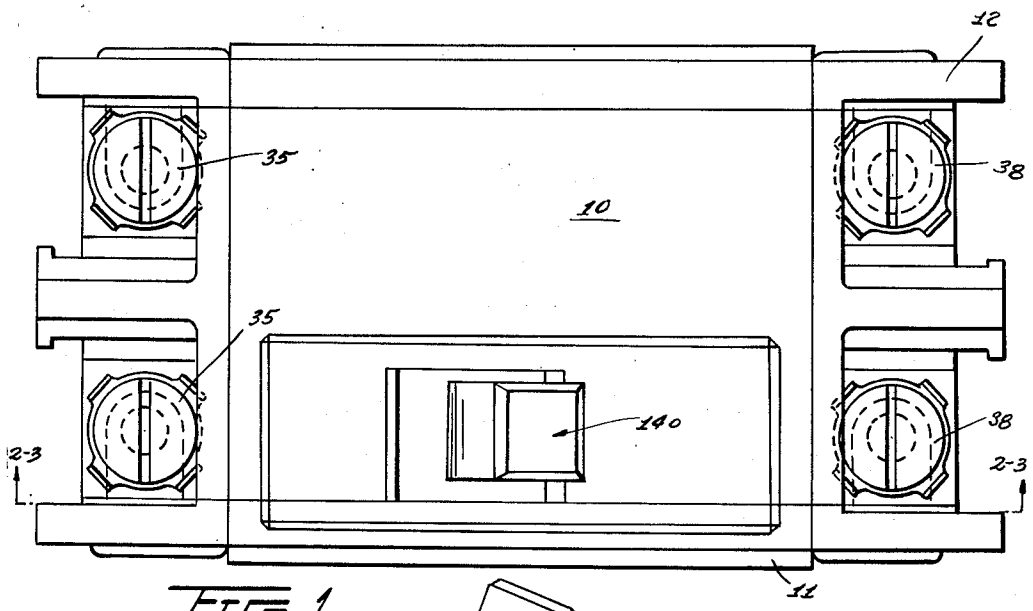


FIG. 1.

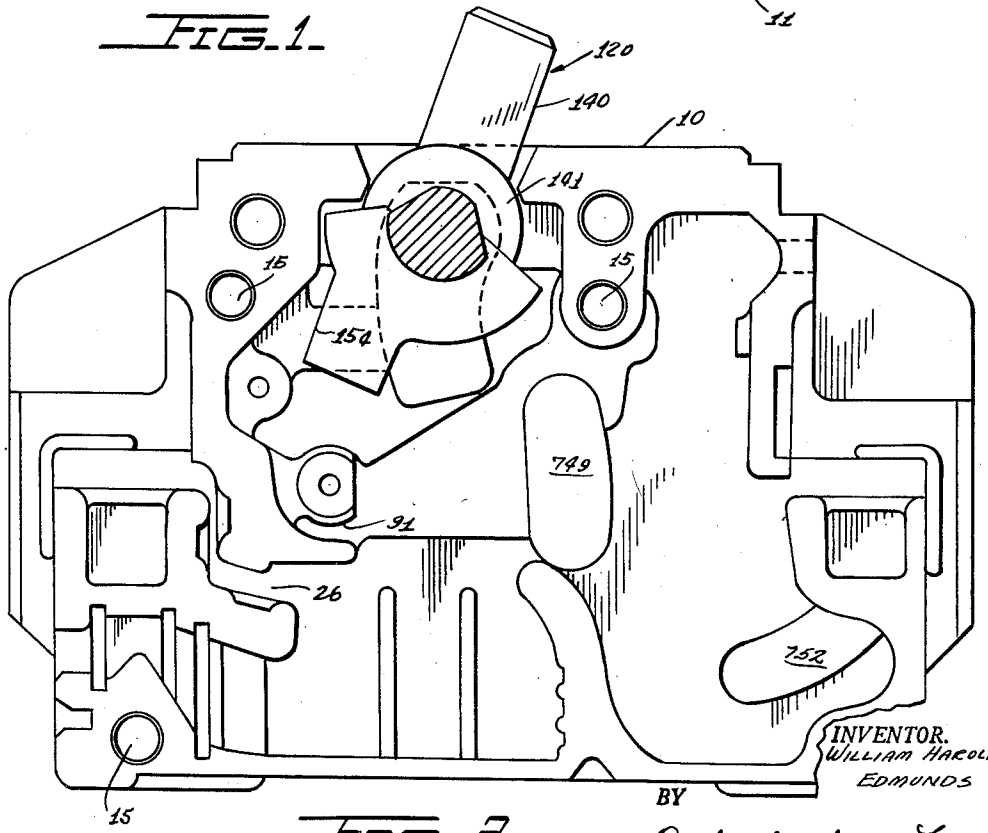


FIG. 2.

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ASSEMBLY OF TWO AND THREE POLE CIRCUIT BREAKERS

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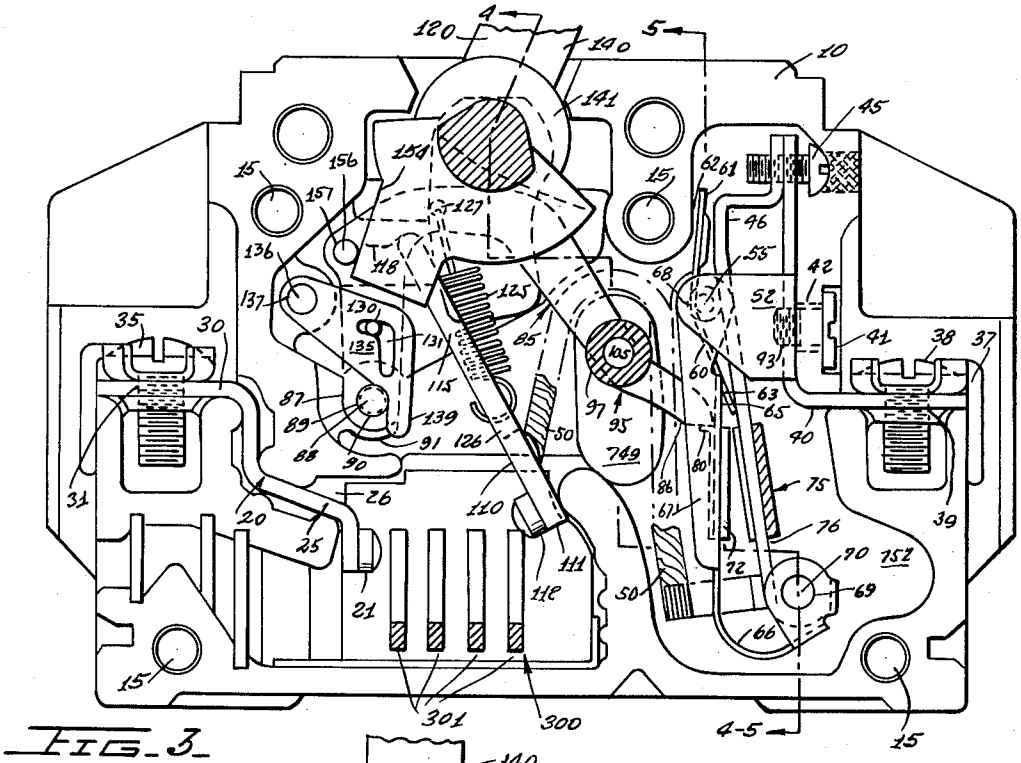


