June 18, 1968 L. L. WRIGHT ET AL 3,389,237

LOAD BREAK AND ISOLATING CIRCUIT INTERRUPTER

Filed March 29, 1965 4 Sheets-Sheet 1

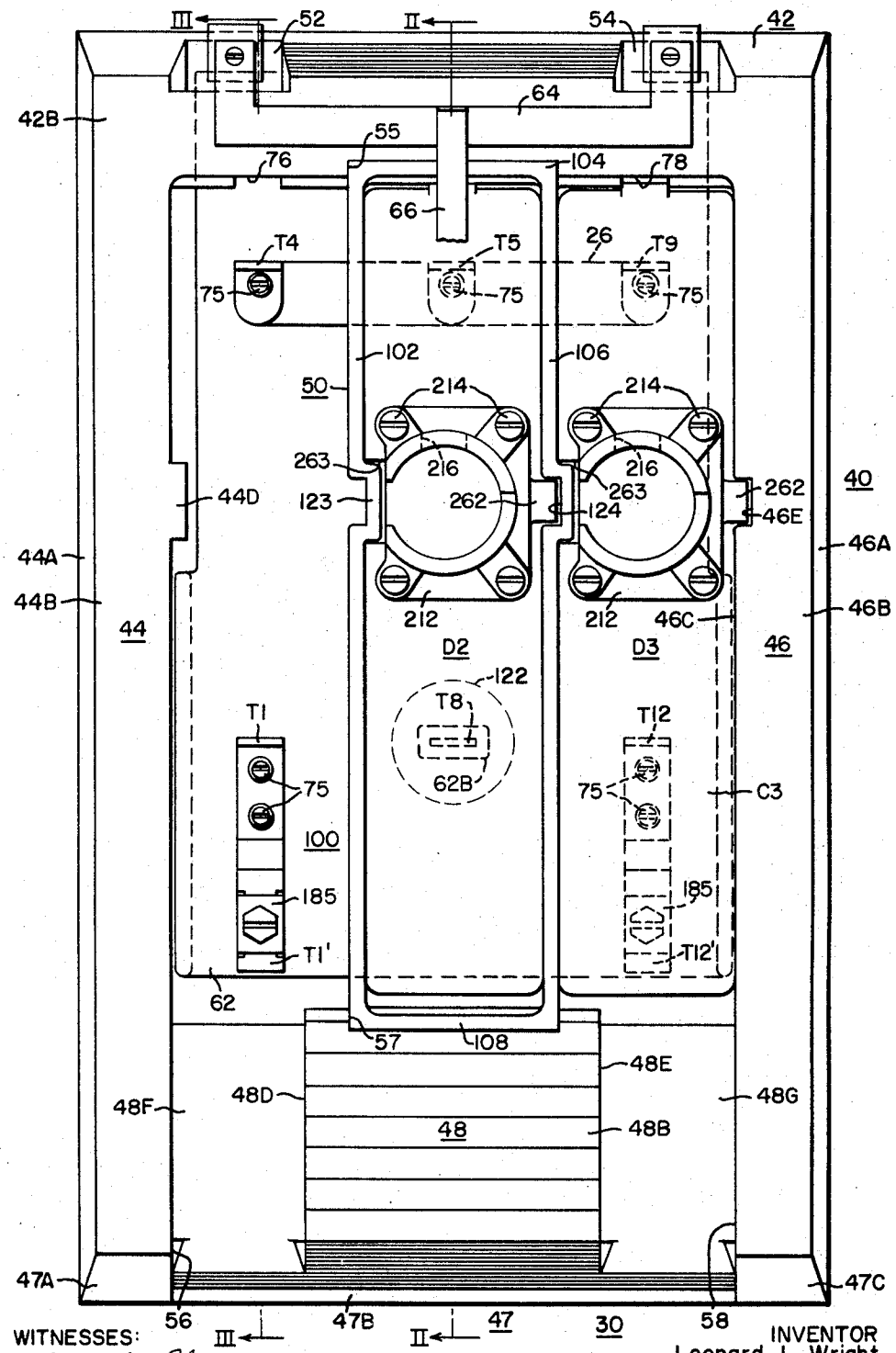

FIG. 1.

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James F. Young

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ATTORNEY

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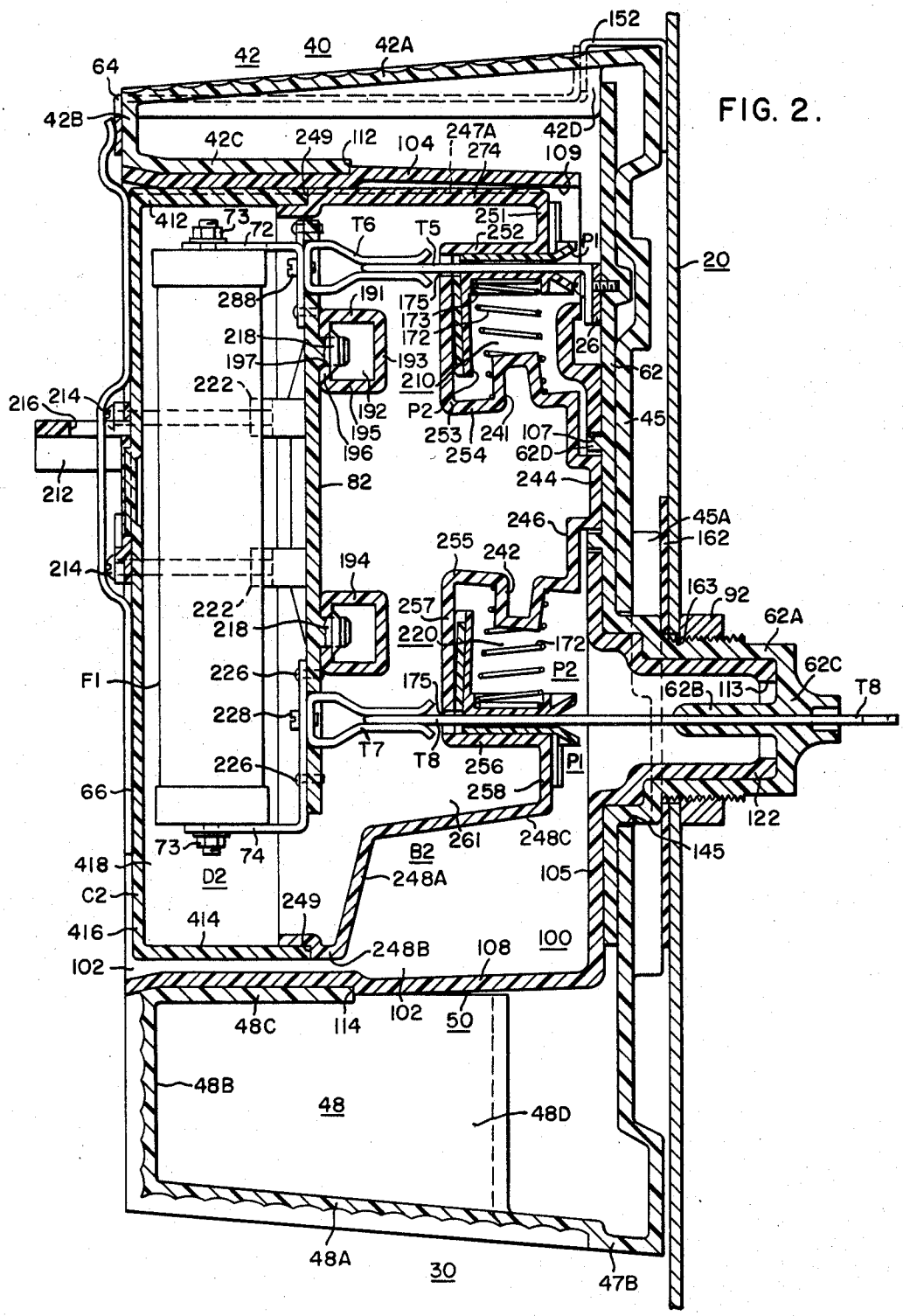
FIG. 2.



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LOAD BREAK AND ISOLATING CIRCUIT INTERRUPTER

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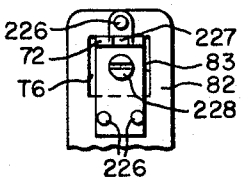
FIG. 5.



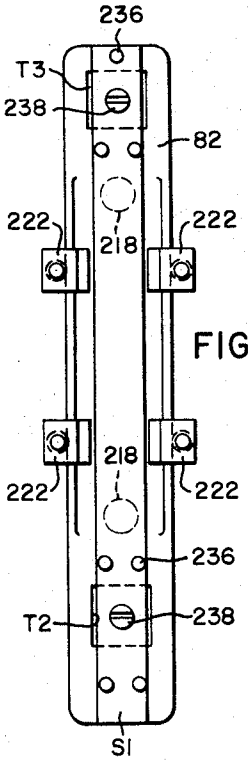
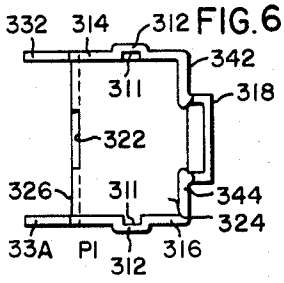


FIG. 4.

