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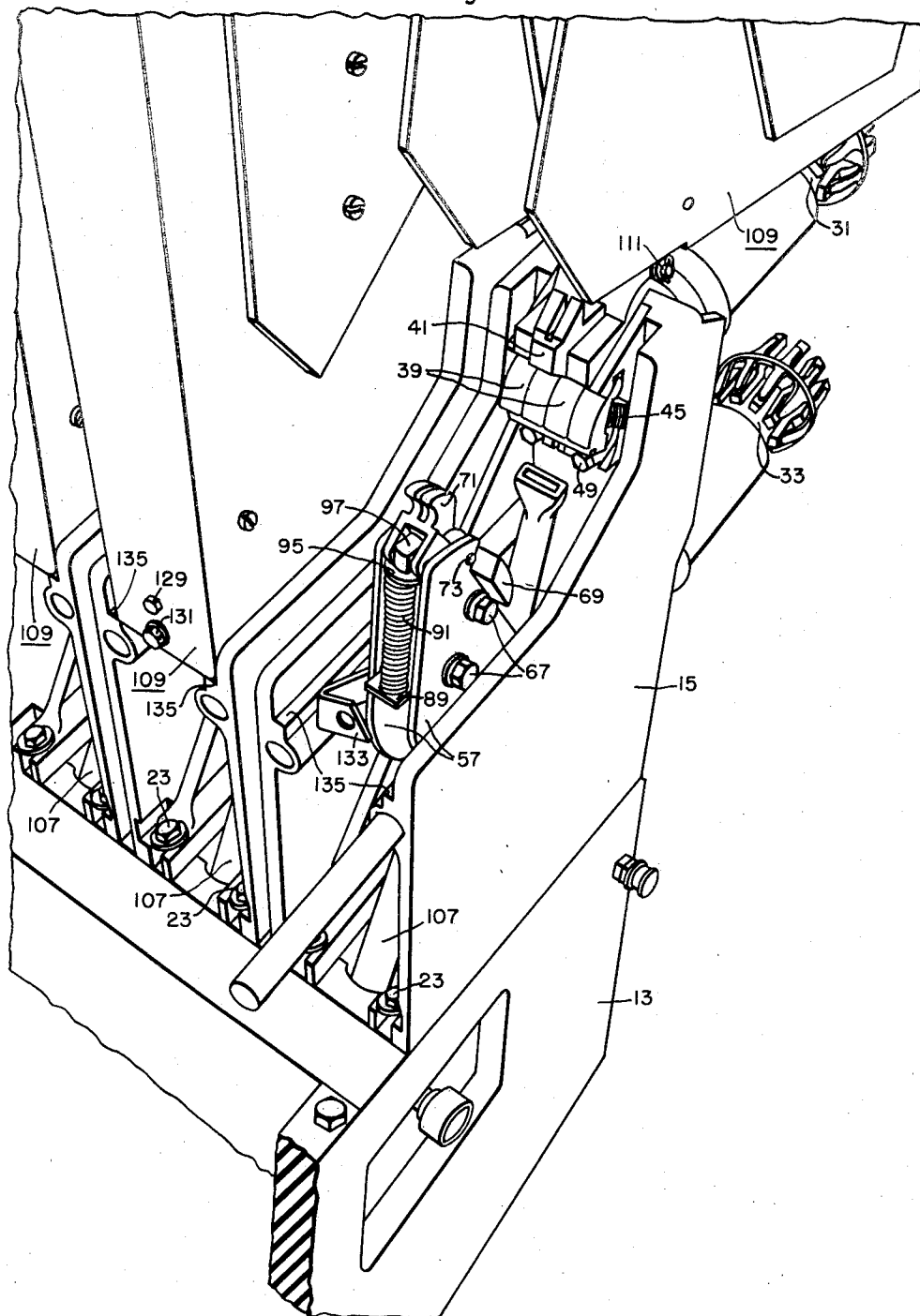
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CIRCUIT BREAKER

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Fig. 3.