FIG. 3

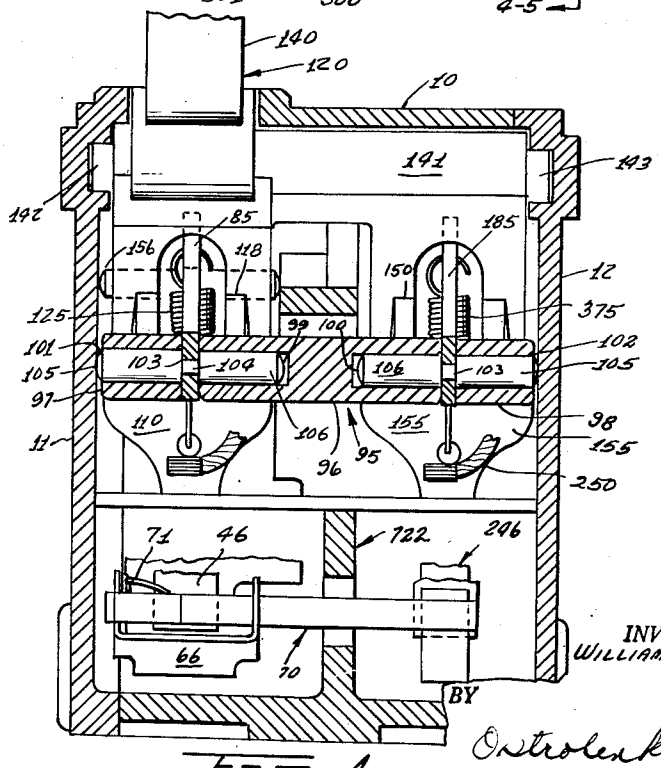


FIG. 4

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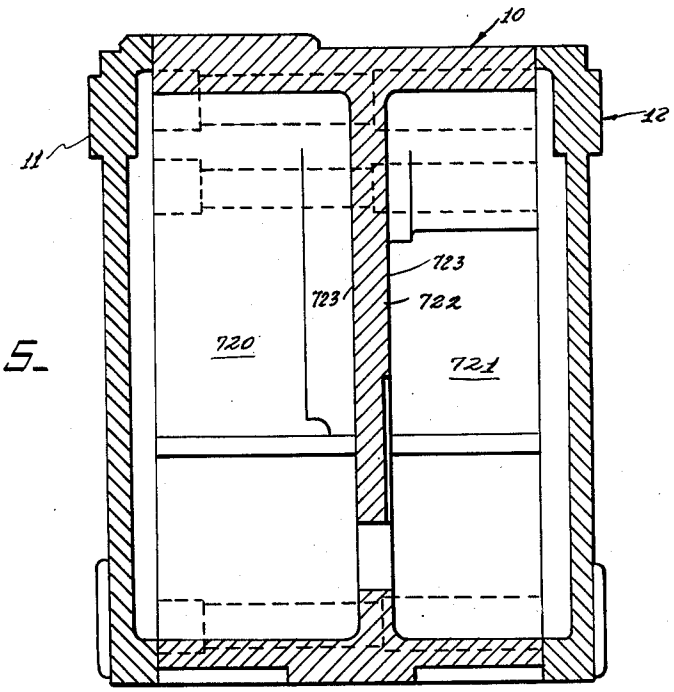
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ASSEMBLY OF TWO AND THREE POLE CIRCUIT BREAKERS

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FIG. 5.



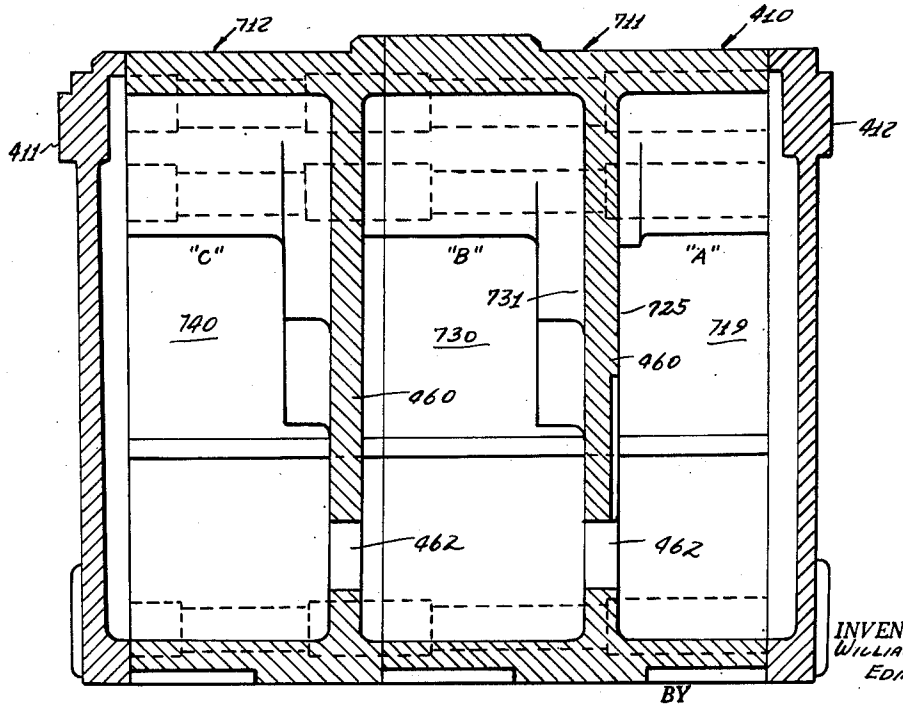


FIG. 7.

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ASSEMBLY OF TWO AND THREE POLE CIRCUIT BREAKERS

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FIG. 6.