FIG. 6.



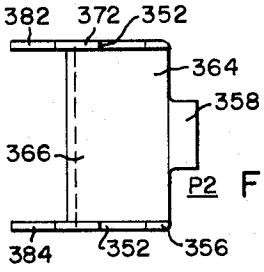
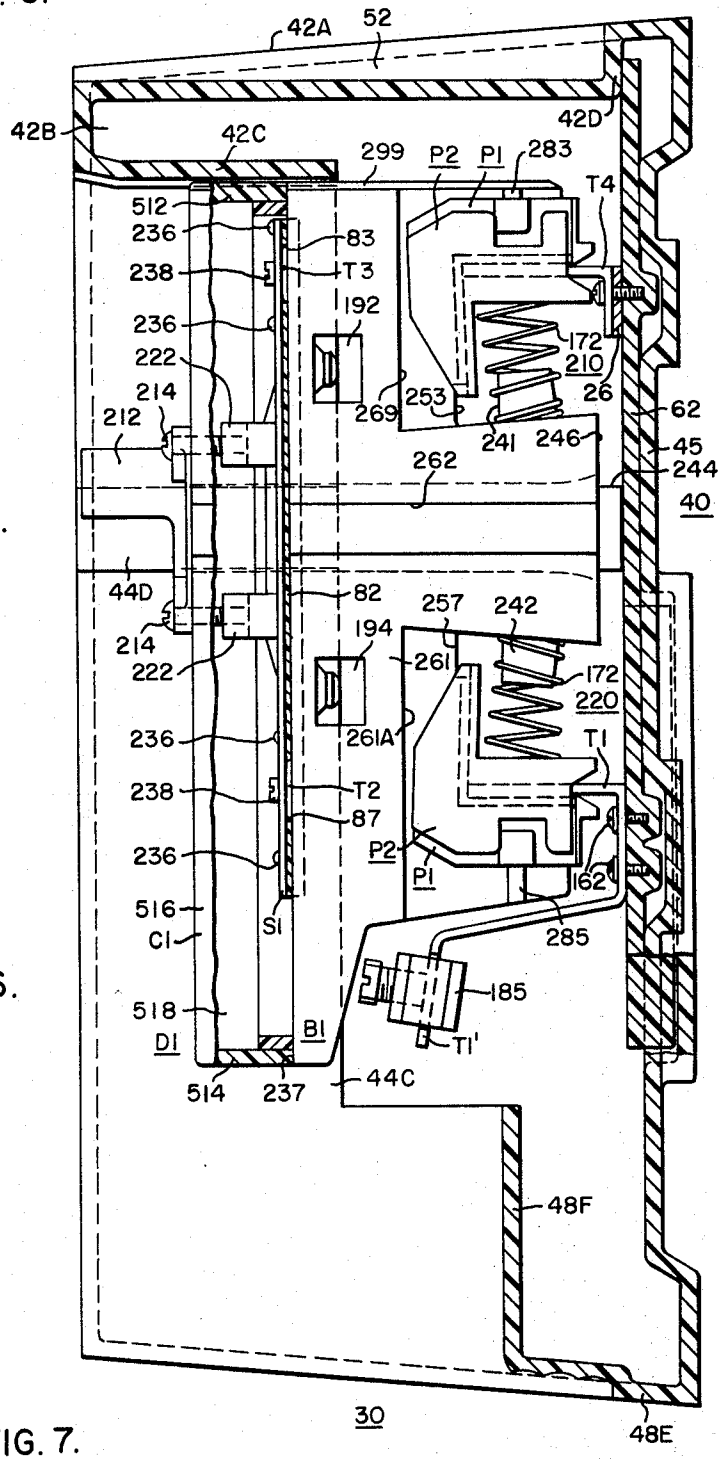


FIG. 7.

FIG. 3.



LOAD BREAK AND ISOLATING CIRCUIT INTERRUPTER

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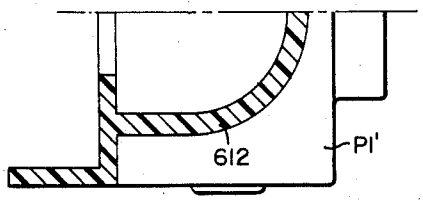
FIG. 8.



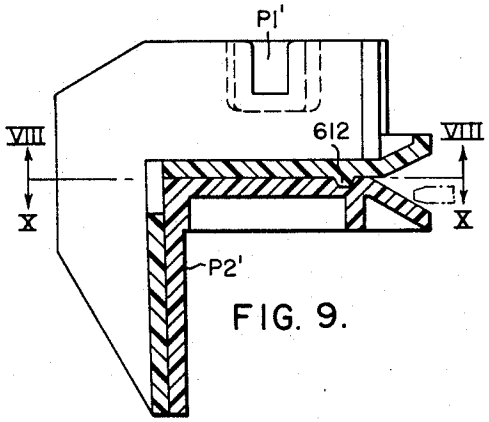


FIG. 9.

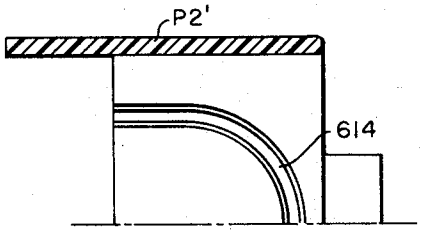
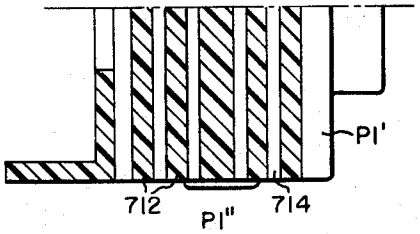


FIG. 10.

FIG. 11.



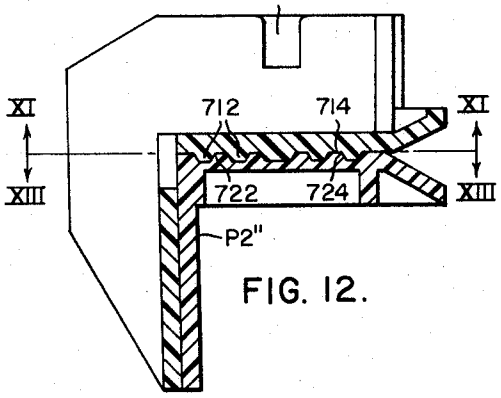


FIG. 12.

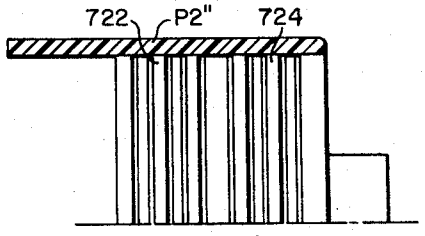


FIG. 13.

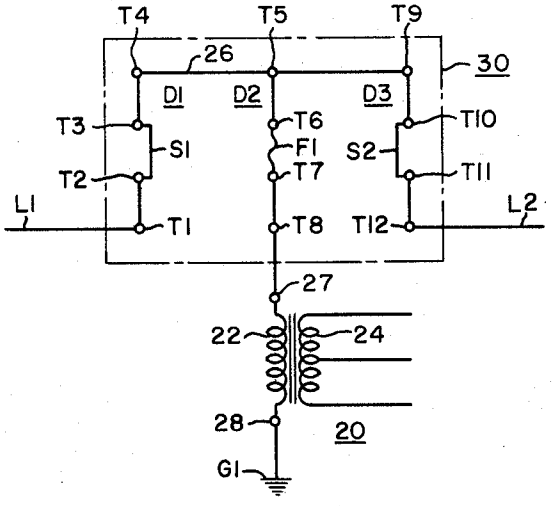


FIG. 14.

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3,389,237

LOAD BREAK AND ISOLATING CIRCUIT INTERRUPTER

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Filed Mar. 29, 1965, Ser. No. 443,359
12 Claims. (Cl. 200—144)

ABSTRACT OF THE DISCLOSURE

An insulating housing having at least one pair of spaced contacts mounted thereon is adapted to receive one or more movable insulating carriers having contacts and arc extinguishing means mounted thereon.

This invention relates to circuit interrupters and more specifically to disconnecting switches of the load break type.

In electric power distribution systems, a high voltage circuit interrupter, such as a load break disconnecting switch, is required in certain applications which is extremely compact in construction and which also provides a maximum of safety and protection for operating and maintenance personnel. One such application is a high voltage circuit interrupter for use with pad mounted distribution transformers which are located at or below ground level. The circuit interrupter may also be required to include some type of protection for the associated electrical apparatus or transformer, such as a fuse. It is therefore desirable to provide a new and improved high voltage circuit interrupter of the type described which is more compact in construction and which is also of the dead front type to protect operating and maintenance personnel.

It is an object of this invention to provide a new and improved circuit interrupter.