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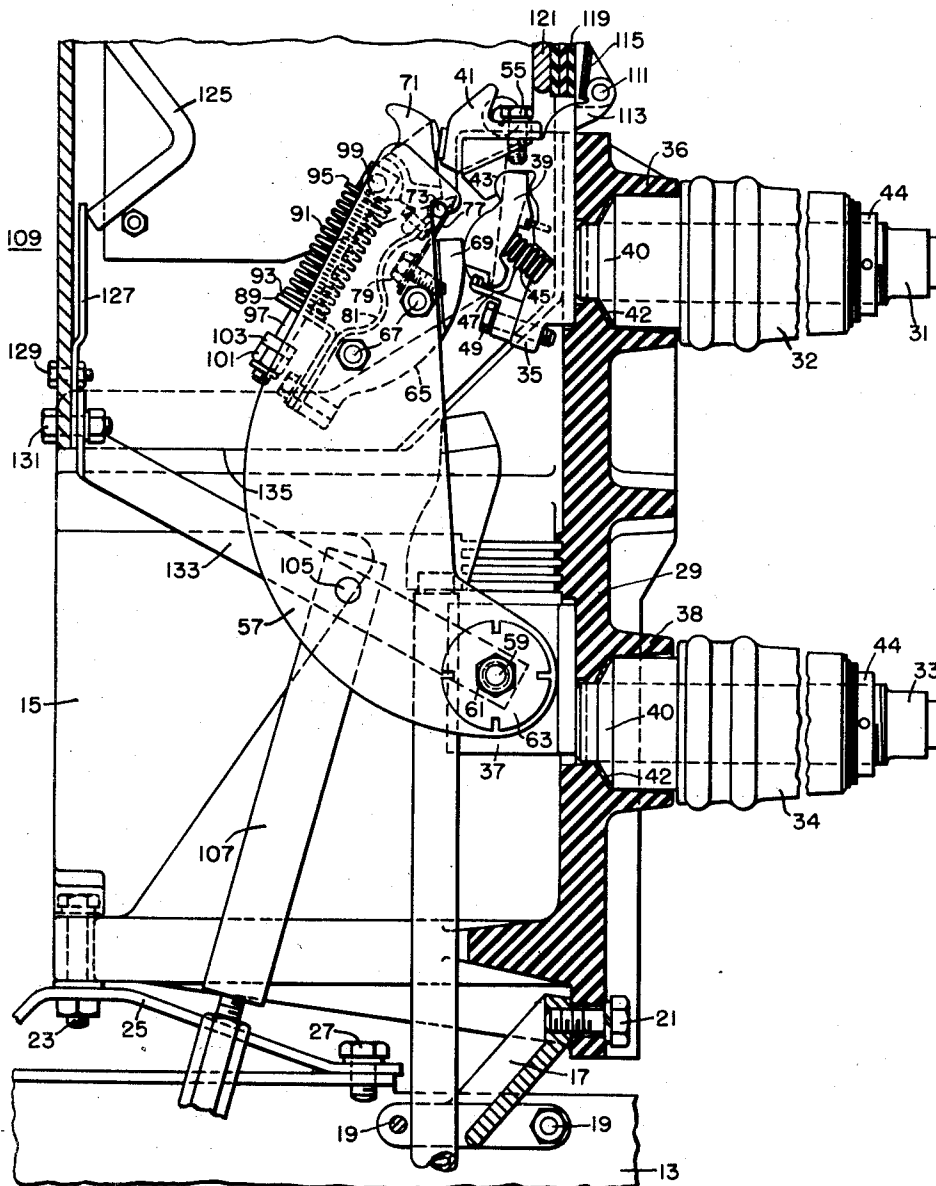
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Fig. 4.