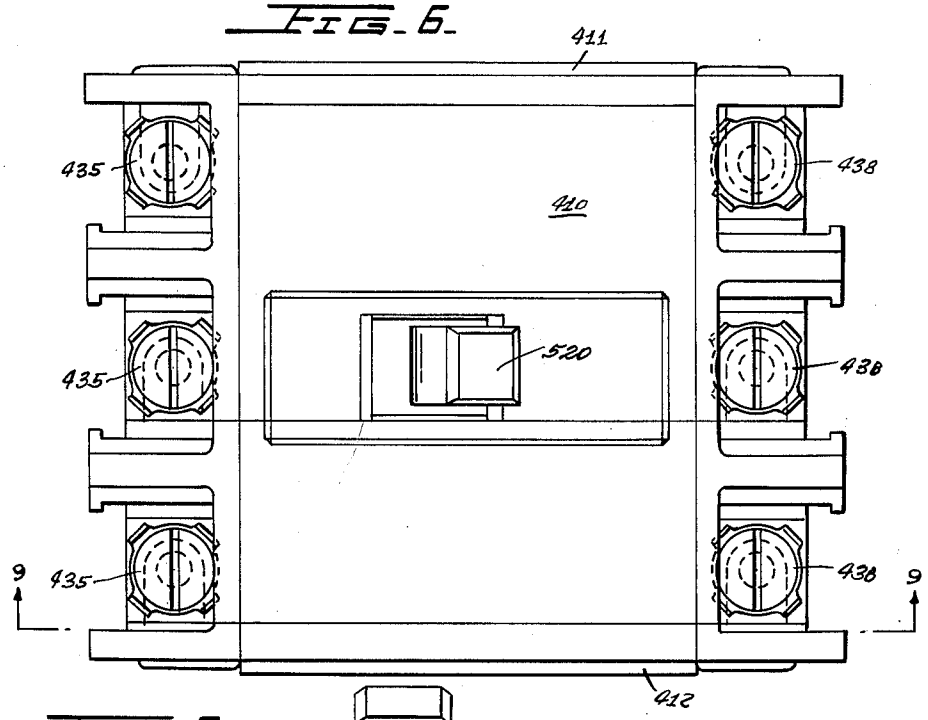
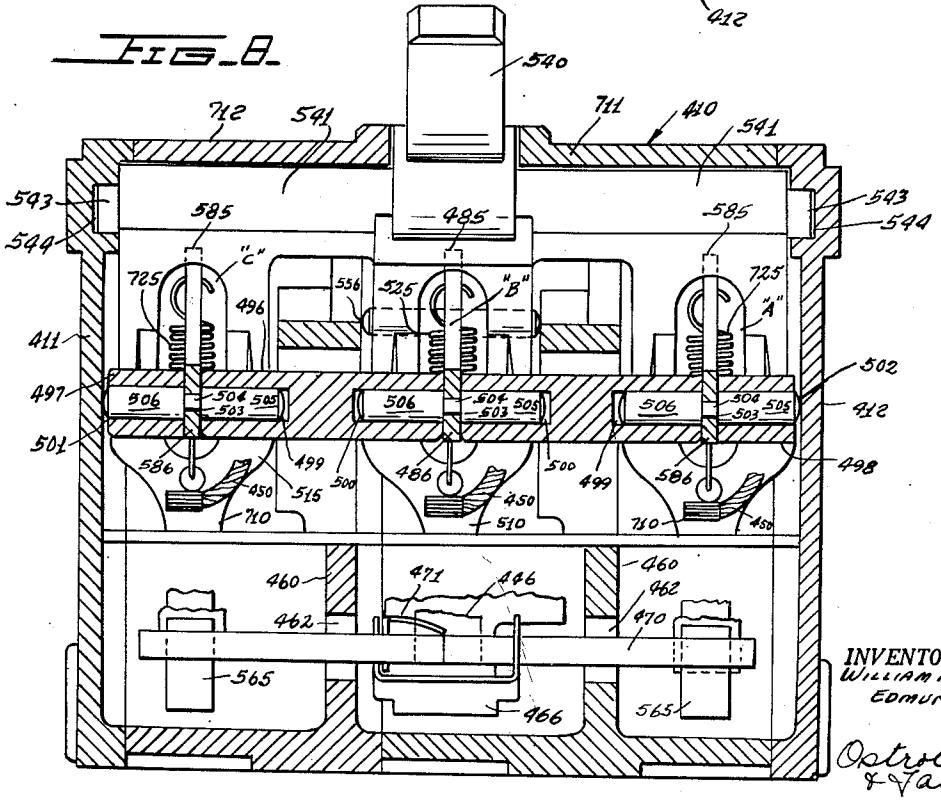


FIG. 8.



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ASSEMBLY OF TWO AND THREE POLE CIRCUIT BREAKERS

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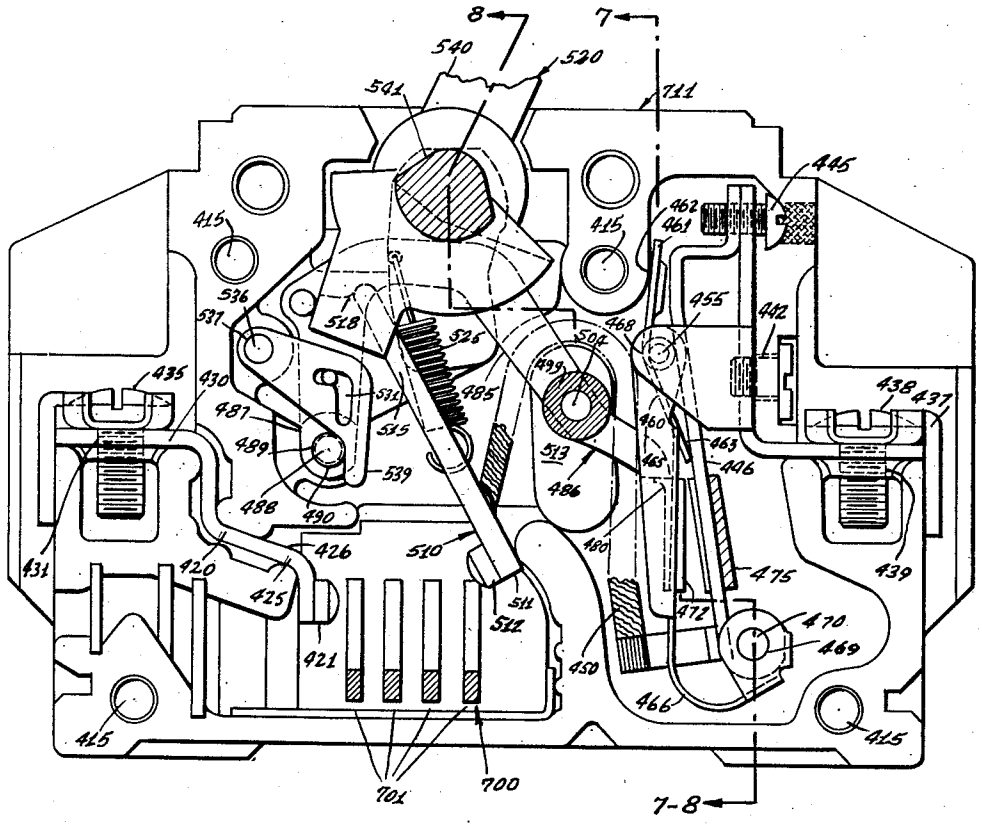


Fig. 9

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2,668,206

ASSEMBLY OF TWO AND THREE POLE CIRCUIT BREAKERS

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Application November 28, 1951, Serial No. 258,615

13 Claims. (Cl. 200—88)

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My present invention relates to multi-pole circuit breakers principally for lighting circuits and more particularly it relates to a method of assembly of this type of circuit breaker.

Circuit breakers used principally for lighting circuits instead of fuses must satisfy two very important requirements, namely, they have to be small and they have to be inexpensive.

Small circuit breakers having two or three poles have been described in applications Serial Nos. 241,013, filed August 9, 1951, and 254,065, filed October 31, 1951.

This type of small circuit breaker could be made quite inexpensively if the labor necessary to assemble them could be reduced to a minimum.

In previous methods of assembling these types of circuit breakers, all the parts of the multi-pole circuit breaker were introduced in the housing of the circuit breaker from the front of the circuit breaker and were fixed in their positions by means of screws, nuts and bolts or rivets.

It is evident that in this type of assembly great care must be exercised that all parts occupy exactly their correct position. More labor was involved in that the assembler had to secure these parts to the housing.