Another object of this invention is to provide an improved arc extinguishing means adapted for use with a circuit interrupter having separable contacts.

A more specific object of this invention is to provide an improved disconnecting switch of the load break type.

A further object of this invention is to provide an improved rectilinearly movable contact carrier in a circuit interrupter having a dead front construction.

Other objects of the invention will, in part, be obvious and will, in part, appear hereinafter.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description, taken in conjunction with the accompanying drawings in which:

FIGURE 1 is a front elevational view of a circuit interrupter embodying the principal features of the invention with one of the drawout assemblies removed;

FIG. 2 is a side elevational view of the circuit interrupter shown in FIG. 1, partly in section, taken along the line II—II in FIG. 1, and showing a portion of the tank or enclosure of an associated electrical apparatus, such as a transformer, on which the circuit interrupter may be mounted;

FIG. 3 is a side elevational view of the circuit interrupter shown in FIG. 1, partly in section and partly broken away, taken along the line III—III in FIG. 1;

FIG. 4 is a front elevational view of a portion of one of the drawout assemblies which forms part of the circuit interrupter shown in FIG. 1;

FIG. 5 is a front elevational view of a portion of one of the drawout assemblies of the circuit interrupter shown in FIG. 1;

FIGS. 6 and 7 are plan views of a pair of associated

insulating plates which forms part of each of the drawout assemblies of the circuit interrupter shown in FIG. 1;

FIG. 8 is a partial bottom view, partly in section, taken along the line at VIII—VIII in FIG. 9, of an alternate insulating plate construction which may be employed in certain applications instead of the insulating plate shown in FIG. 6;

FIG. 9 is a side elevational view, partly in section, of a pair of insulating plates which may be employed in certain applications instead of the pair of insulating plates shown in FIGS. 6 and 7;

FIG. 10 is a partial top plan view, partly in section taken along the line X—X in FIG. 9, of an alternate insulating plate which may be employed instead of the insulating plate shown in FIG. 7;

FIG. 11 is a partial bottom view, partly in section, taken along the line XI—XI in FIG. 12, of a modified insulating plate which may be employed instead of the insulating plate shown in FIG. 6;

FIG. 12 is a side elevational view of a pair of insulating plates, partly in section, which may be employed instead of the pair of insulating plates shown in FIGS. 6 and 7;

FIG. 13 is a top plan view, partly in section, taken along the line XIII—XIII in FIG. 12, showing an insulating plate which may be employed instead of the insulating plate shown in FIG. 7; and

FIG. 14 is a diagrammatic view illustrating the combination of the disclosed circuit interrupter with an associated electrical apparatus, such as a transformer.

Referring now to the drawings and FIGS. 1 through 3 in particular, there is illustrated a circuit interrupter, more specifically a load break disconnecting switch 30 comprising an insulating housing 40 in which a plurality of drawout assemblies or pole units D1, D2 and D3 are normally slidably disposed. In general, a plurality of a relatively stationary, spaced contacts is disposed inside the housing 40 to be engaged by corresponding contacts mounted on the respective drawout assemblies D1, D2 and D3 when said drawout assemblies are slidably moved into said housing and to be disengaged from the corresponding contacts on said drawout assemblies when said drawout assemblies are slidably moved out of the housing 40. It is to be noted that the disclosed circuit interrupter is uniquely adapted for use at higher operating voltages, such as 15 kv. or higher.

More specifically, the housing 40 is preferably molded or cast from a suitable track-resistant insulating material such as a high density, copolymer, polyethylene material, or butyl rubber with an aluminum trihydrate filler, or glass reinforced polyester resin with an aluminum trihydrate filler. The housing 40 includes a rear wall member 45, first and second side wall members 44 and 46, respectively, which project outwardly from said rear wall member and which are laterally spaced from each other, a top member 42 which projects outwardly from said rear wall member and which interconnects said side wall members, a generally U-shaped bottom member 47 which projects outwardly from said rear wall member and a lower projecting member 48 which projects outwardly from said bottom member 47 and which is interconnected with said side wall members. The top member 42 includes first and second spaced wall portions 42A and 42C, respectively, which are interconnected by a front wall portion 42B, as best shown in FIGS. 1 and 2. It is to be noted that the wall portion 42C extends from the front of the housing 40 for only a portion of the distance between the front wall portion 42B and the rear wall member 45. The top member 42 also includes a plurality of spaced recesses, as indicated at 52 and 54 in FIG. 1, which are adapted to receive associated clamping members such as the generally U-shaped clamping members 152, indicated

in FIG. 2, to assist in maintaining the circuit interrupter 30 in assembled relationship with an associated electrical apparatus, such as the tank wall of the transformer 20 indicated in FIG. 2. It is also to be noted that the vertically extending wall portions 42D included in the top member 42 serve to assist in positioning and retaining the insulating plate 62 in proper assembled relationship as will be explained hereinafter. The top member 42 also includes a plurality of laterally spaced recesses 76, 55, 78 in the underside of the wall portion 42C which extend rearwardly from the front of the housing 40 to the inner end of the wall portion 42C, as best shown in FIG. 1. The recesses 76, 78 are provided to guide the inward movement of the associated drawout assemblies D1 and D3, respectively, while the recess 55 is provided to assist in laterally positioning an inner insulating housing 100 as will be described hereinafter.

The side wall member 44 comprises first and second laterally spaced wall portions 44A and 44B which are interconnected by a front wall portion 44B, as best shown in FIGS. 1 and 3. The wall portion 44A extends outwardly from the rear wall member 45 to the front of the housing 40, while the wall portion 44C extends from the front of the housing 40 for only a portion of the distance between the wall portion 44B and the rear wall member 45, as shown in FIG. 3. The wall portion 44C includes a projecting portion 44D which extends from the front of the housing 40 inwardly to the inner edge of the wall portion 44C to assist in guiding the inward movement of the drawout assembly D1 into the housing 40. Similarly, the side wall member 46 includes the first and second laterally spaced wall portions 46A and 46C, respectively, which are interconnected by the front wall portion 46B. The wall portion 46C includes a substantially horizontal recess 46A which extends inwardly from the front of the housing 40 to the inner edge of the wall portion 46C to assist in guiding the inward movement of the drawout assembly D3 into the housing 40.

The bottom member 47 includes a transversely extending wall portion 47B which projects outwardly from the rear wall member 45 and the first and second laterally spaced wall portions 47A and 47C which interconnect the spaced wall portions which make up each of the side wall members 44 and 46, respectively.

In order to assist in supporting the inner insulating housing 100 and to provide additional creepage insulation between certain portions of the circuit interrupter 30, the lower projecting member 48 is provided at the lower end of the housing 40 and disposed intermediate and spaced from the side wall members 44 and 46. The projecting member 48 includes a bottom wall portion 48A which projects outwardly from the wall portion 47B of the bottom member 47, a front wall portion 48B which projects upwardly from the bottom wall portion 48A adjacent to the front of the housing 40, the first and second spaced side wall portions 48D and 48E, respectively, and a top wall portion 48C which extends rearwardly from the front wall portion 48D for only a portion of the distance between the front wall portion 48B and the rear wall member 45, as best shown in FIG. 2. The projecting member 48 also includes the first and second laterally extending wall portions 48F and 48G, respectively, which interconnect the side wall portions 48D and 48E, respectively, of the member 48 with the adjacent wall portions 44C and 46C, respectively, of the side wall members 44 and 46, repectively, as best shown in FIGS. 1 and 3. It is to be noted that the wall portions 48F and 48G are disposed adjacent to and spaced from the rear wall member 45 as shown in FIG. 3. The projecting member 48 includes a recess 57 as indicated in FIG. 1 which extends from the front wall portion 48B to the inner edge of the top wall portion 48C of the projecting member 48 to assist in laterally positioning the inner insulating housing 100, as will be explained hereinafter. It is to be noted that first and second vertically extending recesses 56 and 58, respectively, result between the projecting member 48 and the adjacent side wall members 44 and 46, respectively, to facilitate the external connections of the circuit interrupter with the line conductors of an electric power system, as will be explained hereinafter. It is also to be noted that the exposed surfaces of the wall portions 48B and 48A of the projecting member 48 along with the exposed surface of the wall portion 42A of the top wall member 42 may be corrugated or include a plurality of alternate ridges and depressions.