WITNESSES

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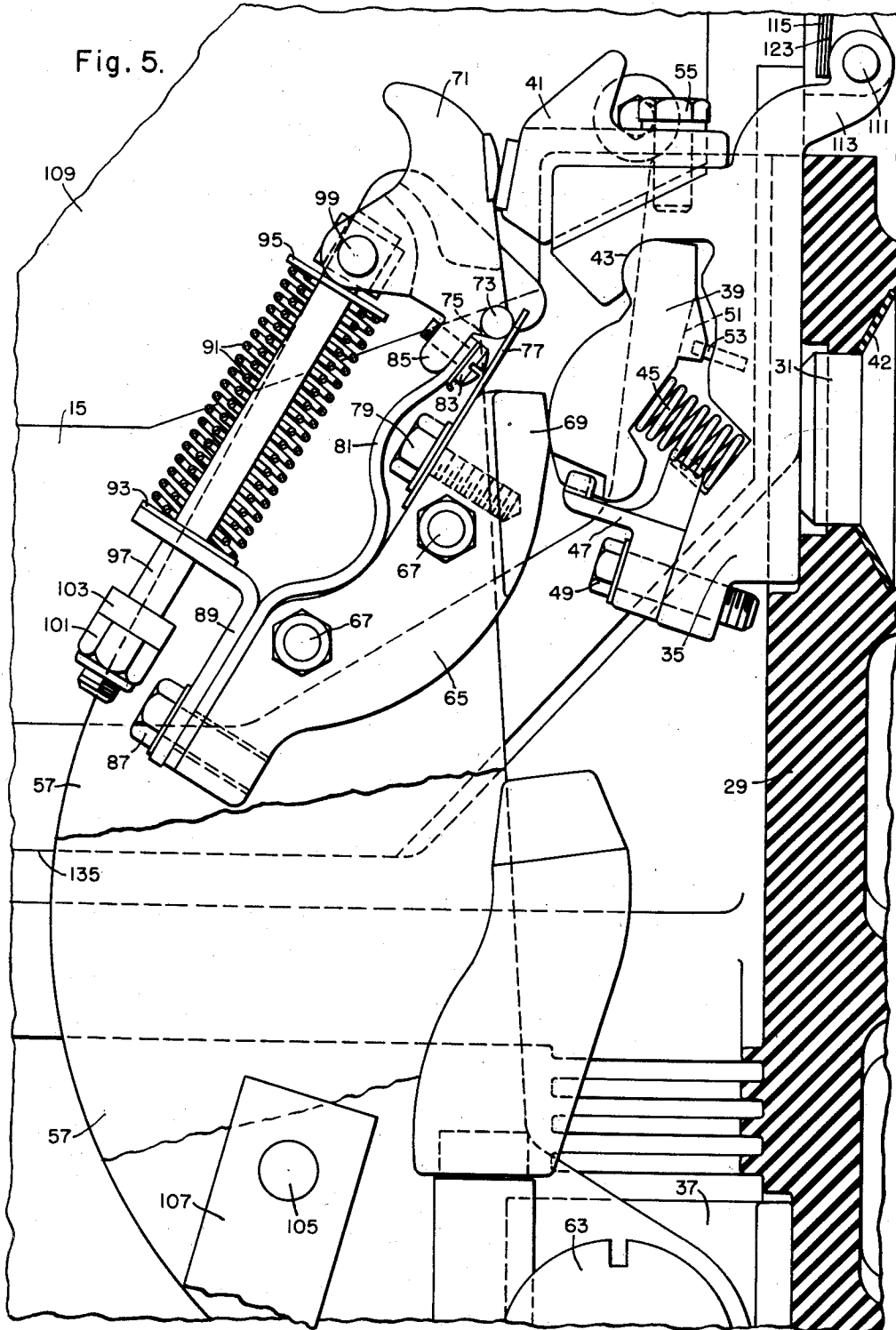
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CIRCUIT BREAKER

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Fig. 5.



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2,866,043

CIRCUIT BREAKER

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Application August 23, 1955, Serial No. 530,062

13 Claims. (Cl. 200—144)

This invention relates to circuit interrupters and more particularly to air circuit interrupters for interrupting high voltages.