It is further evident that different housings would be needed for single pole circuit breakers, for two-pole circuit breakers and for three-pole circuit breakers.

My invention overcomes this difficulty by using a different system of assembly, a system commonly known as pancake assembly. Pancake assembly means that all parts of the circuit breaker instead of being mounted or introduced in the housing from the front are instead introduced in the housing from one side. The pancake arrangement permits building each pole separately and adding the necessary tie links between the poles to make a common trip and operating breaker as the assembly progression continues.

A two-pole breaker, for example, would be made of a single housing with one operating handle, one cover plate on each side of the housing, and the housing would be a moulding with openings on the opposite side covered by the cover plates and divided into two circuit breakers by a central wall.

A three-pole circuit breaker instead could be made by connecting together the above-described two-pole breaker with a single pole circuit breaker moulding. Since each moulding permits side assembly of each pole, the pole mechanism and

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the other current carrying parts are completely assembled as a unit.

The base or mounting mouldings have openings for common operating parts including the handle, cradle tie members and common tripper bar.

The two-pole breaker can be assembled in a panelboard or load center in the same space as two single pole breakers while the three-pole breakers will occupy the same space as three single pole breakers.

One of the cover plates used on the two- and three-pole breakers is exactly the same, thus permitting considerable versatility.

The mouldings for the two- and three-pole circuit breakers can be so shaped that every part of the circuit breaker can be slid into its place without any need for fixing it to the circuit breaker housing except for a few parts.

It is thus seen that cover plates in this type of circuit breaker will have two functions, that of protecting the circuit breaker equipment and that of securing each part of the circuit breaker in its correct position.

It is evident that since the assembler of this type of circuit breaker only has to slide the necessary parts in their proper places, the amount of labor required for assembling this type of circuit breaker is considerably less than in previous types, thus making it possible to manufacture circuit breakers at a substantially lower cost.

The main object of my present invention is, therefore, a method for easily assembling multi-pole circuit breakers from the side instead of from the front.

Another object of my present invention is the provision of means whereby all parts of a multi-pole circuit breaker can be slid into appropriately shaped openings of a circuit breaker moulding.

A further object of my present invention is a method of assembling multi-pole circuit breakers that permits building each pole of the multi-pole circuit breaker separately and adding the necessary tie links between the poles to make a common trip and operating breaker.

The foregoing and many other objects of my invention will become apparent in the following description and drawings in which:

Figure 1 is a front view of a two-pole circuit breaker incorporating my present invention.

Figure 2 is a cross-sectional view taken on line 2—2 of Figure 1 looking in the direction of the arrows showing only the moulding ready to receive the parts of the circuit breaker.

Figure 3 is a cross-sectional view of the circuit

breaker of Figure 1 taken on line 3—3 of Figure 1 looking in the direction of the arrows showing the circuit breaker moulding with all circuit breaker parts in place.

Figure 4 is a cross-sectional view taken on line 4—4 of Figure 3 looking in the direction of the arrows showing the moulding and the circuit breaker parts.

Figure 5 is a cross-sectional view taken on line 5—5 of Figure 3 looking in the direction of the arrows showing only the moulding ready to receive the parts of the two-pole circuit breaker.

Figure 6 is a front view of a three-pole circuit breaker incorporating my present invention.

Figure 7 is a cross-sectional view taken on line 7—7 of Figure 9 looking in the direction of the arrows showing only the moulding ready to receive the parts of the three-pole circuit breaker.

Figure 8 is another cross-sectional view taken on line 8—8 of Figure 9 looking in the direction of the arrows showing the circuit breaker moulding with all circuit breaker parts in place.

Figure 9 is a cross-sectional view taken on line 9—9 of Figure 6 looking in the direction of the arrows showing the circuit breaker moulding with all circuit breaker parts in place.

Referring now to Figures 1 and 2 showing, respectively, the front of a two-pole circuit breaker and the base molding of a two-pole circuit breaker ready to receive the parts of the circuit breaker, a base 10, usually a plastic molding, is so shaped that practically all the components of the circuit breaker can be easily slipped in place and can be secured thereby the application of cover plates 11 and 12 without using any other securing means such as screws, bolts, nuts, etc., the cover plates 11 and 12 being secured to housing 10 by means of rivets or other means engaging openings 15 of housing 10.

Referring now to Figures 4 and 5, it is there seen that a two-pole circuit breaker molding has two recesses, a relatively larger recess 720 and a smaller recess 721. These two recesses 720 and 721 are divided by a plastic separating wall 722 which is an integral part of molding 10.

Recess 720 shown more clearly in Figure 5 houses all the component parts of one pole of the two-pole circuit breaker while recess 721 houses all the component parts of the second pole of the two-pole circuit breaker as shown in application Serial No. 254,065, filed October 31, 1951.

Plastic surfaces 723 on the two sides of wall 722 have the configuration shown in Figure 2 so that all the component parts of one pole of this circuit breaker can be slipped into place at the beginning of the assembly operation.

Referring in fact to Figures 2 and 3 showing the molding 10 with and without the component parts of the two-pole circuit breaker, stationary contact assembly 20 consists of a contact button 21, welded or in any other appropriate way secured to the bent end of a conducting member 25. Member 25 with contact button 21 is slidably mounted in an appropriately shaped recess 26 of molding 10, that is, member 25 can be slid in place in housing 10 when cover plate 11 is removed. The other end 30 of conducting member 25 has a central opening 31 threaded inside and engageable by a screw 35. One wire of one phase of the circuit (not shown) can be secured to the circuit breaker by means of screw 35 and extension 30 of contact member 25. The other wire of the same phase is secured to the circuit breaker at terminal 37. Terminal 37 consists of a screw 38 engaging an opening 39 in an angularly shaped contact member 40.

Contact member 40 of rectangular cross-section is secured to housing 10 by means of a screw 41 engaging through an appropriate opening 42 of housing 10 a threaded opening 43 in contact member 40. The other end of contact member 40 is provided with a screw 45 which engages member 46 at one end of thermally responsive member 46. The other end of thermally responsive member 46 is connected by any appropriate means, for example, soldering to a flexible conductor or pigtail 50.

A support 52, an integral part of contact member 40, consists of two extensions 53 and 54, one on each side of thermally responsive member 46. Both supports 53 and 54 extend beyond thermally responsive member 46 and carry at their farthest end a pin 55. A coil spring 60 around pin 55 has one end 61 against a protruding portion 62 of housing 10 and its other end 63 biases a latch carrying member 65.

Latch carrying member 65 consists of a thin metallic leaf 66 approximately U-shaped having at one end extending arms 67 with openings 68 which are engaged by pin 55 so that member 65 can rotate around pin 55. The other end of member 65 is bent and has a U-shaped portion with aligned openings 69 carrying tripper bar 70. Tripper bar 70 is held in place by a bent finger 71 cut from the metallic leaf 66.

Tripper bar 70 is an insulated bar common to the two phases of the circuit breaker; that is, tripper bar 70 extends from the phase of the circuit breaker now under consideration to the second phase of the same circuit breaker as hereinafter described.