In order to provide rigid, insulating support for the relatively stationary contacts which are disposed and mounted inside the housing 40, which is also substantially non-tracking when exposed to electric arcs, the insulating plate 62 is disposed inside the housing 40 adjacent to the rear wall member 45, as best shown in FIG. 2. The insulating plate 62 is preferably formed or cast from a suitable insulating material which is also substantially non-tracking, such as polyester resin with an aluminum trihydrate filler. The main portion of the insulating plate 62 is disposed substantially parallel to the rear wall member 45 with the upper end of the plate 62 being retained in position by the wall portions 42D of the top wall member 42 between said wall and the rear wall member 45, as shown in FIG. 2. The insulating plate 62 includes an integral tubular portion or bushing 62A which projects rearwardly out of the housing 40 through an opening 145 provided in the rear wall member 45 to provide electrical creepage insulation and support for the relatively stationary contact member T8, as shown in FIG. 2. The tubular portion 62 includes a wall portion 62C which extends radially inwardly to the contact T8 and an insulating portion 62B which is substantially rectangular in cross section, as shown in FIG. 1, and which extends a predetermined distance forward from the wall portion 62 in spaced relation with and in a substantially concentric relation with the tubular portion 62A, as shown in FIG. 2. The outer surface of the tubular portion 62 includes a threaded portion which is adapted to receive an internally threaded retaining ring 92 when the circuit interrupter 30 is assembled with an associated electrical apparatus, such as the transformer 20, shown in FIG. 2. Since the transformer 20 may include a tank which is at least partially filled with an insulating fluid such as oil, a liquid tight seal is formed at the point where the tubular portion 62A of the insulating plate 62 enters the tank of the transformer 20 through an aligned opening 163 by providing a flexible gasket 162 formed from a suitable material, such as cork neoprene rubber and disposed between a shoulder provided on the tubular portion 62 and a tank wall of the transformer 20, as best shown in FIG. 2. In order to assist in maintaining the circuit interrupter 30 in proper assembled relation with the associated electrical apparatus such as the transformer 20, the rear wall member 45 may be provided with integral spacing members 45A which extend vertically on opposite sides of the opening 145 provided in the rear wall member 45. The plate 62 also includes a projecting portion 62D which is substantially ring shaped in configuration and which projects toward the front of the housing 40 intermediate the side of the plate 62 above the tubular portion 62A, as shown in FIG. 2, for a purpose which will be explained hereinafter.

In order to provide creepage insulation between the different pole units of the circuit interrupter 30 and to assist in guiding the movement of the drawout assemblies D1, D2 and D3 into and out of the housing 40, the inner insulating housing 100 is disposed inside the housing 40 and laterally spaced from each of the side wall members 44 and 46 to extend from the front of the housing 40 to the insulating plate 62. The inner housing 100 is generally rectangular in configuration and includes the spaced side wall portions 102 and 106, the top wall portion 104, the

bottom wall portion 108, and the rear wall portion 105, as shown in FIGS. 1 and 2. The inner housing 100 is preferably formed or molded from a suitable track resistant insulating material such as the insulating materials previously described for the housing 40. In order to provide a passageway for the contact T8 and to provide additional creepage insulation between the different portions of the circuit interrupter 30, the inner housing 100 includes an integral tubular portion or bushing 122 which extends rearwardly from the housing 100 outside of the housing 40 around the contact T8 and is disposed in substantially concentric relation with the tubular portion 62A of the insulating plate 62, as shown in FIG. 2. The tubular portion 122 of the housing 100 includes an opening 113 through which the contact T8 and the insulating portion 62B of the insulating plate 62 project in a forward direction. The housing 100 is vertically positioned between the wall portion 42C of the top wall member 42 and the wall portion 48C of the projecting member 48, as shown in FIG. 2. The top wall portion 104 and the bottom wall portion 108 of the housing 100 include the shoulder portions 112 and 114, respectively, which engage the adjacent inner edges of the associated wall portions 42C and 48C, respectively, to assist in retaining the housing 100 in assembled relationship with the housing 40 when the housing 100 is moved inwardly into the housing 40 during the assembly of the circuit interrupter 30. As mentioned previously, the recess 55 in the wall portion 42C and the recess 57 in the wall portion 48C of the projecting member 48 function to laterally position the housing 100 in assembled relation with the housing 40. The side wall portion 102 of the housing 100 includes a substantially horizontal recess 122 which assists in guiding the movement of the drawout assembly D1 into or out of the housing 40, while the side wall portion 106 includes a substantially horizontal projecting portion 124 which assists in guiding movement of the drawout assembly D3 into or out of the housing 40. The other side of the recess 122 forms a projecting portion in the side wall portion 102 and the other side of the projecting portion 124 forms a complementary recess in the side wall portion 106 which both assist in guiding the sliding movement of the drawout assembly D2 into or out of the housing 40. The rear wall portion 105 of the housing 100 includes an opening 107 through which the projecting portion 62D of the plate 62 passes to assist in laterally retaining the housing 100 and the plate 62 in proper assembled relationship. The housing 100 also includes an opening 109 through the rear wall portion 105 to permit at least one of a plurality of relatively stationary contacts disposed inside the housing 40 to pass into the receptacle defined by the housing 100. It is to be noted that the side wall portions 102 and 106 of the housing 100 form insulating barriers between the respective pole units of the circuit interrupter 30 and that the housing 100 subdivides the large receptacle formed inside the overall housing 40 into three laterally spaced receptacles which are disposed substantially parallel to one another and which extend from an opening at the front of the housing 48 rearwardly to the insulating plate 62 adjacent to the rear wall member 45.

A plurality of laterally spaced pairs of upper and lower spaced, relatively stationary contacts are disposed inside the housing 40 and mounted on the insulating plate 62. In particular, the upper and lower contacts T4 and T1, respectively, for the left pole unit as viewed from the front of the housing 40 are secured to the insulating plate by suitable fastening means, such as the screws or bolts 75. The upper contact T5 is similarly secured to the insulating plate 62 by suitable fastening means, such as the screw or bolt 75, while the lower contact T8 for the intermediate pole unit is supported by the tubular portion 62A and more specifically is molded into the insulating portion 62B of the plate 62, as shown in FIG. 2 and is further sealed in place with a suitable sealing and insulating compound material, such as a flexible epoxy material neoprene rubber, or silicone rubber. The upper and lower spaced contacts or terminals T9 and T12, respectively, for the right-hand pole unit, as viewed from the front of the housing 40, are secured to the insulating plate 62 by suitable fastening means, such as the screws or bolts 75. The main portion of each of the relatively stationary contacts T1, T4, T5, T8, T9 and T12 projects outwardly from the rear wall member 45 to engage corresponding contacts on the respective drawout assemblies D1, D2 and D3 as will be described hereinafter. The upper stationary contacts or terminals T4, T5 and T9 may be electrically interconnected by substantially flat conducting bar 26 which is also secured to the insulating plate 62 by the screws or bolts 75 which pass through aligned openings in said contacts and the conductor bar 26, as shown in FIG. 1. The lower stationary contacts T1 and T12 may include the depending contacting portions T1' and T12', respectively, on which are mounted conventional solderless cable connectors 185 to facilitate the external connections of the circuit interrupter 30 with an electrical power system which pass through the respective recesses 56 and 58 provided underneath the contacts T1 and T12, respectively.

It is to be noted that when the inner housing 100 is assembled with the outer insulating housing 40 that the inner housing 100 bears against the insulating plate 62 in a direction away from the front of the housing 40 to assist in maintaining the insulating plate 62 in a proper assembled relationship with the inner housing 100 and the outer housing 40.

In general each of the drawout assemblies D1, D2 and D3 is slidably movable into and out of the housing 40 independently of the other drawout assemblies to actuate a pair of relatively movable, spaced contacts on each of said drawout assemblies to engage or disengage corresponding relatively stationary contacts disposed niside the housing 40 and arc extinguishing means to extinguish any arc which results when corresponding contacts are disengaged while carrying current through the particular pole unit of the circuit interrupter 30 that is actuated. The drawout assemblies D1, D2, and D3 include the insulating base members B1, B2, and B3, respectively, and the insulating cover members C1, C2 and C3, respectively, which are removably secured to the associated insulating base members.

Since the base members B1, B2 and B3 of the drawout assemblies D1, D2 and D3, respectively, are identical, only the insulating base member B2 will be described in detail. The base member B2 is generally rectangular or oblong in configuration and is preferably formed or molded from a suitable track-resistant insulating material, such as those previously disclosed in connection with the outer insulating housing 40. As best shown in FIG. 2, the base member B2 comprises first and second side wall portions 261 (only one shown in FIG. 2) which are spaced from one another, the top wall portion 247, the bottom wall portion 248, and the rear wall portions 251, 253, 246, 257 and 258 which are successively interconnected by the transversely and substantially vertically extending wall portions 252, 254, 255 and 256 respectively. It is to be noted that the rear wall portions 253 and 257 which are spaced from one another are offset in a forward direction from the other rear wall portions 251, 246 and 258 to form first and second generally rectangular recesses in which the first and second arc extinguishing means 210 and 220, respectively, are disposed. The transversely extending wall portion 254 which interconnects the rear wall protions 253 and 246 includes an upwardly projecting portion 241 which acts as a spring seat for the spring 172 which forms part of the first arc extinguishing means 210. Similarly, the transversely extending wall portion 255 which interconnects the rear wall portions 246 and 257 includes a downwardly projecting portion 242 which functions as a spring seat for the spring 172 which forms part of the second arc extinguishing means 220. The top wall portion 247 of the base member B2 includes a raised portion 247A which extends from near the front of the

base member B2 to the rear wall portion 251 to project into the recessse 76 and 78 in the case of the base members B1 and B3 which form part of the drawout assemblies D1 and D3, respectively, to assist in guiding the movement of the latter drawout assemblies into or out of the housing 40 and to assist in laterally positioning the latter drawout assemblies when the drawout assemblies D1 and D3 are disposed inside the housing 40. The side wall portions 261 of the base member B2 each includes the upper and lower vertically extending raised portions 283 and 285, respectively, as best shown in FIG. 3 for the base mmeber B1, to engage corresponding recesses provided on the insulating plates P1 and P2 which form part of each of the first and second arc extinguishing means 210 and 220, respectively, at the opposite sides of the base member B2. These interfitting raised portions and recesses assist in guiding a substantially vertical movement of the insulating plates P1 and P2 which form part of each of said arc extinguishing means.

