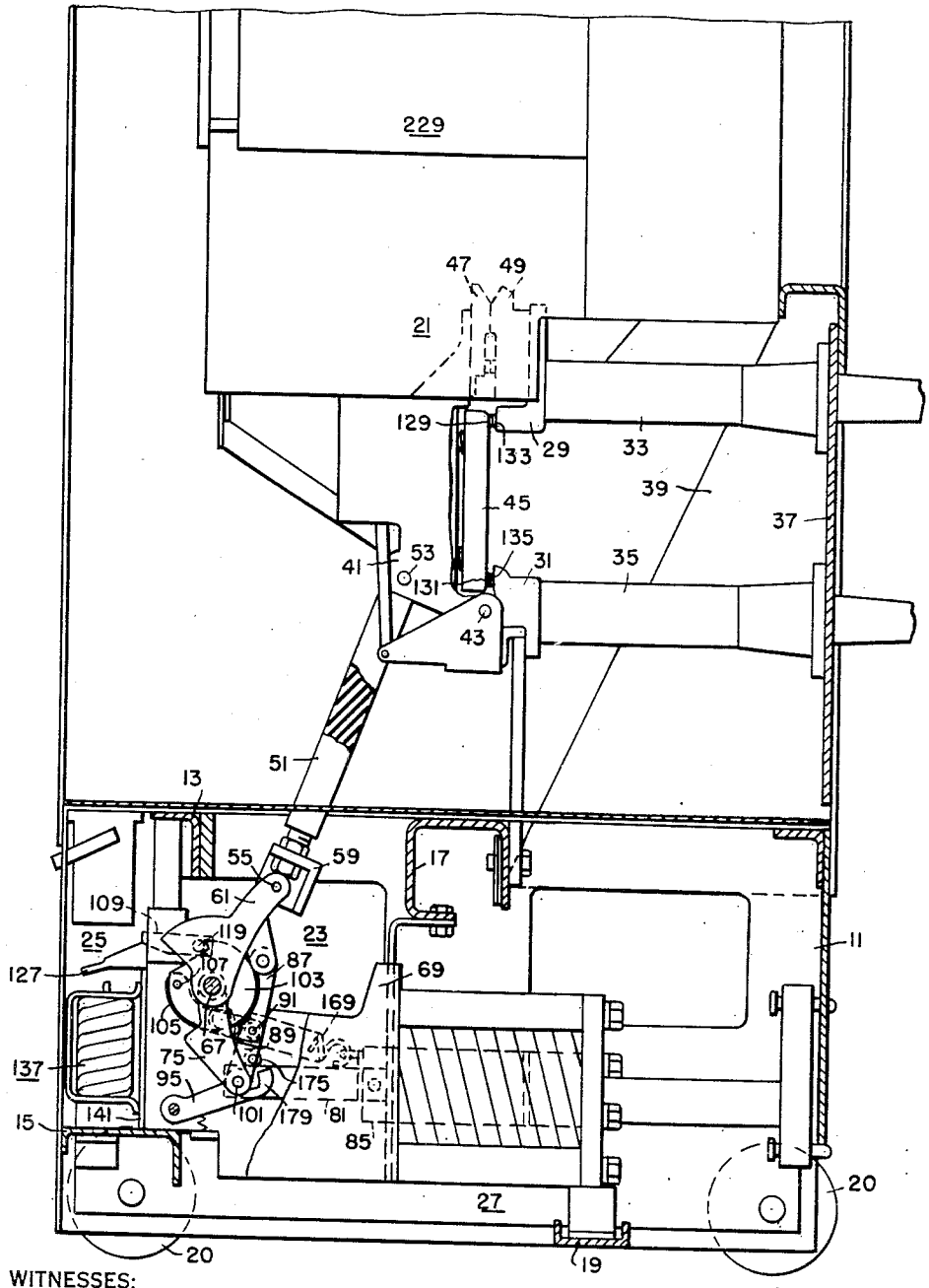
Oct. 30, 1956 E. G. KEES 2,769,062

AIR CIRCUIT BREAKER CONTACTS

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Fig.1.