Trip lever 65 is further provided with an armature 72 which is secured to a trip lever 65 by any suitable means, for example, a rivet. Armature 72 is the movable part of the fault current responsive magnet 75 which consists of a rectangular piece of metal with a central recess 76 to receive thermally responsive member 46 to which it is also secured by means of a rivet. The same rivet that secures armature 72 to trip lever 65 can be used to secure latch 80 to trip lever 65.

Thermally responsive member 46 and magnet 75, as is quite evident, are designed to operate at different values of fault currents. For example, when a fault current is relatively small, the thermally responsive member 46 will operate to open the circuit breaker as hereinafter described. If, on the other hand, the fault current is relatively high, magnet 75 will come into operation before thermally responsive member 46 and open the circuit breaker. This is important in that by this means thermally responsive member 46 is protected against very heavy currents which could permanently distort and damage bimetallic member 46 and also affords instantaneous trip operation.

Latch 80 carried by trip lever 65 engages a hook-shaped cradle 85 and more precisely latch 80 engages one end 86 of cradle 85. Cradle 85 is pivoted at the other end 87 by means of a pin 88 engaging an opening 89 in cradle 85 and an aligned opening 90 in a boss 91 of molding 10.

Cradle 85 of the first phase moves together with cradle 185 of the second phase since the two cradles 85 and 185 are connected together by an insulating tie bar 95. Tie bar 95 actually con-

sists of a center insulating sleeve 96 and two lateral insulating sleeves 97 and 98. Central sleeve 96, cylindrical in shape, has two recesses 99 and 100, one at each end of cylinder 96. Lateral sleeves 97 and 98 instead have an axial or longitudinal opening 101 and 102, respectively.

Cradles 85 and 185 both have an open 103. Each opening 103 is engaged by the cylindrical extension 104 of a cylindrical pin 105. A metallic hollow cylinder 106 is slid on the extension 104 and riveted there. Thus, cradles 85 and 185 are clamped to pins 105 and will move with pins 105. Sleeves 97 and 98 are placed around pins 105, while sleeve 96 is placed around the hollow cylinders 106, thus completely insulating one phase from the other and making at the same time a mechanism strong enough to resist damage produced by repeated opening or closing operations.

It is quite evident that since the function of extension 104 of pin 105 is only that of moving cradles 85 and 185 together and since covers 11 and 12 are here used to keep the slidably mounted parts in their places, it is not really necessary to rivet hollow cylinder 106 to pin 105 and thus clamp cradle 85 or 185 since the same effect can be had if these parts were all slidable with respect to each other.

Pigtail 50 connected on one side to thermally responsive member 46 is connected on the other side to movable contact arm 110. Movable contact arm 110 is approximately U-shaped or is shaped like a tuning fork, the lowest part 111 of movable contact member 110 carrying an electrical contact 112. The two extensions 115 of contact arm 110 can rotate in groove 118 of handle molding 120. An over center tension spring 125 is connected on one side to movable contact arm 110 through an opening 126 in contact arm 110 and on the other side to cradle 85 through an opening 127 in cradle 85. Cradle 85 is further provided with a pin 130 which engages a slot 131 of a contact kicking member 135. Contact kicking member 135 is pivoted around pin 136 which engages an opening 137 in contact kicking member 135 and an aligned opening, not shown, in molding 10. Contact kicking member 135 is provided with an extension 139 at the end of the contact kicking member 135 opposite that at which it is pivoted.

The function of the contact kicking member 135 is to assist the initial opening operation caused by a fault current; more specifically, it provides a means for kicking the movable contact away from the complementary contact when the spring has been moved over center during automatic opening. In other words, kicker 135 prevents contact 112 from sticking to the stationary contact 21 at fault currents, thus preventing welding of the contacts.

Manual operating handle molding 120 operates simultaneously both contacts of the two phase circuit breaker under consideration. It has, therefore, a single handle 140 with an integral axially extending member 141. This axial member 141 has two pivots 142 and 143, one on each side of axial member 141, both integral parts of molding 120. Axial member 141 has two pairs of fulcri 118 and 150 of which, as previously explained, fulcrum 118 is for movable contact member 110, while fulcrum 150 is for movable contact member 155 of the second phase of the two-phase circuit breaker under consideration. Molding 120 is also provided with two extensions 154, one on each side of fulcrum 118 operable to engage a reset pin 156 carried by cradle 85 in an appropriate opening 157 located between pin 130 and spring opening 127 in cradle 85.

Referring now to Figures 3 and 4, it is there seen that the two phases use practically the same parts except in their common operating mechanisms for both automatic and manual operation.

To be more specific, the second phase fault current responsive means consists of a thermally responsive member 246. The free end of thermally responsive member 246 is connected to pigtail or flexible conductor 250. Thermally responsive member 246 further carries rigidly secured to it an approximately U-shaped metallic member (not shown). The U-shaped metallic member constitutes the magnet for the magnetic fault current responsive means when current flows through thermally responsive member 246.

A leaf spring (not shown) is riveted to one end of thermally responsive member 246. This leaf spring extends beyond the free end of thermally responsive member 246 and to the other side of thermally responsive member 246. Leaf spring 265 also carries the armature, not shown, for the magnet.

As it is evident from this description, no latch is provided for this second section phase, that is, only the first phase or the phase which has the manual operating means is provided with a latch 80 for latching cradle 85.

When a fault occurs in the second phase, either thermally responsive member 246 or its magnet will operate and will engage and move tripper bar 70 in such a direction as to unlatch cradle 85 from latch 80 of the first phase, but since cradle 185 of the second phase moves together with cradle 85 of the first phase as previously described, cradle 185 will rotate together with cradle 85 around its pivot pin, not shown.

This movement of cradle 185 will carry spring 375 of the second phase over center with respect to movable contact arm 155, thus opening the electrical contacts between the movable contact and stationary contact not shown.

The second phase is also provided with a contact kicking assembly (not shown) which operates in the same manner as kicking assembly 135 of the first phase.

Each phase is further provided with an arc extinguishing chamber 300 having a plurality of conducting arc extinguishing plates 301. One of the two chambers 300 is located between the stationary contact 21 and movable contact 112, while the other chamber 300 of the second phase is located between the corresponding contacts of the second phase. As above-mentioned, all the other parts of this second phase are the same as those used in the first phase.

Recess 721 of the same molding 10 houses all the component parts of the other pole of the two-pole circuit breaker under consideration as shown in application Serial No. 254,065, filed October 31, 1951, and the assembly operation will then be performed first by placing molding 10 on its side and mounting all the component parts in recess 720 which also has the configuration shown in Figure 2.

All parts corresponding to this pole of the two-pole circuit breaker are slid into place into the appropriate openings as shown in Figure 2.

When all the component parts of this phase of the two-pole circuit breaker are mounted in the recess 720, cover plate 11 is placed over recess 720. After this, the molding 10 is reversed and the component parts of the other phase of

the two-pole circuit breaker are mounted in recess 721.

As previously mentioned, the component parts mounted in recess 720 are slightly different from those used in recess 721 in that the operating mechanisms (handle 140 and latch 80, see Figure 3) are housed in recess 720. A tie bar 95 is slid through opening 746 in center wall 722 to secure together the two cradles 85 and 185 of the two-pole circuit breaker. The common tripper bar 70 is also slid through a second opening 752 in separating wall 722 so that the operation of any one of the two thermally responsive elements 46, 246 or magnets 75 (shown for only one phase) will cause both poles to trip open.