In order to facilitate the assembly of the insulating plate 82 within the receptacle formed inside the hollow insulating member B2, the transversely extending openings 192 and 194, which are vertically spaced from one another, are provided in the base member B2. Each of the openings 192 and 194 is substantially rectangular in cross-section, as disclosed, and is surrounded by the transversely extending walls 191, 193, 195 and 196. It is to be noted that the insulating plate 82 includes first and second vertically spaced projecting portions 218 which pass through aligned openings 197 in the wall 196 adjacent to the insulating plate 82 and are secured to the base member B2 by any suitable fastening means, such as a washer and a spring grip fastener, which may then be painted or coated with a suitable insulating material, such as a polyester resin. The insulating plate 82 is preferably formed or cast from a suitable insulating rigid material which is substantially non-tracking, such as a polyester resin with an aluminum trihydrate filler.

In order to provide a passage through which the external connections may be made to the terminals provided in the outer pole units of the circuit interrupter 30 and to provide spaces in which the terminals may be disposed, the bottom portion of the base member B2 which is identical to the base members of the drawout assemblies D1 and D3, includes a first bottom wall portion 248B which is vertically offset from a second bottom wall portion 248C with a transversely extending wall portion 248A which interconnects the bottom wall portions 248B and 248C, as shown in FIGS. 2 and 3. As best shown in FIGS. 1 and 3, the lower depending portions T1 and T12' of the contacts T1 and T12, respectively, extend into the spaces below the bottom wall portions of the base members B1 and B3, respectively, to permit direct access for the cables which extend upwardly through the recesses 56 and 58 to the terminal connectors 185 on the respective terminals.

In order to assist in guiding and supporting the base member B2 when the associated drawout assembly D2 is moved into or out of the housing 40, the side wall portion 102 of the housing 100 includes a substantially horizontal recess 263 on the outer surface thereof and a substantially horizontal projecting portion 262 on the outer surface of the other side wall portion 106, as best shown in FIGS. 1 and 3. The recess 263 is engaged by a corresponding projecting portion 122 on the inner housing 109 while the projecting portion 262 engages a corresponding recess 124 provided on the other side wall portion 106 of the inner housing 100. The other base members B1 and B3 includes identical recesses and projecting portions to assist and guide the latter base members during the movement of the associated drawout assemblies into or out of the housing 40.

Each of the base members B1, B2 and B3 and their associated cover members C1, C2 and C3, respectively, includes a rearwardly extending portion as indicated at 299 for the base B1 in FIG. 3, on the top thereof which in the case of the drawout assemblies D1 and D3 engages the recesses 76 and 78, respectively, to assist in laterally postitioning said drawout assemblies and guiding their movements into and out of the housing 40.

It is to be noted that the rear wall portion 246 of the base member B2 includes a rearwardly projecting portion 244 which enters the recess provided inside the ring shaped projecting portion 62D provided on the insulating plate 62 when the base member B2 which forms part of the drawout assembly D2 is moved into the housing 40, as shown in FIG. 2.

In order to facilitate the assembly of the removable cover C2 with the base member B2, a shoulder portion 249 is provided around the outer periphery of the base member B2 at the front of the base member B2 as shown in FIG. 2. The cover C2 is generally rectangular in configuration and defines a generally rectangular receptacle within the cover with a substantially rectangular opening at the inner end which fits over the outer end of the base member B2 to engage the shoulder portion 249. The cover C2 is preferably formed or molded from a suitable track resistant insulating material, such as the materials previously described in connection with the insulating housing 40. The cover C2 may be removably secured to the base member B2 by the plurality of bolts 214 which extend through suitable openings in the cover C2 to engage the internally threaded insulating posts 222 which are provided integrally with the insulating plate 82 at the opposite sides of the insulating plate and vertically spaced from one another. An insulating fitting 212 is disposed on the outer surface of the cover C2 and secured thereto by the same bolts 214, which are preferably formed from a suitable insulating material such as nylon. The fitting 212 includes an opening 216 which is adapted to receive a hook stick to actuate the sliding movement of the drawout assembly D2 into and out of the housing 40.

More specifically, the cover member C2 includes a front wall portion 416, first and second side wall portions 418 (only one shown in FIG. 2), a top wall portion 412 and a bottom wall portion 414 to define a generally rectangular receptacle within the cover member C2. Similarly, the cover members C1 and C3 of the drawout assemblies D1 and D3, respectively, are similar to the cover C2 and each of the covers C1 and C3 includes a front wall portion 516, first and second spaced side wall portions 518 (only one shown in FIG. 3), a top wall portion R12, and a bottom wall portion 514 which together define a substantially rectangular receptacle within each of the cover members C1 and C2 which are preferably formed from the same track resistant materials previously described in connection with the housing 40. It should be noted that the cover members C1 and C3 differ from the cover member C2 in that the depth of each of the wall portions 512, 514 and 518 of the cover members C1 and C3 are less than the corresponding depth of each of the wall portions 412, 414 and 418 of the cover member C2 for reasons which will be explained hereinafter. Each of the cover members C1 and C3 also includes an insulating fitting 212 which is adapted to receive a hookstick through an opening 216 to manually actuate the drawout assembly D1 and D3, respectively, into or out of the housing 40.

Each of the drawout assemblies D1, D2 and D3 includes a pair of spaced upper and lower, relatively movable contact terminals or contact clips which are mounted on the base member of the respective drawout assemblies for movement therewith to engage or disengage corresponding relatively stationary contacts which are disposed inside the housing 40 when the respective drawout assemblies are moved into or out of the housing 40. Since the contacts provided on the drawout assemblies D1 and D3 are identical, only the contacts for the drawout assembly D1 will be described in detail. As best shown in FIGS. 2, 3 and 4, the upper and lower contact clips T3

and T2, respectively, of the drawout assembly D1 are secured to and supported by a bridging conductor bar S1 by any suitable means, such as the screws 238, which pass through spaced openings in the conductor bar S1 to engage the contact clips T3 and T2. The conductor bar S1 in turn is secured to the insulating plate 82 by any suitable means, such as the rivets 236, with the conductor bar S1 being disposed between the insulating posts 222 which are provided at the opposite sides of the insulating plate 82. The bight portions of contact clips T3 and T2 are disposed in corresponding openings 83 and 87, respectively, at the upper and lower ends of the insulating plate 82, as shown in FIGS. 2 and 3, to assist in positioning and maintaining said contact clips in assembled relationship with the insulating plate 82. It is to be noted that the bridging conductor S1 electrically connects the upper and lower contact clips T3 and T2, respectively, of the drawout assembly D1 and also the upper and lower stationary contacts T4 and T1, respectively, of the left pole unit when the drawout assembly D1 is moved into the housing 40. Similarly, the drawout assembly D2 includes the upper and lower contact clips or terminals T6 and T7, respectively, which are mounted at the upper and lower ends, respectively, of the insulating plate 82 for movement with the drawout assembly D2. As shown in FIGS. 2 and 5, the upper contact clip T6 of the drawout assembly D2 is fastened to an associated upper fuse terminal 72 through an opening at the upper end of the insulating plate 82 by any suitable means, such as the screw 228. The generally L-shaped upper fuse terminal 72 is fastened or secured in turn to the upper end of the insulating plate 82 at the opposite side of the plate 82 from the contact clip T6 by any suitable means, such as the rivets 226 shown in FIG. 5, and includes a slot or recess 27 in the propecting portion to receive the upper contact of a removable fuse unit F1, as shown in FIG. 2 which may be of the current limiting type. The lower contact clip T7 of the drawout assembly D2 is also secured to a lower fuse terminal 74 by any suitable means, such as the screw 228, through a corresponding opening at the lower end of the insulating plate 82 with the generally L-shaped lower fuse terminal 74 being secured to the lower portion or end of the insulating plate 82 by any suitable means, such as the rivets 226. The lower fuse terminal 74 also includes a slot to receive the lower contact of the fuse unit F1 which may be secured to the upper and lower fuse terminals 72 and 74, respectively, by any suitable means, such as the nuts 73, which may be arranged to threadably engage the threaded upper and lower contacts of the fuse F1. It is to be noted that the fuse unit F1 is electrically connected between the upper and lower contact clips T6 and T7 and also between the upper and lower relatively stationary contacts T5 and T8, respectively, of the intermediate pole unit of the circuit interrupter 30 when the drawout assembly D2 is moved into the housing 40. It is to be noted that each of the base members B1, B2 and B3 includes a pair of upper and lower openings 175 adjacent to the upper and lower contact clips provided on each of said base members to permit the entrance of the corresponding stationary contacts which are disposed inside the housing 40 when the respective drawout assemblies are moved into the housing 40, as best shown in FIG. 2, for the drawout assembly D2. As previously indicated, the cover member C2 of the intermediate drawout assembly D2 is of a greater depth to accommodate a protective circuit interrupter, such as the fuse unit F1, shown in FIG. 2 while the cover members C1 and C3 of the drawout assemblies D1 and D3, respectively, are of a lesser depth since they need only accommodate the bridging conductor bars S1 and S3, respectively.