WITNESSES:

E. A. McCloskey.

Paul O. Harlin.

INVENTOR

Ernest G. Kees.

BY

Ralph L. Swingle

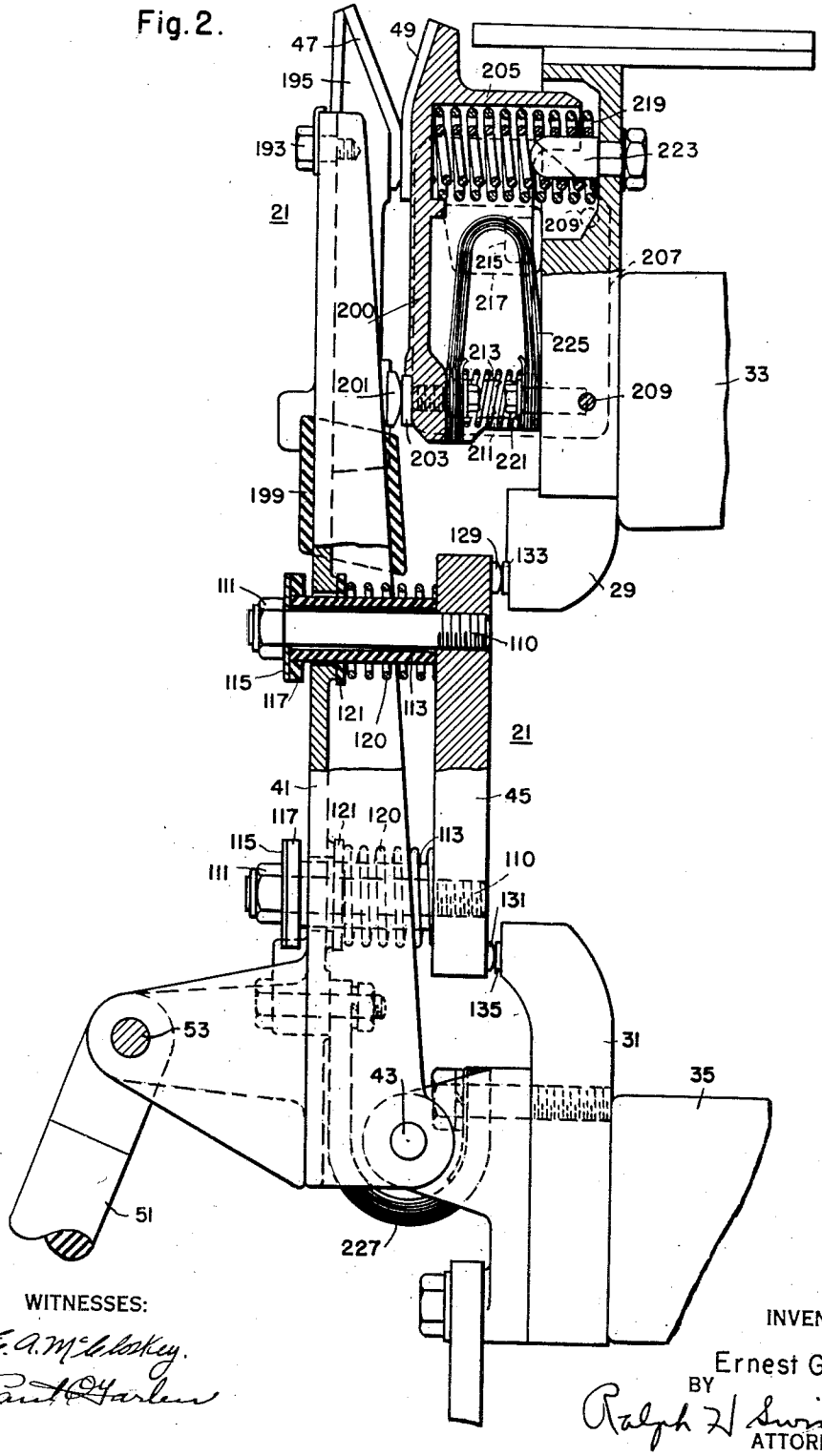
ATTORNEY

Oct. 30, 1956 E. G. KEES 2,769,062

AIR CIRCUIT BREAKER CONTACTS

Filed Oct. 21, 1952 3 Sheets-Sheet 2

Fig. 2.