An object of the invention is to provide a circuit interrupter embodying an improved contact structure.

Another object of the invention is to provide a circuit interrupter embodying self-aligning contacts.

Another object of the invention is to provide a circuit interrupter in which the contact structure is disposed within a U-shaped channel frame of molded insulating material.

Another object of the invention is to provide a circuit interrupter in which the contact structure is disposed within a U-shaped channel frame of molded insulating material and in which the terminal studs and bushings are mounted on the insulating frame without the use of a metal frame or metal flanges.

Another object of the invention is to provide a circuit interrupter embodying an arc chute which is hinged on the upper contact block.

The invention both as to structure and operation, together with additional objects and advantages thereof, will be best understood from the following description thereof when read in conjunction with the accompanying drawings.

In said drawings:

Figure 1 is a side elevational view of one of the pole units of the circuit interrupter.

Fig. 2 is a detail sectional view showing the hinge arrangement for the arc chute.

Fig. 3 is a perspective view of the circuit interrupter with one of the arc chutes shown in the hinged open position.

Fig. 4 is a vertical sectional view taken through one of the pole units showing the contact structure.

Fig. 5 is an enlarged elevational view, partly in section, showing the contact structure.

The circuit interrupter comprises generally a plurality of pole unit assemblies 11 (Fig. 1) which are individually mounted on a base structure 13. Since the pole units are the same only one will be described. The pole unit comprises a channel-shaped frame 15 of high strength molded insulating material rigidly mounted on the base 13 by means of a bracket 17 (Figs. 1 and 4) secured to the base 13 by means of bolts 19, the frame 15 being secured to the bracket by bolts 21, only one being shown. The front of the frame 15 is secured by means of bolts 23 to a bracket 25 which is secured to the base structure 13 by bolts 27.

Supported in the rear wall 29 of the insulating frame 15 is an upper terminal stud 31 and a lower terminal stud 33. The studs 31 and 33 extend through suitable openings in the rear wall 29 of the frame 15 and have contact blocks or feet 35 and 37 respectively brazed or otherwise suitably secured to their inner ends. Surrounding the studs 31 and 33 respectively are insulating bushings 32 and 34 which extend into suitable openings in cylindrical

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extensions 36 and 38 molded integral with the rear wall of the insulating channel frame 15. The inner ends of the bushings 32—34 have beveled or conical surfaces 40 thereon which engage with similar surfaces on the frame 15 with resilient washers 42 between the surfaces. The purpose of the washers 42 is to take up any slight irregularities in the conical surfaces upon tightening of nuts 44 which are threaded onto the outer ends of the studs 31—33, thereby providing for accurate positioning and alignment of the studs. Making the channel-shaped frame 15 of a high-strength insulating material permits mounting the studs 31—33 and the bushings 32—34 directly on the frame without the use of the conventional metal flanges on the bushings. This reduces the size and cost of the circuit interrupter.

The upper block 35 supports the stationary main contacts 39 and the stationary arcing contact 41. The stationary main contacts 39 of which there are four for each pole unit (see Fig. 3) are pivotally supported inside an overhanging portion 43 on the block 35 and are biased outwardly by springs 45 to the closed contact position. A stop member 47 is secured to the lower portion of the block 35 by bolts 49 to limit pivotal movement of the contact members 39. Each of the contact members 39 has a slot 51 therein which engages a pin 53 projecting from the block 35 to hold the contacts in alignment. The stationary arcing contact member 41 is secured to the top portion of the block 35 by a bolt 55. The upper contact block 35, together with a hinge projection 113, the lower contact block or contact hinge member 37 and the stationary arcing contact 41 are all made from extruded sections thereby further reducing the cost of the circuit interrupter.