In general, the first and second arc extinguishing means 210 and 220, respectively, which form part of each of the drawout assemblies D1, D2 and D3 are disposed on the associated base member adjacent to the upper and lower openings 175 through which the corresponding stationary contacts disposed inside the housing 40 pass to engage the associated upper and lower contacts mounted on each of the drawout assemblies, as best shown in FIG. 2, for the drawout assembly D2. The first and second arc extinguishing means 210 and 220, respectively, are provided to rapidly extinguish any electric arc which results between the corresponding contacts at the upper and lower ends of each drawout assembly when the respective drawout assemblies are moved out of the housing 40 to disengage the corresponding engaged contacts. Each of the arc extinguishing means 210 and 220 includes a pair of insulating plates P1 and P2 which include substantially flat planar portions which are biased together by an associated biasing spring 172 which extends between a spring seat 173 provided on the insulating plate P2 and the spring seat 241 in the case of the arc extinguishing means 210 and the spring seat 242 in the case of the arc extinguishing means 220. As shown in detail in FIGS. 6 and 7, the insulating plate P1 which is generally L-shaped in cross section includes a first planar portion 324 and a second planar portion 326 which meet at substantially a right angle, first and second spaced side wall portions 314 and 316 which project vertically away from the laterally spaced sides of the first planar portion 324, and first and second spaced side wall portions 332 and 334 which project away from the laterally spaced sides of the second planar portion 326. The insulating plate P1 also includes an opening 322 at the junction of the planar portions 324 and 326 to permit the passage therethrough of the corresponding stationary contact which engages the associated contact clip inside the base member of the associated drawout assembly. The insulating plate P1 also includes a lip portion 318 which projects away from one edge of the planar portion 324 at an acute angle to assist in guiding the inward movement of the stationary contact when the associated drawout assembly is moved into the housing 40. Similarly, the insulating plate P2 includes first and second planar portions 364 and 366, respectively, which intersect at substantially a right angle, first and second side wall portions 372 and 356 which are spaced from one another and which project away from the laterally spaced sides of the first planar portion 364 at substantially a right angle, and the first and second spaced side wall portions 382 and 384 which project away from the laterally spaced sides of the second planar portion 366 at substantially a right angle. The second insulating plate P2 also includes a lip portion 358 which projects away from the outer edge of the first planar portion 364 at an acute angle in a diverging direction away from the lip portion 318 of the first insulating plate, as best shown in FIGS. 2, 6 and 7. Each of the side wall portions 314 and 316 of the first insulating plate P1 includes a vertically extending recess 311 which receives one of the projecting portions 283 provided on the associated base member to assist in guiding the substantially vertical movement of the first insulating plate P1, while the second insulating plate P2 includes a recess 352 in each of the side wall portions 372 and 356 into which a vertically extending projecting portion 312 on each of the side wall portions 314 and 316 of the first insulating plate P1 projects to assist in guiding the vertical movement of the second insulating plate P2.

When each pair of insulating plates P1 and P2 is assembled in nested relation, as shown in FIGS. 2 and 3, the side wall portions 332 and 334 together with the second planar portion 326 of the first insulating plate P1 and the side wall portions 382 and 384 together with the second planar portion 366 of the second insulating plate P2 each form channel shaped portions which are disposed around the rear wall portions 253 or 257 of the associated base member which acts as a vertically extending track on which the insulating plates P1 and P2 are disposed to travel. The side wall portions 314 and 316 of the first insulating plate P2 and the side wall portions 372 and 356 of the second insulating plate P2 are also

disposed in nested relation and with the associated first planar portions 324 and 364, respectively, form channel shaped portions which bear against the wall portions 252 in the case of the arc extinguishing means 210 and against the wall portion 256 in the case of the arc extinguishing means 220. The lip portion 318 of the insulating plate 51 is laterally reinforced by the adjacent wall portions 342 and 344. The insulating plates P1 and P2 are preferably formed or cast from a suitable substantially non-tracking insulating material such as a glass-reinforced polyester resin with an aluminum trihydrate filler, since the insulating plates P1 and P2 are exposed to electric arcs when the adjacent corresponding contacts disengage while said contacts are carrying current.

The material from which the plates P1 and P2 are formed, such as the material just mentioned, should also evolve gas during arc interruption in order to cool the arc or to otherwise assist in interrupting the arc. Other suitable materials include high molecular weight polyoxymethylene sold under the trademark "Delrin," or horn or vulcanized fiber.

In the operation of the circuit interrupter 30, when the respective drawout assemblies D1, D2 and D3 are in their normal operating position disposed inside the housing 40, as shown in FIGS. 1 to 3, the relatively stationary contacts disposed inside the housing 40 engage the corresponding movable contacts disposed on the respective drawout assemblies since the relatively stationary contacts force each pair of insulating plates P1 and P2 to separate as the stationary contacts enter between the lip portions 318 and 358 against the yieldable biasing force of the associated biasing spring 172 to cause the relatively movable insulating plate P2 to move in a substantially vertical direction away from the associated insulating plate P1 which is held in a relatively stationary position against the associated wall portions 252 or 256 of the associated base member, as shown in FIG. 2. The respective stationary contacts then pass through the generally rectangular passageway which is defined between the separated insulating plates to enter the contact clips through one of the openings 175 in the associated base member, as shown in FIG. 2, for the stationary contact T5 and the movable contact T6. When one of the drawout assemblies D1, D2 or D3 is moved out of the housing 40 by the use of a hookstick which is inserted through the opening 216 in one of the insulating fittings 212, the upper and lower stationary contacts disengage from the corresponding upper and lower movable contacts on the particular drawout assembly, as the insulating plates P1 and P2 adjacent to each movable contact on the drawout assembly move away from the stationary contact. For example, as the drawout assembly D2 is moved out of the housing 40, as shown in FIG. 2, the upper stationary contact T5 will first disengage from the contact clip T6. As the drawout assembly D2 is moved farther to the left, the stationary contact T5 will remain in the position shown in FIG. 2 as the insulating plates P1, P2 are moved toward the left with the drawout assembly D2, until the plates P1 and P2 move past the left end of the stationary contact T5 and are forced together with a snap action under the influence of the biasing spring 172 to rapidly and effectively extinguish any arc which results between the contact T5 and the contact T6 while said contacts are carrying load current. Since the load current which is carried by each drawout assembly is interrupted at the upper and lower corresponding contacts of each drawout assembly, each pole of the circuit interrupter 30 considered as a load break disconnecting switch is of the double break type. As mentioned previously, each of the draw units D1, D2 and D3 is rectilinearly movable into and out of the associated housing 40 independently of one another to provide a maximum of flexibility in the operation of the circuit interrupter 30.

Referring now to FIG. 14, there is illustrated diagrammatically a typical application of a circuit interrupter 30 with an associated electrical apparatus, such as a transformer 20, having first and second windings 22 and 24, respectively. As illustrated, the terminal T1 of the circuit interrupter 30 may be connected to a source of alternating current potential through a line conductor L1, while the terminal P12 of the circuit interrupter 30 may be connected to the line conductor L2 of an alternating current power system. In a typical application, either the line conductor L1 or the line conductor L2 may be connected to a source of alternating current potential with the other line serving to continue the connections of the power system to other electrical apparatus which may be employed in the system. When the drawout assemblies D1, D2 and D3 are disposed inside the associated housing with the corresponding contacts inside the housing being engaged with those on the drawout assemblies, an electric circuit is formed which extends from the line conductor L1 to the terminals T1 and T2 through a bridging conductor S1 to the terminals T3 and T4, through the conductor bar 26 to the terminals T5 and T6 of the intermediate drawout assembly D2, through the fuse unit F1 to the terminals T7 and T8, and thence to the high voltage terminal 27 of an associated high voltage winding 22 of the transformer 20 to the terminal 28 and finally to a ground terminal or point of substantially zero potential G1, as shown in FIG. 14. Similarly, an electric circuit is formed which extends from the line conductor L2 through the terminals T11 and T12, through the bridging conductor S2 of the drawout assembly D3, through the terminals T10 and T9, through the conductor bar 26 to the terminals T5 and T6 of the intermediate drawout assembly D2, through the fuse unit F1 to the terminals T7 and T8 and finally to the high voltage terminal 27 of the transformer 20. It is to be noted from inspection of the electric circuit provided in FIG. 14 that the transformer 20 may be provided with electric power from either the conductor L1 or L2 through the circuit interrupter 30 which also provides an electric path through which electric power may flow in either direction between the line conductors L1 and L2. If it is desired to isolate transformer 20 from the line conductor L1, the drawout assembly D1 may be moved out of the housing 40 to disengage the movable contacts T3 and T2 from the corresponding stationary contacts T4 and T1, respectively. Similarly, if it is desired to electrically isolate the transformer 20 from the line conductor L2, the drawout assembly D3 may be moved out of the housing 40 to disengage the movable contacts T10 and T11 from the corresponding stationary contacts T9 and T12, respectively. If it is desired to electrically isolate the transformer 20 from both of the line conductors L1 and L2 while maintaining an electrically continuous circuit between the line conductor L1 and the line conductor L2, the intermediate drawout assembly D2 may be moved out of the housing 40 to disengage the movable contacts T6 and T7 from the corresponding stationary contacts T5 and T8, respectively. The outer drawout assemblies D1 and D3 may also be both removed to interrupt the flow of electric power between the line conductors L1 and L2 and also to isolate the transformer 20. It is to be understood that in a particular application, the drawout assemblies D1 and D3 may be provided with protective fuse units and covers similar to the cover C2 since the base members of each of the drawout assemblies D1, D2 and D3 are identical to permit interchangeability of different types of drawout assemblies.