WITNESSES:

E. A. McGlothlin.

Paul O. Harlow

INVENTOR

Ernest G. Kees.

BY

Ralph W. Swingle

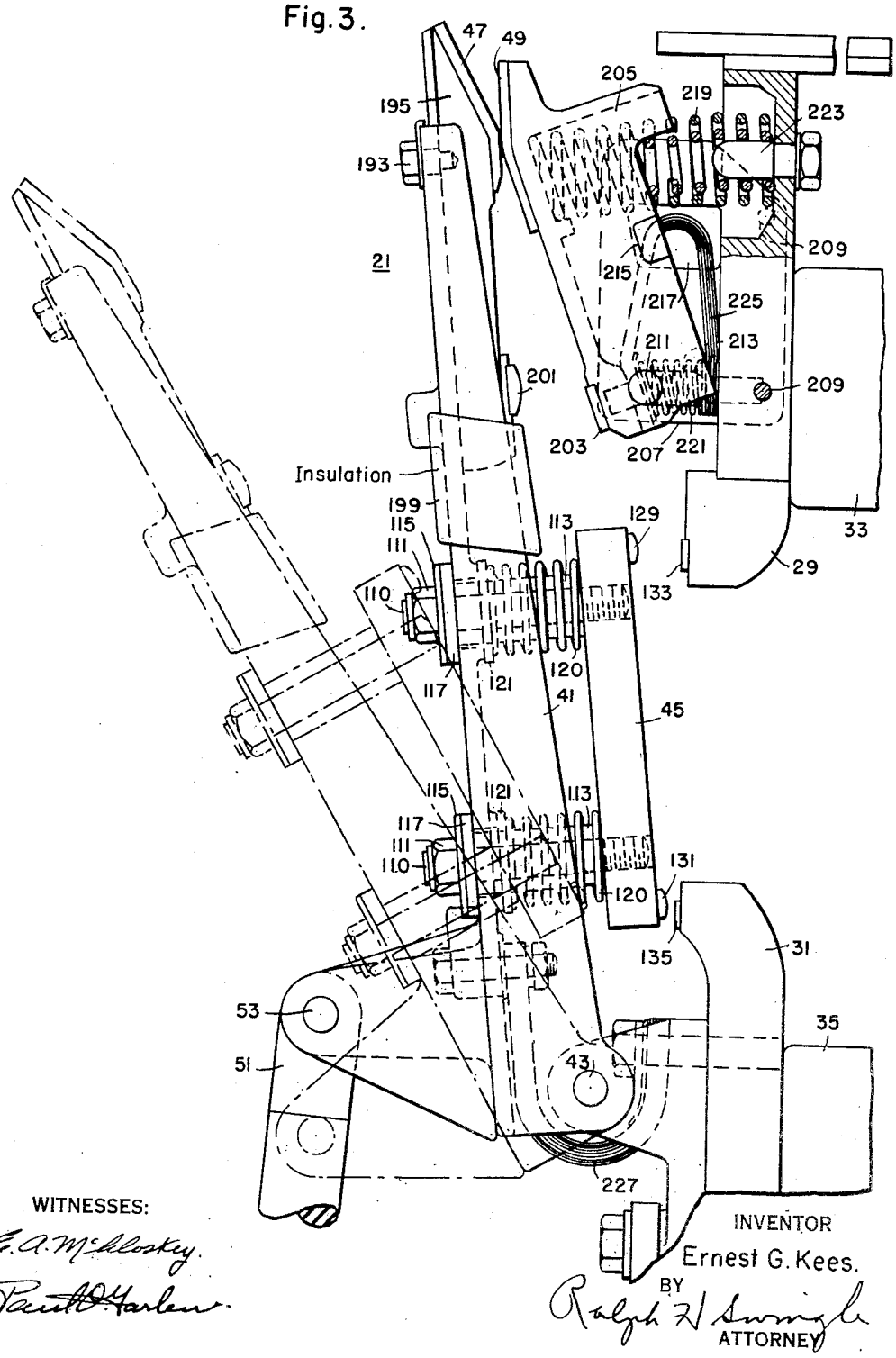
ATTORNEY

Oct. 30, 1956 E. G. KEES 2,769,062

AIR CIRCUIT BREAKER CONTACTS

Filed Oct. 21, 1952 3 Sheets-Sheet 3

Fig. 3.



WITNESSES:

E. A. McCloskey.

Paul O. Harlow.

INVENTOR

Ernest G. Kees.

BY

Ralph L. Scrivner

ATTORNEY

United States Patent Office

2,769,062

Patented Oct. 30, 1956

2,769,062

AIR CIRCUIT BREAKER CONTACTS

Ernest G. Kees, Pittsburgh, Pa., assignor to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania

Application October 21, 1952, Serial No. 315,935

10 Claims. (Cl. 200—144)

This invention relates to circuit breakers and, more particularly, to contact structures for air circuit breakers.

Conventional air circuit breakers are usually provided with one or more sets of contacts which are designed to by-pass a large portion of the current for a short interval of time during circuit interruptions for the purpose of minimizing damage to the main contacts. The sets of contacts usually separate in sequence during a circuit opening operation with the main contacts separating first, the intermediate contact second and the arcing contacts last to draw the arc. Under certain conditions a switching surge may be produced which will cause the arc to transfer its moving terminal to the moving main contact or to the upper portion of the moving switch arm from where it may move outside the arcing chamber and cause severe damage to the breaker or failure thereof.

An object of the invention is to provide a circuit breaker embodying an improved contact structure which tends to prevent the arc drawn upon separation of the breaker contacts from moving outside the arc extinguishing chamber.

Another object of the invention is to provide a circuit breaker with an improved contact structure which fits into a relatively small space and has high current-carrying capacity.