Spaced switch arms 57 (Figs. 3, 4 and 5) are formed from flat copper punchings and are pivotally mounted one on each side of the lower block or contact hinge member 37, by a bolt 59 and nut 61. A spring washer 63 compressed between the nut 61 and one of the switch arms 57 provides good electrical contact between the block 37 and the switch arms 57. A movable main contact member 65 is rigidly mounted by means of bolts 67 between the movable switch arms 57 and has a wide contact portion 69 for cooperating with all of the stationary contact members 39 for its pole unit. A movable arcing contact member 71 is provided with integral trunnions 73 which extend from opposite sides thereof and pivotally engage pivot recesses 75 in the upper ends of the switch arms 57. The trunnions 73 and the moving arcing contact member 71 are held in position by a clip 77 mounted by means of a bolt 79 on the moving main contact member 65. The moving arcing contact member 71 is electrically connected to the main moving contact member 65 by a flexible conductor 81 having its upper end secured by means of a screw 83 to a projection 85 of the moving arcing contact and its lower end secured to the main movable contact member by a bolt 87. The bolt 87 also secures an angular bracket 89 to the main moving contact member 65.

The moving arcing contact 71 is biased in a clockwise direction to the closed contact position by springs 91 compressed between a washer 93 bearing against the bracket 89 and a washer 95 which bears against the moving arcing contact 71. A rod 97 having one end pivotally connected by a pin 99 to the moving arcing contact 71 extends axially through the coil springs 91 and through an opening in the bracket 89. The lower end of the rod 97 is threaded to receive a nut 101 and a spacer 103 is mounted on the rod between the nut 101 and the bracket 89. The nut 101 serves as an adjustable stop to limit the movement of the moving arcing contact 71 relative

to the switch arms 57 and the rod 97 acts as a guide for the springs 91.

Pivotaly connected to each of the moving contact structures by means of a pin 105, is an operating rod 107. The operating rod 107 for each of the poles of the breaker at its lower end is connected to a common cross bar (not shown) but which is operated by a suitable operating mechanism to move the movable contact structure for all of the poles to open and closed positions in unison.

The operating mechanism may be of any suitable type but is preferably of the general type disclosed in Patent No. 2,515,994, issued July 18, 1950 to Joseph D. Findley, Jr., Alvin W. Ogg and Fritz E. Florschutz and assigned to the assignee of this invention. The operating mechanism disclosed in this patent includes the common bar to which the operating rods for the several poles of the interrupter are connected for unitary movement, trip means for tripping the circuit interrupter free of the operating mechanism and a closing solenoid for actuating the operating mechanism to close the interrupter. The operating mechanism and the movable contact structure for all of the poles of the interrupter are releasably held in closed position by the trip mechanism and are biased in opening direction by the springs 45 and 91 and by spring means (not shown) on the operating mechanism.

When the trip mechanism functions in response to an abnormal circuit condition, as fully described in the previously mentioned Patent No. 2,515,994, the operating mechanism is released whereupon the operating rods 107 are moved downwardly and the moving contacts are moved quickly to the open position about pivot 59.

The main current path through the interrupter is from the upper terminal 31 (Figs. 4 and 5), through contact block 35, the main stationary contacts 39, the main moving contact 69, the moving switch members 57 and the conducting block 37 to the lower terminal 33. A parallel current path is formed from the upper terminal 31 through contact block 35, the stationary arcing contact 41, the moving arcing contact 71, through the flexible conductor 81 and the moving switch members 57 to the lower terminal 33. In the closed position of the interrupter the magnetic effect of the current loop through the main contacts 39—69 tends to blow the main contacts on. When the main contacts separate during an opening operation the main current loop is shifted to the arcing contacts and, as the arcing contacts separate, the magnetic effect of the current loop tends to blow the arc established by separation of the arcing contacts upwardly away from the contacts and into an arc chute 109 (Figs. 1 and 5).