It is important to note that when the drawout assemblies D1, D2 and D3 are disposed inside the housing 40 in their normal operating positions, as shown in FIG. 1, the entire front portion of the circuit interrupter 30 is formed of electrically insulating material to provide a dead front construction and a maximum of safety for operating personnel. It is also important to note that due to the greatly increased creepage insulation provided

between the different portions of the circuit interrupter **30** and between the circuit interrupter **30** and the associated electrical apparatus such as a transformer **20**, that any insulation failure which might occur would of necessity occur as insulating puncture failure rather than as a creepage insulation failure or flashover to permit a greatly reduced size of the circuit interrupter **30** which is much more compact in structure than high voltage circuit interrupters of a conventional type.

Referring now to FIGS. 8 through 10, there is illustrated an alternate construction for the insulating plates P1 and P2. In particular, the insulating plates P1′ and P2′ are similar to the corresponding insulating plates P1 and P2, respectively, as previously described except that the insulating plate P1′ includes a generally U-shaped projecting portion **612** which extends downwardly from the substantially horizontal planar portion of the insulating plate P1′ with the bight portion of the projecting portion **612** extending substantially transversely of the insulating plate P1′ adjacent to the lip portion of the plate P1′. The insulating plate P2′ includes a generally U-shaped groove or recess **614** to receive the projecting portion **612** of insulating plate P1′ when the insulating plates P1′ and P2′ are assembled with the substantially horizontal planar portions engaged, as shown in FIG. 9.

Referring now to FIGS. 11 through 13, there is illustrated another alternate embodiment of the insulating plates P1 and P2 which may be employed in certain applications. In particular, the insulating plates P1″ and P2″ are similar to the insulating plates P1 and P2, respectively, except that the substantially horizontal planar portions of each of the insulating plates P1″ and P2″ included in a plurality of alternate transversely extending ridges and grooves or depressions **712** and **714**, respectively, which interlock or interfit when the insulating plates P1′ and P2″ are assembled, as shown in FIG. 12.

The alternate insulating plate constructions illustrated in FIGS. 8 through 10 and 11 through 13, respectively, have the advantage that when the insulating plates are formed from a gas evolving material to improve the interrupting ability or rating of the circuit interrupter **30**, the plate constructions shown in the alternate embodiments increase the effective areas which evolve gas during arc interruption.

It is to be understood that a circuit interrupter as disclosed may include one or more pole units as required in a particular application. It is also to be understood that in particular applications, certain portions of the housing **40** or the base members B1, B2 and B3 which are disclosed as spaced wall portions may be constructed as a single solid insulating wall.

The apparatus embodying the teachings of this invention has several advantages. For example, a circuit interrupter as disclosed provides a much more compact construction than conventional circuit interrupters of a similar type because the insulating creepage distances are so great between the different portions of the circuit interrupter, as disclosed, to thereby provide creepage and puncture insulating strengths which are approximately equal. The electrically insulating materials in the different portions of the disclosed circuit interrupter are therefore, used more efficiently to provide a more compact construction. Another important advantage of the disclosed circuit interrupter is that the interrupter is of the double break type to provide increased interrupting ability and is of the dead front type to provide greater safety for operating and maintenance personnel. In addition, the drawout assemblies in a circuit interrupter as disclosed are slidably movable and independently movable to actuate the corresponding contacts of the circuit interrupter between engaged and disengaged positions with means for guiding the movement of each drawout assembly both in a substantially horizontal plane and in a substantially vertical plane into and out of the associated housing.

It is to be understood that in certain applications an optional safety feature may be added to the circuit interrupter **30** by providing a grounding strap or conductor on top of the housing **40** which is generally U-shaped in configuration as illustrated to extend from each of the clamps **152** which in turn are electrically connected to the tank of the associated electrical apparatus or transformer which is normally at ground potential to the front of the housing **40** adjacent to the front wall portion **42B**, as shown in FIG. 2. A spring conductor **66** may be then disposed on the front of the drawout assembly D2 to engage the ground conductor **64** when the drawout assembly D2 is moved into the housing **40**, as best shown in FIGS. 1 and 2.

Since numerous changes may be made in the above-described apparatus and different embodiments of the invention may be made without departing from the spirit and scope thereof, it is intended that all the matter contained in the foregoing description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

We claim as our invention:

1. Arc extinguishing means adapted for use with a circuit interrupter having separable contacts comprising an insulating member disposed around one of said contacts and having an opening therein to permit the other contact to be moved into engagement with said one of said contacts, a pair of relatively movable insulating plates disposed in front of said opening to permit access to said one of said contacts when said other contact is moved into engagement therewith and to substantially close off access to said opening when said other contact is moved out of engagement with said one of said contacts, said plates being disposed in nested relation to move relative to one another in a direction substantially transverse to the direction of separating movement of said contacts, each of said plates being generally L-shaped and including first and second intersecting planar portions and additional planar portions extending substantially transversely in the same direction away from each of the first and second planar portions of both of said plates to assist in guiding the relative movement of said plates, one of said plates including an opening which is substantially aligned with the opening in said insulating member, and means for biasing said plates together intermediate the ends of said plates only in a direction substantially transverse to the direction of separating movement of said separable contacts to permit the entrance of said other contact between said plates and to close said plates with a snap action when said other contact moves out of said plates.

2. Arc extinguishing means adapted for use with a circuit interrupter having separable contacts comprising an insulating member disposed around one of said contacts and having an opening therein to permit the other contact to be moved into engagement with one of said contacts, a pair of relatively movable insulating plates disposed in front of said opening to permit access to said one of said contacts when said other contact is moved into engagement therewith and to substantially close off access to said opening when said other contact is moved out of engagement with said one contacts, said plates being disposed in nested relation to move relative to one another in a direction substantially transverse to the direction of separating movement of said contacts, each of said plates being generally L-shaped and including first and second interesting planar portions and additional planar portions extending substantially transversely in the same direction away from each of the first and second planar portions of both of said plates to assist in guiding the relative movement of said plates, one of said plates including an opening which is substantially aligned with the opening in said insulating member, and means for biasing said plates together intermediate the ends of said plates only in a

direction substantially transverse to the direction of separating movement of said contacts to permit the entrance of said other contact between said plates and to move said plates together with a snap action when said other contacts move out of said plates, one of said plates including a generally U-shaped portion projecting toward the other plate with the bight portion of said U-shaped portion disposed adjacent to the point where said other contact enters between said plates and the other plate having a generally U-shaped recess of matching shape to mate with the projecting portion of said one of said plates.

3. A circuit interrupter comprising a housing formed from electrically insulating material and including a base portion and wall portions projecting away from said base portion to define a receptacle within said housing, one or more stationary contacts mounted on said base portion inside said housing to project away from said base portion, a contact carrier formed of electrically insulating material and disposed to move rectilinearly into and out of said housing, one or more movable contacts mounted on said carrier and surrounded by insulating material except in the direction of movement of said carrier, each contact on said carrier being disposed to engage a corresponding stationary contact when said carrier is moved into said housing and to disengage said stationary contact when said carrier is moved out of said housing, at least one insulating plate slidably disposed on said carrier to close off access to said movable contact when said carrier is moved out of said housing and to permit access when said carrier is moved into said housing, and means biasing said insulating plate toward the closing position generally transversely to the direction of movement of said contact carrier while permitting access to said movable contact when said carrier moves into said housing and said stationary contact bears against said plate to engage said movable contact.