Another object of the invention is to provide a circuit breaker with an improved contact structure having high interrupting and current-carrying capacities which is rugged and durable in construction.

Another object of the invention is to provide a circuit breaker with an improved contact arrangement according to the preceding paragraphs wherein the main movable contacts are insulated from the moving switch arm on which they are mounted.

Other objects and advantages of the invention will be pointed out in the following description and illustrated in the accompanying drawings, which disclose, by way of example, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

In said drawings:

Figure 1 is a side elevational view, partly in section, of a circuit breaker embodying the principles of the invention;

Fig. 2 is an enlarged side elevational view, partly in section, showing the improved contact structure in the closed-contact position;

Fig. 3 is a view similar to Fig. 2 but showing the contacts in full lines in the position at which the arcing contacts are about to separate and in dot-and-dash lines in the full open position.

Referring to Fig. 1 of the drawings, the circuit breaker is of the roll-out type and is mounted on a truck comprising a pair of side plates 11 (only one being shown) which are rigidly joined by cross members 13, 15, 17 and 19 to form a rigid frame for supporting the circuit breaker. The truck is mounted on wheels 20 to facilitate rolling the breaker into and out of a cubicle in order to

connect and disconnect the breaker in an electrical circuit.

The circuit breaker is of the multi-pole type (only one pole being shown) and comprises generally a plurality of sets of separable contact means 21, a common operating mechanism 23, a trip device 25, and a closing means 27.