After having placed all the component parts in recess 721 of housing 10, as shown in Figure 3, the second cover plate 12 is placed on recess 721 and appropriate rivets are then slid through holes in the two cover plates 11 and 12 and appropriate holes in housing 10 so that the cover plates 11 and 12 are rigidly secured to housing 10, and all the component parts of the two-pole circuit breaker are secured in their respective positions by the two cover plates 11 and 12.

Referring now to Figures 6, 7, 8 and 9 showing the front, a section of the housing and two sections of a three-pole circuit breaker incorporating my invention, it is seen that housing 410 of the three-pole circuit breaker actually consists of a housing 711 for a two-pole circuit breaker and a housing 712 for a single pole circuit breaker mounted side by side. Cover plates 411 and 412 are secured to housings 410 and 712 to keep all the component parts in place.

All the component parts for each of the three phases are the same as those described for the two-pole circuit breaker except for the elements common to all three poles.

In fact, handle molding 520 consists of a handle 540 and in a direction perpendicular to said handle 540 two extensions 541 similarly shaped, one on each side of handle 540. At the ends of these extensions 541 are two cylindrical extensions 543 which by engaging appropriate openings 544 of cover plates 411 and 412 make possible the rotational movement of molding 520 around cylindrical extensions 543. Members 541 actually constitute a single piece having three pairs of grooves 518 in which arms 515 of movable contact arms 510 can rotate.

The central phase in the three-pole circuit breaker corresponds to the first phase of the two-pole circuit breaker above described in that it is the only phase provided with a latch 480 for its cradle 485. This center phase instead of having a leaf spring has, similarly to the first phase of the two-pole circuit breaker, a metallic leaf member 465 (corresponding to member 65 of Figure 4) which at its end 466 carries the tripper bar 470.

Tripper bar 470 can be operated by the center phase now under consideration by means of the thermally responsive means 446 or should the fault current be very high by means of a magnet 475 secured to thermally responsive member 446 and an armature 476 secured to leaf member 466.

Here tripper bar 470 extends through opening 462 in phase separating walls 460 of moldings 711 and 712 into the two lateral phases. Tripper bar 470 extends sufficiently so that any one of the two leaf springs 565 operated by thermally responsive members (not shown) similar to members 246 or magnets (not shown) will engage tripper bar 470 and unlatch the central phase latch 480 from engagement with the central cradle 485.

Central cradle 485 now free from engagement with latch 480 will rotate around its pivot (not shown). Rotation of central cradle 485 around the pivot will produce similar rotations in the other two cradles 585 since all cradles are connected for simultaneous movement by tie bar 495.

Tie bar 495 extending through openings 513 of phase separating walls 460 into the other two phases, actually consists of two center insulating sleeves 496 and two lateral insulating sleeves 497 and 498. Central sleeves 496, cylindrical in shape, have two recesses 499 and 500 one on each end of insulating cylinder 496. Lateral sleeves 497 and 498 instead have axial or longitudinal openings 501 and 502, respectively.

Cradles 485 and 585 all have an opening 503 near the ends 486 and 586, respectively. Each opening 503 is engaged by a cylindrical extension 504 of a cylindrical pin 505 and a metallic hollow cylinder 506 is then slid on the extension 504 and riveted there.

Thus, cradles 485 and 585 are clamped to these pins 505 and will move with pins 505. Sleeves 497 and 498 are placed around pins 505, while sleeves 499 are placed around the hollow cylinder 506, thus completely insulating one phase from the others and making at the same time a mechanism strong enough to resist damage produced by repeated opening or closing operations. Sleeves 497 and 498 and pins 505 are kept in place by the two cover plates 411 and 412, one on each side of the three-pole circuit breaker.

As above mentioned, rotation of central cradle 485 produces through the bar 495, similar rotations in the other two cradles 585.

Rotation of cradles 485 and 585 brings the springs 525 and 725, respectively, over center with respect to the movable contact arms 510 and 710, respectively, thus opening the contacts of the center phase and also the contacts (not shown) of the other two phases simultaneously.

The assembly process is made in the following steps: First, all the component parts forming phase A of the three-pole circuit breaker are slipped in their respective positions in recess 719. Surface 725 of housing 410 has the configuration shown in Figure 2 to permit the operator to slide practically all the component parts in their appropriate positions without any need for securing these parts with screws, bolts and nuts, etc.

After all the component parts have been slid in place in recess 719, a cover plate 412 is placed on recess 719 to close recess 719. The two-pole section 711 of housing 410 is then reversed and the component parts of phase B are then slid in place in their correct positions in recess 730. This section 730 of housing 711 is also provided with a surface 731 having the configuration shown in Fig. 2 so that all the component parts of phase B can be easily slid in place and positioned there with practically no need for securing means.

Section 712 of the single pole circuit breaker is then mounted on recess 730 to close recess 730.

When housing section 712 is mounted on housing section 711, it may already have the component parts of phase C mounted in its recess 740 and secured thereto by means of another cover plate 411.

The three phases are thus seen to be separated by two walls 460, all provided with appropriate openings so that tie bar 495 and tripper bar 470 common to all three phases can be positioned in housing 410.

As shown in the previously mentioned application Serial No. 254,065, filed October 31, 1951, the center phase B is provided also with a manual operating mechanism 520 and a latch similar to latch 38 shown in Figure 3 for the two-pole circuit breaker. Actually, the center phase B of the three-pole circuit breaker has all the component parts shown in Figure 3 for the two-pole circuit breaker.

After placing the cover plates 411 and 412 on housings 711 and 712, thus forming the complete housing 410, rivets are passed through appropriate openings in cover plates 411 and 412 and housing 410, thus securing cover plates 411 and 412 to housing 410.

To summarize the above, in the case of the two-pole circuit breaker, first all the component parts of the principal phase are mounted in recess 720; then cover plate 11 is placed over recess 720. After this, the molding 10 is reversed and the component parts of the second phase of the two-pole circuit breaker are mounted in recess 721. Finally, the second cover plate 11 is secured to housing 10, thus completing the two-pole circuit breaker.

In the case of the three-pole circuit breaker, since the housing 410 of the three-pole circuit breaker is actually formed by the superposition of housing 711 of the two-pole circuit breaker and housing 712 of the single pole circuit breaker, all the component parts for the single pole circuit breaker are mounted in housing 712. The interconnecting links consisting of the tie bar 495 and tripper bar 470 are then placed in their positions extending from one cover plate 411 to the other cover plate 412. Cover plates 411 and 412 are then placed over recess 719 of housing 711 and the other over recess 740 of housing 712.

In the foregoing I have described my invention solely in connection with specific illustrative embodiments thereof. Since many variations and modifications of my invention will now be obvious to those skilled in the art, I prefer to be bound not by the specific disclosures herein contained but only by the appended claims.