4. A circuit interrupter comprising a housing formed from electrically insulating material and including a base portion and wall portions projecting away from said base portion to define a receptacle within said housing, one or more stationary contacts mounted on said base portion inside said housing to project away from said base portion, a contact carrier formed of electrically insulating material and disposed to move rectilinearly into and out of said housing, one or more movable contacts mounted on said carrier and surrounded by insulating material except in the direction of movement of said carrier, each contact on said carrier being disposed to engage a corresponding stationary contact when said carrier is moved into said housing and to be disengaged from said stationary contact when said carrier is moved out of said housing, at least one insulating plate slidably disposed on said carrier to close off access to said movable contact when said carrier is moved out of said housing and to permit access when said carrier is moved into said housing, and means biasing said insulating plate toward the closing position generally transversely with respect to the direction of movement of said contact carrier while permitting access to said movable contact when said carrier moves into said housing and said stationary contact bears against said plate to engage said movable contact, the exterior portions of said housing and said carrier in the direction of movement of said carrier being formed entirely of electrically insulating material when said carrier is disposed inside said housing.

5. A circuit interrupter comprising an insulating housing having a base portion and wall portions extending away from said base portion to define a receptacle having an opening spaced away from said base portion, an insulating carrier including inwardly projecting portions at each end thereof and an intermediate inwardly projecting portion disposed to move rectilinearly into and out of said housing, one or more pairs of spaced contacts mounted on and projecting away from said base portion inside said housing, one or more pairs of spaced contacts mounted on said carrier to engage corresponding contacts on said base portion when said carrier is moved into said housing and substantially surrounded by the insulating material of said carrier except in the direction of movement of said carrier into said housing, a pair of insulating plates disposed on said carrier between said intermediate portion and each inwardly projecting portion at the ends of said carrier and being slidably movable on said carrier to permit access between said plates to the contacts on said carrier when said carrier is moved into said housing and to close off access to said contacts when said carrier is moved out of said housing, and spring means disposed between one plate of each pair and said intermediate portion to bias each pair of plates together generally transversely with respect to the direction of movement of said insulating carrier and toward the adjacent inwardly projecting portion at one end of said carrier.

6. A circuit interrupter comprising an insulating housing having a base portion and wall portions extending away from said base portion to define a receptacle having an opening spaced away from said base portion, an insulating carrier including inwardly projecting portions at each end thereof and an intermediate inwardly projecting portion disposed to move rectilinearly into and out of said housing, one or more pairs of spaced contacts mounted on and projecting away from said base portion inside said housing toward said opening, one or more pairs of spaced contacts mounted on said carrier to engage corresponding contacts on said base portion when said carrier is moved into said housing and substantially surrounded by the insulating material of said carrier except in the direction of movement of said carrier into said housing, a pair of nested insulating plates disposed on said carrier between said intermediate portion and each inwardly projecting portion at the ends of said carrier and being slidably movable on said carrier to permit access between said plates to the contacts on said carrier when said carrier is moved into said housing and to close off access to said contacts when said carrier is moved out of said housing, and spring means disposed between one plate of each pair and said intermediate portion to bias each pair of plates together generally transversely with respect to the direction of movement of said insulating carrier and toward the adjacent inwardly projecting portion at one end of said carrier, each of the plates of each pair of plates including a plurality of alternate ridges and depressions extending transversely of the line of movement of said carrier and interfitting with those of the adjacent plate.

7. A circuit interrupter comprising an insulating housing having three laterally spaced openings at one end and being closed at the other end, three pairs of spaced upper and lower contacts mounted side by side inside and on the housing and accessible through said openings, three separate insulating contact carriers disposed to move rectilinearly into and out of said housing through said openings, spaced upper and lower contacts mounted on each carrier to engage corresponding contacts on said housing when the carrier is moved into the housing, the latter contacts being accessible for engagement with the corresponding contacts on said housing only in the direction of movement of the carrier into the housing and being substantially surrounded in all other directions by the insulating material of said carrier, a pair of relatively movable insulating plates mounted on each carrier adjacent to each contact on the carrier to close off access to the associated contact when the carrier is moved out of said housing and to permit access between said plates to the associated contact when said carrier is moved into said housing, and means for biasing said plates together intermediate the ends of said plates in a direction substantially transverse to the direction of movement of the associated carrier.

8. A circuit interrupter comprising an insulating housing having three laterally spaced openings at one end and

being closed at the other end, three pairs of spaced upper and lower contacts mounted side by side inside the housing and accessible through said openings, three separate insulating contact carriers disposed to move rectilinearly into and out of said housing through said openings, spaced upper and lower contacts mounted on each carrier to engage corresponding contacts on said housing when the carrier is moved into the housing, the latter contacts being accessible for engagement with the corresponding contacts on said housing only in the direction of movement of the carrier into the housing and being substantially surrounded in all other directions by the insulating material of said carrier, a pair of relatively movable insulating plates mounted on each carrier adjacent to each contact on the carrier to close off access to the associated contact when the carrier is moved out of said housing and to permit access between said plates to the associated contact when said carrier is moved into said housing, and means for biasing said plates together intermediate the ends of the plates in a direction substantially transverse to the direction of movement of the associated carrier, one contact of one of said pairs of contacts on said housing projecting out of said housing through the portion of said housing opposite the associated opening.

9. A circuit interrupter comprising a first insulating housing an opening therein between spaced side walls, a second insulating housing disposed inside said first housing to subdivide the opening of said first housing into three laterally spaced openings with the second housing providing an insulating barrier between the intermediate opening and each of the other laterally spaced openings, a pair of spaced contacts mounted on the first housing inside each laterally spaced opening, an insulating member disposed to move rectilinearly into and out of said housings through each of said laterally spaced openings, and a pair of spaced contacts mounted on each insulating member to engage corresponding contacts on said first housing when the associated insulating member is moved into at least one of said housings, at least one of the pair of contacts on said first housing inside said intermediate opening projecting outside said first housing in a direction away from said intermediate opening.

10. A circuit interrupter comprising a first insulating housing having an opening therein between spaced side walls, a second insulating housing disposed inside said first housing to subdivide the opening of said first housing into three laterally spaced openings with the second housing providing an insulating barrier between the intermediate opening and each of the other laterally spaced openings, a pair of spaced contacts mounted on the first housing inside each laterally spaced opening, an insulating member disposed to move rectilinearly into and out of said housings through each of said laterally spaced openings, a pair of spaced contacts mounted on each insulating member to engage corresponding contacts on said first housing when the associated insulating member is moved into at least one of said housings, at least one of the pair of contacts on said first housing inside said intermediate opening projecting outside said first housing in a direction away from said intermediate opening, a pair of insulating plates each including a planar portion disposed substantially parallel to the direction of movement of each insulating member, said plates being slidably disposed on each insulating member adjacent to each contact on said member to close off access to the associated contact on said member when said member is moved out of at least one of said housings, and means for yieldably biasing the planar portions of said plates together intermediate the ends of said planar portions transversely of the direction of movement of the associated insulating member to extinguish any arc which results when an insulating member is moved to disengage corresponding contacts on said first housing and said insulating member.

11. A circuit interrupter comprising an insulating housing including a rear wall portion and a plurality of laterally spaced wall portions which extend outwardly from said rear wall portion to define a plurality of laterally spaced openings at the front of said housing, an insulating plate formed of substantially non-tracking material disposed inside said housing adjacent to said rear wall portion, a pair of spaced upper and lower contacts mounted on said plate inside each opening and projecting toward the front of said housing, a plurality of insulating members disposed to slidably move into and out of said housing through the respective laterally spaced openings, a pair of spaced upper and lower contacts mounted inside each insulating member with an opening adjacent to each contact to permit engagement by a corresponding contact on said housing when said insulating member is moved into said housing, at least one contact on said housing projecting through the rear wall portion outside said housing, said plate including a tubular insulating portion which passes through said rear wall portion and projects outside said housing to enclose at least a portion of the latter contact outside said rear wall portion, a pair of insulating plates slidably mounted on said insulating member adjacent to the opening associated with each contact on said insulating member, each of said plates including a planar portion which substantially meets that of the associated plate in a plane substantially parallel to the direction of movement of the associated insulating member when said insulating member is moved out of said housing, and means for yieldably biasing each pair of plates together intermediate the ends of the plates when the associated insulating member moves out of said housing to disengage corresponding contacts on said housing and said member with one of the contacts passing between the associated pair of plates.

12. A circuit interrupter comprising an insulating housing including a rear wall portion and a plurality of laterally spaced wall portions which extend outwardly from said rear wall portion to define a plurality of laterally spaced openings at the front of said housing, an insulating plate formed of substantially non-tracking material disposed inside said housing adjacent to said rear wall portion, a pair of spaced upper and lower contacts mounted on said plate inside each opening and projecting toward the front of said housing, a plurality of insulating members disposed to move rectilinearly into and out of said housing through the respective laterally spaced openings, a pair of spaced upper and lower contacts mounted inside each insulating member with an opening adjacent to each contact to permit engagement by a corresponding contact on said housing when said insulating member is moved into said housing, at least one contact on said housing projecting through the rear wall portion outside said housing, said plate including a tubular insulating portion which passes through said rear wall portion and projects outside said housing to enclose at least a portion of the latter contact outside said rear wall portion and a conducting member disposed inside at least one insulating member to electrically connect the upper and lower contacts associated with said insulating member.

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