The contact means consists generally of stationary contact blocks 29 and 31 mounted respectively on upper and lower terminal members 33 and 35 which, in turn, are rigidly supported on a back plate 37. The back plate 37 is rigidly supported by angular brackets 39 (only one being shown) rigidly secured to the side plates 11 of the frame. The detailed description of the improved contact structure will be fully described hereinafter.

The specific structures of the operating mechanism, trip mechanism and the closing means shown are fully disclosed in Patent No. 2,515,994, issued July 18, 1950, to Joseph D. Findley, Alvin W. Ogg, and Fritz E. Florschutz and assigned to the assignee of the instant invention, for which reason only a brief description of these mechanisms is given herein.

A switch arm 41 for operating the movable contacts (there being a switch arm 41 for each pole of the breaker) is pivotally mounted by a pivot pin 43 on the lower terminal member 35 and is operatively connected by means of an insulating operating rod 51 to the operating mechanism 23. The upper ends of the operating rods 51 are pivotally connected by pivot pins 53 to the corresponding switch arms 41, and the lower ends of the operating rods are connected by suitable means to an angular crossbar 59 which is common to all of the poles of the breaker. The crossbar 59 is pivotally connected at its ends by pivot pins 55 (only one being shown) to an operating lever 61 which is pivotally mounted on a shaft 67 supported in the side members of a generally U-shaped frame 69. The frame 69 is supported on the cross members 13, 15 and 17 and is shown partly broken away more clearly to show the operating mechanism.

In addition to the operating lever 61, the operating mechanism consists of a closing lever 75 also mounted on the shaft 67 and connected by means of a link 81 to the movable armature 85 of the closing solenoid 27. The operating lever 61 and the closing lever 75 are connected by means of an underset thrust-transmitting toggle comprising toggle links 87 and 89 pivotally connected together by a knee pivot pin 91. The toggle link 87 is pivotally connected to the operating lever 61 and the toggle link 89 is pivotally connected to the closing lever 75.

The closing lever 75 is held in the closed position by a spring-biased latch 95 which normally engages a roller 101 on the closing lever and holds the latter in the position shown.

The toggle 87—89 is releasably held in a slightly underset position by a latch member 103 mounted on the shaft 67 for movement relative thereto. A link 105 connects the knee of the toggle 87—89 to the latch member 103 which is normally releasably held in latching position by the latching and tripping mechanism 25. This mechanism comprises a trip member 109 carrying a latch roller 119 engaging a shoulder on the latch member 103 to releasably restrain the latter and the toggle 87—89 in thrust-transmitting position.

The latch 109 is of the slip-off type, and a trigger latch 127 is provided to releasably restrain the latch member 109 and the latch roller 119 in latching position. A tripping electromagnet 137 is provided to operate the latch mechanism and effect release of the operating mechanism and opening of the circuit breaker.

When an overload current occurs, the tripping electromagnet 137 is energized and operates the latch mechanism

to effect release of the latch 109 which, in turn, releases the latch member 103. Upon release of the latch member 103, the toggle 87—89 immediately collapses, permitting clockwise rotation of the operating lever 61 and opening movement of the switch arms 41 for the several poles of the breaker.

The toggle 87—89 is reset to its thrust-transmitting position, and the latch member 103 is reset and relatched automatically during the opening operation. This is effected by a pair of springs 169 (only one being shown) connected under tension between the armature 85 and the closing lever 75 at a point near the shaft 67. When the toggle 87—89 collapses, a roller 175 on the toggle link 89 engages a nose 179 on this latch 95 and moves the latch 95 to disengage the latter from the roller 101, thus releasing the closing lever 75 whereupon the springs 169 move the armature 85 and through the link 81 rotate the closing lever 75 clockwise. This movement extends the toggle 87—89 to its underset position and through the link 105 rotates the member 103 clockwise to its latching position, permitting resetting of the latching mechanism to latching position. Thereafter, the circuit breaker is closed by energization of the closing solenoid 27 from any suitable source. When energized, the solenoid 27 attracts its armature 85 and through the link 81 rotates the closing lever 75 counterclockwise. Since the toggle 87—89 is held in thrust-transmitting position, the movement of the closing lever is transmitted therethrough and actuates the operating lever 61 and the rods 51 to close the contact means 21. As the mechanism reaches the closed position, the latch 95 re-engages the roller 101 and restrains the breaker mechanism in the closed circuit position.