I claim:

1. In a multi-pole circuit breaker, a plurality of fixed contacts, a plurality of movable contact arms carrying movable contacts, said arms having a circuit closed position in which their movable contacts engage said fixed contacts and a circuit open position in which said contacts are disengaged, a plurality of U-shaped cradles, one of said cradles having one end latched and pivotally mounted at its opposite end, the remaining cradles being only pivotally mounted at one end, a tie bar, said tie bar rigidly connecting said cradles for simultaneous motion, a plurality of springs, one end of said springs being secured to said movable arms and the opposite end of said springs being secured to said cradles at the apex of the U-shaped cradles, a pivotally mounted operating handle having a manually operable end on one side of the pivot mounting and having a plurality of notches on the opposite end of the pivot mounting, said movable contact arms being pivotally mounted in said notches and extending substantially in the longitudinal direction of said handle, with said movable contacts on the end opposite the pivotal mounting of said arms, the notches in said handle being on one side of said spring when said handle is in closed position so that said springs apply a closing force on said arms for operating said arms to circuit closed position, and the notches on said handle being on the opposite side of said springs when said handle is in open position so that said springs apply an opening force on said arms for operating said arms to circuit open position, a plurality of fault current responsive means, one of said means having a latch for latching the said cradle, a tripper bar, said tripper bar being operable by said fault current responsive means, an insulating housing, said housing having a plurality of recesses, insulating walls separating said recesses, each of said poles being mounted on one of said recesses, aligned openings in said separating walls, said tie bar, said tripper bar and said longitudinal portion of said handle extending through said openings from one end to the other of said housing, means securing said cover plates at the said ends of said housing.

2. In a multi-pole circuit breaker, a plurality of fixed contacts, a plurality of movable contact arms carrying movable contacts, said arms having a circuit closed position in which their movable contacts engage said fixed contacts and a circuit open position in which said contacts are disengaged, a single insulating housing, said housing having a plurality of recesses, insulating walls separating said recesses, each of said sets of contacts being mounted on one of said recesses, aligned openings in said separating wall, cover plates, means securing said cover plates to said housing to close said recesses.

3. In a two-pole circuit breaker, a plurality of fixed contacts, a plurality of movable contact arms carrying movable contacts, said arms having a circuit closed position in which their movable contacts engage said fixed contacts and a circuit open position in which said contacts are disengaged, a plurality of U-shaped cradles, one of said cradles having one end latched and pivotally mounted at its opposite end, the remaining cradles being only pivotally mounted at one end, a tie bar, said tie bar rigidly connecting said cradles for simultaneous motion, a plurality of springs, one end of said springs being secured to said movable arms and the opposite end of said springs being secured to said cradles at the apex of the U-shaped cradles, a pivotally mounted operating handle having a manually operable end on one side of the pivot mounting and having a plurality of notches on the opposite end of the pivot mounting, said movable contact arms being pivotally mounted in said notches and extending substantially in the longitudinal direction of said handle, with said movable contacts on the end opposite the pivotal mounting of said arms, the notches in said handle being on one side of said spring when said handle is in closed position so that said springs apply a closing force on said arms for operating said arms to circuit closed position, and the notches on said handle being on the opposite side of said springs when said handle is in open position so that said springs apply an opening force on said arms for operating said arms to circuit open position, a plurality of fault current responsive means, one of said means having a latch for latching the said cradle, a tripper bar, said tripper bar being operable by said fault current responsive means, an insulating housing, said housing having two recesses, an insulating wall separating the said two recesses, the said two poles being mounted in the said two recesses, said insulating wall having three openings, said tie bar extending through one of said openings from one end to the other of said housing, said tripper bar extending through the second of said openings from one end to the other

of said housing and said longitudinal extension of said handle extending through the third of said openings from one end to the other of said housing, cover plates, means securing said cover plates at the said ends of said housing.

4. In a two-pole circuit breaker, a plurality of fixed contacts, a plurality of movable contact arms carrying movable contacts, said arms having a circuit closed position in which their movable contacts engage said fixed contacts and a circuit open position in which said contacts are disengaged, a handle for manually operating said contact arms, a single insulating housing, said housing having two recesses, an insulating wall separating the said two recesses, the said two poles being mounted in the said two recesses, said insulating wall having a plurality of openings, said tie bar, said tripper bar and said handle extending through said openings from one end to the other of said housing, cover plates, means securing said cover plates at the said ends of said housing.

5. In a three-pole circuit breaker, a plurality of fixed contacts, a plurality of movable contact arms carrying movable contacts, said arms having a circuit closed position in which their movable contacts engage said fixed contacts and a circuit open position in which said contacts are disengaged, a plurality of U-shaped cradles, one of said cradles having one end latched and pivotally mounted at its opposite end, the remaining cradles being only pivotally mounted at one end, a tie bar, said tie bar rigidly connecting said cradles for simultaneous motion, a plurality of springs, one end of said springs being secured to said movable arms and the opposite end of said springs being secured to said cradles at the apex of the U-shaped cradles, a pivotally mounted operating handle having a manually operable end on one side of the pivot mounting and having a plurality of notches on the opposite end of the pivot mounting, said movable contact arms being pivotally mounted in said notches and extending substantially in the longitudinal direction of said handle, with said movable contacts on the end opposite the pivotal mounting of said arms, the notches in said handle being on one side of said spring when said handle is in closed position so that said springs apply a closing force on said arms for operating said arms to circuit closed position, and the notches on said handle being on the opposite side of said springs when said handle is in open position so that said springs apply an opening force on said arms for operating said arms to circuit open position, a plurality of fault current responsive means, one of said means having a latch for latching the said cradle, a tripper bar, said tripper bar being operable by said fault current responsive means to unlatch said latched cradle under fault current conditions, an insulating housing, said housing comprising two sections, one of said sections having two recesses, two of said poles being mounted in said two recesses, the second of said sections having one recess, the third of said poles being mounted in said one recess, said sections being mounted side by side to form said housing, the wall of said one recess section and the insulating wall of the said two recess section having a plurality of sets of aligned openings, said tie bar extending through one set of said openings from one end to the other of said housing, said tripper bar extending through another set of said openings from one end to the other of said housing, said longitudinal extension of said handle extending through another set of said openings from one end to the other of said housing, cover plates, means securing said sections together and securing said cover plates at the said ends of said housing.

6. In a three-pole circuit breaker, a plurality of fixed contacts, a plurality of movable contact arms carrying movable contacts, said arms having a circuit closed position in which their movable contacts engage said fixed contacts and a circuit open position in which said contacts are disengaged, a handle for manually operating said contact arms, an insulating housing; said housing comprising two sections, one of asid sections having two recesses, an insulating wall separating the said two recesses, two of said poles being mounted in said two recesses, the second of said sections having one recess, the third of said poles being mounted in said one recess, said sections being mounted side by side to form said housing, the wall of said one recess section and the insulating wall of the said two recess section having a plurality of sets of aligned openings, said tie bar extending through one set of said openings from one end to the other of said housing, said tripper bar extending through another set of said openings from one end to the other of said housing, said handle extending through another set of said openings from one end to the other of said housing, cover plates, means securing said sections together and securing said cover plates at the said ends of said housing.