The arc chute may be of any suitable type such, for instance, as the arc chute disclosed in Patent No. 2,692-319, issued October 19, 1954 to R. C. Dickinson and R. E. Frink and assigned to the assignee of this invention. The arc chute comprises generally a pair of serially related stacks of arc extinguishing plates and blowout magnetic means for controlling and extinguishing the arc established by separation of the arcing contacts.

The arc chute 109 is hinged to the frame 15 by means of a pin 111 (Figs. 1, 2 and 3) supported in the rearwardly extending hinge portion 113 of the upper contact block 35. The pin 111 pivotally supports a bracket 115 secured by means of bolts 117 to the arc chute housing 119 which is of insulating material. The bolts 117 threadedly engage a rear arc horn 121 and also support a spring contact member 123 on the lower rear portion of the arc chute which engages the portion 113 of the upper contact block 35. The lower end of a front arc horn 125 (Fig. 4) is disposed against a resilient conducting member 127 secured by means of a bolt 129 to the lower portion of the front wall of the arc chute housing. Also secured to the arc chute housing adjacent the lower end of the conducting strip 127 by means of a bolt 131 is the upper end of a conducting strip 133

having its lower end secured to the lower contact block 37 by the bolt 59.

Following separation of the main contacts, during an opening operation, the current loop is shifted therefrom to the arcing contacts and, as the arcing contacts separate, the magnetic effect of the current loop tends to blow the arc, established by separation of the arcing contacts, upwardly into the arc chute 109. Due to the presence of the magnetic blowout coil (not shown) in the arc chute, the arc is further distorted and elongated until the end thereof at the stationary arcing contact is transferred to the rear arc horn 121 over the hinge projection 113, spring contact 123 and bolts 117 to the rear arc horn. As the moving contact structure moves to the open position the moving arcing contact comes into proximity to the forward arc horn 125, whereupon the end of the arc at the moving arcing contact is transferred to the forward arc horn.

In the normal position of the arc chute the lower edges of the arc chute housing rest on ledges 135 (Figs. 3, 4 and 5) molded on the side walls of the insulating frame 15. By removing the bolt 131 the arc chute may be swung backwardly about the hinge pin 111 to the position shown in Fig. 3 to provide access to the contact structure. The arc chute and the channel member meet and form continuous side barriers which separate on a line below the top of the contacts to permit inspection of the contacts. The resilient conducting member 127, which is secured to the lower part of the front of the arc chute by the bolt 129, is in contact with the lower end of the front arc horn 125 and, in the normal or closed position of the arc chute is in contact with the upper end of the conducting strip 133. When the bolt 131 is removed and the arc chute is hinged back to the Fig. 3 position the contact between the conducting strips 127 and 133 is broken. This contact is automatically re-established when the arc chute is moved to its normal position (Fig. 4) and the bolt 131 is secured in place.

The invention provides a circuit interrupter having a channel-shaped frame of one-piece molded high-strength insulating material in which the stationary and movable contact structures are supported and enclosed. This permits mounting the terminals and the bushings therefor directly on the molded insulating frame without the use of metal flanges on the bushings thus reducing the overall size of the circuit interrupter. By providing a separate biasing spring for each of the several main contact fingers the main stationary contacts are made self-aligning. The contact structure is made readily accessible by hinging the arc chute so that it can be pivotally moved out of the way. By making the contact blocks or feet and the stationary arcing contacts of low cost extrusions the cost of the circuit breaker is reduced. The cost is further reduced by making some of the parts, including the moving switch arms, from flat punchings. The elimination of the metal mounting frame and metal flanges for mounting the terminal bushings also contributes to the low cost of the circuit interrupter.

While the invention has been disclosed in accordance with the provisions of the patent statutes, it is to be understood that various changes in the structural details and arrangement of parts thereof may be made without departing from the spirit of the invention.