Referring now to Fig. 2 of the drawings, the switch arm 41 is channel-shaped and carries a bridging contact member 45. The bridging contact member is mounted on the switch arm 41 for limited movement relative thereto by means of a pair of spaced bolts 110 threaded into tapped openings in the bridging member 45 and extending through openings in the channel-shaped switch arm 41. The ends of the bolts 110 on the side of the switch arm 41 opposite the bridging contact member 45 have nuts 111 thereon to retain the bridging contact member in position.

The bridging contact member 45 is completely insulated from the switch arm 41 by means of insulating sleeves 113 surrounding the bolts 110 and extending through the openings in the switch arm 41. A metal washer 115 is disposed between the nuts 111 and the ends of the sleeves 113, the other ends of the sleeves 113 abutting against the bridging contact member 45. Insulating washers 117 surrounding the sleeves 113 are disposed between the metal washers 115 and the back of the switch arm 41. Coil springs 120 surrounding the sleeves 113 and compressed between the bridging contact member and insulating washers 121 bias the bridging contact member 45 away from the switch arm 41 and provide contact pressure in the closed position of the switch arm 41.

The bridging contact member has rigidly mounted thereon adjacent its ends contact members 129 and 131 which are adapted to cooperate respectively with fixed contacts 133 on the contact block 29 and 135 on the contact block 31.

Mounted on the upper or free end of the switch arm 41 by means of a bolt 193 is a contact block 195 which carries the movable arcing contact 47 and also a movable intermediate contact 201. The movable intermediate contact 201 cooperates with a stationary intermediate contact 203, which together with the stationary arcing contact 49, is mounted on a contact platform 205. The contact platform 205 is mounted on the upper stationary contact block 29 for limited movement relative thereto by means of a pair of spaced plates 207 (only one being shown) disposed one on each side of the contact block 29 and rigidly secured thereto by means of bolts 209.

The platform 205 is provided with laterally extending studs 211 (only one being shown) disposed adjacent the lower end thereof and extending into elongated slots 213 in the plates 207 for supporting the lower end of the platform for limited movement. Ears 215 (only one being shown) extend laterally from the sides of the platform 205 into substantially rectangular openings 217 in the plates 207 to limit the movement of the platform.

The platform is biased outwardly away from the contact block 27 by means of a coil spring 219 disposed adjacent the upper end of the platform and a coil spring 221 located near the lower end of the platform 205. The springs 219 and 221 are compressed between the contact block 29 and the contact platform 205 and the spring 219 is provided with a guide stud 223 secured to the contact block 29.

The contact platform 205 is electrically connected to the upper contact block 29 by means of a flexible conductor 225, and a flexible conductor 227 electrically connects the pivoted end of the switch arm 41 to the lower contact block 31. In the closed position of the circuit breaker the circuit extends from the upper terminal 33, contact block 29, contacts 133, 129, the bridging contact member 45, contacts 131, 135 and the contact block 31 to the lower terminal 35. Another circuit extends through the arcing contacts 49, 47, and intermediate contacts 203, 201, contact block 195, switch arm 41 and the flexible conductor 227 to the lower contact block 31.

When the tripping electromagnet 137 (Fig. 1) is energized to effect the collapse of the toggle 87, 89, the operating lever 61 starts to rotate clockwise permitting downward movement of the rod 51 and movement of the switch arm 41 about its pivot 43 in opening direction. As the switch arm 41 (Figs. 2 and 3) moves in opening direction the contacts 129, 131 under the force of the springs 120 remains in engagement with the stationary contacts 133, 135 respectively until the insulating washers 117 engage the back of the switch arm 41. Thereafter the bridging contact member will move in opening direction with the switch arm 41.