7. In a multi-pole circuit breaker, a plurality of fixed contacts, a plurality of movable contact arms carrying movable contacts, said arms having a circuit closed position in which their movable contacts engage said fixed contacts and a circuit open position in which said contacts are disengaged, a plurality of U-shaped cradles, one of said cradles having one end latched and pivotally mounted at its opposite end, the remaining cradles being only pivotally mounted at one end, a tie bar, said tie bar rigidly connecting said cradles for simultaneous motion, a plurality of springs, one end of said springs being secured to said movable arms and the opposite end of said springs being secured to said cradles at the apex of the U-shaped cradles, a pivotally mounted operating handle having a manually operable end on one side of the pivot mounting and having a plurality of notches on the opposite end of the pivot mounting, said movable contact arms being pivotally mounted in said notches and extending substantially in the longitudinal direction of said handle, with said movable contacts on the end opposite the pivotal mounting of said arms, the notches in said handle being on one side of said spring when said handle is in closed position so that said springs apply a closing force on said arms for operating said arms to circuit closed position, and the notches on said handle being on the opposite side of said springs when said handle is in open position so that said springs apply an opening force on said arms for operating said arms to circuit open position, a plurality of fault current responsive means, one of said means having a latch for latching the said cradle, a tripper bar, said tripper bar being operable by said fault current responsive means to unlatch said latched cradle under fault current conditions, an insulatnig housing, said housing comprising a plurality of sections, some of said sections having two recesses and some having one recess, each of said poles being mounted in one of said recesses, each of said sections being mounted side by side to form said housing, in-

sulating walls separating said recesses, sets of aligned openings in said separating walls, said tie bar extending through one set of said openings from one end to the other of said housing, said tripper bar extending through another set of said openings from one end to the other of said housing and said longitudinal extension of said handle extending through the third of said openings from one end to the other of said housing, cover plates, means securing said sections together and said cover plates at the said ends of said housing

8. In a multi-pole circuit breaker, a plurality of fixed contacts, a plurality of movable contact arms carrying movable contacts, said arms having a circuit closed position in which their movable contacts engage said fixed contacts and a circuit open position in which said contacts are disengaged, a plurality of U-shaped cradles, said cradles having one end latched and pivotally mounted at its opposite end, a plurality of springs, one end of said springs being secured to said movable arms and the opposite ends of said springs being secured to said cradles at the apex of the U-shaped cradles, a pivotally mounted operating handle having a manually operable end at one side of the pivot mounting and having a plurality of notches on the opposite end of the pivot mounting, said movable contact arms being pivotally mounted in said notches and extending substantially in the longitudinal direction of said handle with said movable contacts on the opposite end of said pivotal mounting of said arms, the notches in said handle being on one side of said spring when said handle is in closed position so that said springs apply a closing force on said arms for operating said arms to circuit closed position, and the notches of said handle being on the opposite side of said springs when said handle is in open position so that said springs apply an opening force on said arms for operating said arms to a circuit open position, fault current responsive means having a latch for latching said cradle, an insulating housing, said housing having a plurality of recesses, insulating walls separating said recesses, each of said poles being side mounted on one side of said recesses, and means securing said cover plates to the sides of said housing.

9. In a two pole circuit breaker, a plurality of fixed contacts, a plurality of movable contact arms carrying movable contacts, said arms having a circuit closed position in which their movable contacts engage said movable contacts and a circuit open position in which the said contacts are disengaged, U-shaped cradle means having one end latched and pivotally mounted at its opposite end, a plurality of springs, one end of said springs being secured to said movable arms and the opposite end of said springs being secured to said U-shaped cradle means at the apex thereof, pivotally mounted operating handle means having a manually operable end on one side of the pivot mounting and having a plurality of notches on the opposite ends of the pivot mounting, said movable contact arm being pivotally mounted in said notches and extending substantially in the longitudinal direction of said handle with said movable contacts on the end opposite the pivotal mounting of said arms, the notches in said handle being on one side of said spring when said handle is in closed position so that said springs apply a closing force on said arms for operating said arms to circuit closed position, the notches on said handle being on the opposite sides of said springs when said handle is in open position so that said springs apply an opening force on said arms for operating said arms to circuit open position, fault current responsive means having a latch for latching said U-shaped cradle means, a single insulating molded housing, said housing having two recesses and an insulated wall separating the said two recesses, the said two poles being side mounted in the said two recesses, said insulating wall electrically insulating said two poles from each other, cover plates, means securing said cover plates to said housing to thereby cover said poles and said recesses.

10. In a three pole circuit breaker, a plurality of fixed contacts, a plurality of movable contact arms carrying movable contacts, said arms having a circuit closed position in which their movable contacts engage said fixed contacts and a circuit open position in which said contacts are disengaged, U-shaped cradle means having one end latched and pivotally mounted at the opposite ends, a plurality of springs, one end of said springs being secured to said movable arms and the opposite end of said springs being secured at the apex of said U-shaped cradle means, pivotally mounted operating handle means having a manually operable end on one side of the pivot mounting and having a plurality of notches on the opposite ends of the pivot mounting, said movable contact arms being pivotally mounted in said notches and extending substantially in the longitudinal direction of said handle, said movable contacts on the ends opposite the pivotal mounting of said arms, the notches in said handle being on one side of said spring when said handle is in closed position so that said springs apply a closing force on said arms for operating said arms to circuit closed position, the notches in said handle being on the opposite side of said springs when said handle is in open position so that said springs apply an opening force on said arms for operating said arms to circuit open position, fault current responsive means having a latch for latching said U-shaped cradle means, said fault current responsive means effective to unlatch said U-shaped cradle means under fault current conditions, an insulating housing comprising two sections, one of said housing sections having two recesses, an insulating wall separating said two recesses, two of said poles being side mounted in said two recesses, the second of said housing sections having one recess, the third of said poles being mounted in said last mentioned recess, said sections being mounted side by side to form a pancaked assembly, cover plates, means securing said sections together and securing said cover plates at the end of said housing.

11. In a three pole circuit breaker, a plurality of fixed contacts, a plurality of movable contact arms carrying movable contacts, said arms having a circuit closed position in which their movable contacts engage said fixed contacts and a circuit open position in which said contacts are disengaged, handle means for manually operating said contacts, a single insulating housing, said housing comprising two sections, one of said housing sections having two recesses with an insulating wall separating said two recesses, two of said poles being mounted in said two recesses, a second of said housing sections having one recess, the other of said poles being mounted in said one recess, said sections being mounted side by side to form said housing, cover plates, means securing said sections together and securing said cover plates at the said ends of said housing.

12. In a multi-pole circuit breaker, a plurality of fixed contacts, a plurality of movable contact

arms carrying said movable contacts, said arms having a circuit closed position in which their movable contacts engage said fixed contacts and a circuit open position in which said contacts are disengaged, handle means for manually operating said contact arms, an insulating housing, said housing having two recesses and an insulating wall, said insulating wall separating said two recesses of said housing, a pole of said circuit breaker being mounted in each of said two recesses, cover plates, said cover plates secured at the ends of said housing to cover said recesses and said poles.

13. In a two pole circuit breaker, a plurality of fixed contacts, a plurality of movable contact arms carrying movable contacts, said arms having a circuit closed position in which their movable contacts engage said fixed contacts and a circuit open position in which said contacts are disengaged, handle means for manually operating

said contact arms, a single insulating molded housing, said single insulating molded housing having an insulating wall and two recesses, said insulating wall separating said two recesses of said single insulating molded housing, said two poles being mounted in said two recesses, two cover plates, means securing said two cover plates to said housing to cover said recesses and said poles.

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