The contact platform 205, under the influence of the springs 219, 221 will follow the moving arcing and intermediate contacts 47, 201, respectively until the studs 211 engage the left walls of the slots 213 in the plates 207. Thereafter the platform 205 will turn counterclockwise about the studs 211 until the ears 215 engage the left walls of the openings 217 in the plates 207. The intermediate contacts 201, 203 start to separate upon engagement of the studs with the ends of the slots 213 and the arcing contacts 47, 49 start to separate when the ears 215 are arrested by the walls of the openings 217.

Figure 3 illustrates in full lines the contact structure at the point in the opening operation when the arcing contacts 47, 49 are about to separate, and shows the switch arm 41 in the full open position by dot and dash lines. Continued movement of the switch arm 41 in opening direction will cause separation of the arcing contacts 47, 49 drawing the arc between them. The arc is drawn into an arc extinguishing structure indicated generally at 229 (Fig. 1) when it is quickly extinguished. The arc extinguishing structure 229 may be of any suitable type, but is preferably of the type fully disclosed in Patent No. 2,442,199 issued May 25, 1948, to R. C. Dickinson and R. E. Frink and assigned to the assignee of the present invention.

In the type of circuit breaker illustrated the arc will usually be drawn between the arcing contacts 47, 49. Under certain conditions when the circuit constants give a low damping factor and the current is of sufficient magnitude, a switching surge may be produced which will cause the arc to tend to transfer its moving terminal to the moving main contact or to the upper portion of the moving contact arm from where it may move out of the throat of the arcing chamber and cause failure of the breaker or severe damage thereto.

In order to prevent the arc from striking to the upper

portion of the switch arm 41 adjacent the main and intermediate contacts, a sleeve 199 of insulating material surrounds that portion of the switch arm. By completely insulating the bridging contact members 45 from the switch arm 41 the arc is prevented from transferring to the main contacts upon separation thereof. Thus any tendency of the arc to establish itself on the moving switch arm 41 is limited to the area adjacent the arcing contacts which is within the arc extinguishing structure.

Having described the invention specifically in accordance with the provisions of the patent statutes, it is to be understood that various changes and modifications can be made without departing from the spirit of the invention.

I claim as my invention:

1. A circuit interrupter comprising spaced stationary contacts, a current carrying switch member movable between open and closed positions and electrically connected to one of said stationary contacts, a main bridging contact mounted on said movable switch member for limited movement relative thereto and engageable with said spaced stationary contacts when said movable switch member is moved to closed position, spaced support members on said bridging contact movable relative to said switch member for slidably supporting said bridging contact on said movable switch member, insulating means surrounding said support members for insulating said bridging contact from said movable switch member, and spring means between said movable switch member and said bridging contact providing contact pressure in the closed position of said movable switch member.

2. A circuit interrupter comprising spaced stationary contacts, a switch member movable between open and closed positions, a main bridging contact mounted on said movable switch member for limited movement relative thereto and engageable with said spaced stationary contacts when said movable switch member is moved to closed position, spaced support members on said bridging contact movable relative to said switch member for slidably supporting said bridging contact on said movable switch member, insulating means surrounding said support members for insulating said bridging contact from said movable switch members, and spring means between said movable switch member and said bridging contact providing contact pressure in the closed position of said movable switch member.

3. A circuit interrupter comprising spaced stationary contacts, a switch member movable between open and closed positions, a bridging contact mounted on said movable switch member for limited movement relative thereto and engageable with said spaced stationary contacts when said movable switch member is moved to closed position, spaced support members rigidly mounted on said bridging contact and extending through openings in said movable switch member for slidably supporting said bridging contact on said movable switch member, insulating sleeves surrounding said support members for insulating said bridging contact from said movable switch member, insulating washers surrounding said support members adjacent said movable switch members, and spring means surrounding said insulating sleeves and compressed between said insulating washers and said bridging contact to provide contact pressure in the closed position of said movable switch member.

4. A circuit interrupter comprising a movable switch member, means for actuating said switch member to open and closed positions, a main bridging contact mounted on said movable switch member for limited sliding movement relative thereto, spaced stationary contacts cooperating with said main bridging contact member in the closed position of said movable switch member, a stationary arcing contact, a movable arcing contact mounted on said movable switch member and cooperating with said stationary arcing contact to establish an arc, an arc chute having means therein for extinguishing said arc, support means slidably supporting said bridging contact member on said movable switch member, insulating means insulating said bridging contact member from said movable switch member, and insulating means mounted on and surrounding said movable switch member adjacent said arc chute, said insulating means preventing the arc from striking across to the movable switch member outside of said arc chute.

5. A circuit interrupter comprising a movable switch member movable to open and closed position, a main bridging contact member mounted on said movable switch member, spaced stationary contacts cooperating with said main bridging contact member in the closed position of said movable switch member, a stationary arcing contact, a movable arcing contact rigid with said movable switch member cooperating with said stationary control for establishing an arc, an arc chute having arc extinguishing means thereon, support members supporting said main bridging contact member on said movable switch member for limited sliding movement relative thereto, insulating means comprising insulating tubes surrounding said support members and insulating washers on said insulating tubes disposed on opposite sides of said movable switch member for insulating said main bridging contact member from said movable switch member, insulating means mounted on and surrounding said movable switch member adjacent said arc chute, and said insulating means preventing the arc from striking outside said arc chute and from moving outside said arc chute after the arc is established within said arc chute.

6. A circuit interrupter comprising spaced stationary contacts, a switch member movable between open and closed positions, a main bridging contact mounted on said movable switch member for limited movement relative thereto and engageable with said spaced stationary contacts when said movable switch member is moved to closed position, support members on said bridging contact movable relative to said switch member for supporting said bridging contact on said movable switch member, insulating means on said support members for insulating said bridging contact from said movable switch member, spring means between said movable switch member and said bridging contact providing contact pressure in the closed position of said movable switch member, and insulating means preventing current flow through said spring means.

7. A circuit interrupter comprising spaced stationary contacts, a current carrying switch member movable between open and closed positions and electrically connected to one of said stationary contacts, a bridging contact carried by but insulated from said switch member for cooperating with said stationary contacts, means mounting said bridging contact on said switch member permitting movement of said bridging contact relative to said switch member, and said bridging contact in the open position of said switch member being insulated from said stationary contacts.

8. A circuit interrupter comprising spaced stationary contacts, a movable switch member movable between open and closed positions and at all times electrically connected to one of said stationary contacts, a rigid bridging member mounted on said movable switch member for cooperating with said stationary contacts, said rigid bridging member being insulated from said movable switch member, means mounting said rigid bridging member on said movable switch member for movement relative thereto, and said rigid bridging member being insulated from said stationary contacts in the open position of said movable switch member.

9. A circuit interrupter comprising spaced stationary contacts, a movable switch member movable between open and closed positions, said movable switch member being electrically connected to one of said stationary contacts, a bridging contact carried by but insulated from said movable switch member for cooperating with said

spaced stationary contacts, means mounting said bridging contact on said movable switch member permitting movement of said bridging contact relative to said movable switch member, said bridging contact in the open position of said movable switch member being insulated from said stationary contacts, and insulating means surrounding said movable switch member above said bridging contact.

10. A circuit interrupter comprising spaced stationary contacts, a movable switch member movable between open and closed positions and at all times electrically connected to one of said stationary contacts, a rigid bridging member mounted on said movable switch member for cooperating with said stationary contacts, said rigid bridging member being insulated from said movable switch member, means mounting said rigid bridging member on said movable switch member for movement relative thereto, said rigid bridging member being insulated from said stationary contacts in the open position of said movable switch member, and insulating means surrounding said movable switch member just above said rigid bridging member.

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