We claim as our invention:

1. In a circuit interrupter, a U-shaped housing of one-piece molded insulated material, a pair of spaced terminal studs mounted on and extending into said U-shaped housing, stationary contact means mounted in said U-shaped housing on one of said studs, said stationary contact means comprising a plurality of pivoted main contact members, a pair of movable switch members pivotally mounted in said U-shaped housing on the other one of said studs, movable contact means carried by said pair of movable switch members cooperating with said stationary contact means, said movable contact

means comprising a main movable contact rigidly mounted between said switch members and having portions extending laterally in opposite directions beyond said switch members engaging all of said stationary main contact members, a movable arcing contact pivotally supported between said movable switch members cooperating with said stationary arcing contact, and an arc chute hinged on said stationary contact means adjacent said U-shaped housing and movable to a position to provide access to said contact means.

2. A circuit interrupter comprising a U-shaped housing of one-piece molded insulating material, a pair of spaced terminal studs mounted on and extending into said U-shaped insulating housing, conducting members rigidly secured to said terminal studs within said insulating housing, stationary contact means mounted on one of said conducting members, a movable switch member pivotally mounted in said U-shaped insulating housing on the other one of said conducting members, movable contact means carried by said movable switch member cooperating with said stationary contact means, a projection on said one conducting member, an arc chute pivotally supported on said projection, and means on said U-shaped insulating housing supporting said arc chute in the normal position of said arc chute to form continuous barriers between the poles of said interrupter, said stationary contact means and said movable contact member being disposed entirely between said barriers.

3. A circuit interrupter comprising a U-shaped housing of one-piece molded insulating material, a pair of spaced terminal studs mounted on and extending into said U-shaped housing, conducting members rigidly secured to said terminal studs within said U-shaped housing, stationary contact means mounted on one of said conducting members, a movable switch member pivotally mounted in said housing on the other one of said conducting members, movable contact means carried by said movable switch member cooperating with said stationary contact means, a hinge portion on said one conducting member, an arc chute pivotally supported on said hinge portion and having forward and rear arc runners therein, and inwardly extending shoulders on said U-shaped housing supporting said arc chute in the normal position of said arc chute, and resilient means connected to said rear arc runner and biased against said projection to form an electrical connection between said rear arc runner and said one conducting member in all positions of said arc chute.

4. A circuit interrupter comprising a U-shaped housing of one-piece molded insulating material, spaced terminal studs mounted on and extending into said U-shaped housing, conducting blocks rigidly secured to said terminal studs, stationary contact means mounted within said U-shaped housing on one of said conducting blocks, said stationary contact means comprising a plurality of main contact fingers pivotally supported on said one conducting block and an arcing contact rigidly mounted on said one conducting block, movable contact means cooperating with said stationary contact means comprising a pair of spaced movable switch arms pivotally supported within said U-shaped housing on the other end of said conducting blocks, operating means for said movable switch arms, a single main moving contact member rigidly mounted between said pair of movable switch arms and having contact portions extending laterally in opposite directions beyond the sides of said pair of switch arms engaging all of said plurality of main stationary contact fingers, a movable arcing contact having pivot means thereon, pivot notches in the edges of said switch arms for receiving said pivot means to pivotally support said movable arcing contact on said movable switch arms, means rigidly mounted on said main movable contact member engaging said pivot means and holding said arcing contact in said pivot notches, a bracket rigidly mounted on said main movable contact member, and spring means compressed between said bracket and said

movable arcing contact biasing said movable arcing contact in closing direction relative to said movable switch arms.

5. A circuit interrupter comprising a U-shaped housing of one-piece molded insulating material having a back portion and spaced integral side walls, spaced terminal studs mounted on said back portion and extending into said housing, conducting blocks rigidly mounted within said U-shaped housing on said terminal studs within said housing, stationary contact means mounted on one of said studs, movable contact means pivotally mounted within said U-shaped housing on the other of said terminal studs cooperating with said stationary contacts, said side walls extending from said back portion farther than said movable contact means in the open position thereof, operating means for said movable contact means, an outwardly extending projection integral with said one conducting block, an arc chute pivotally supported on said projection, and said U-shaped insulating housing having inwardly extending shoulders supporting said arc chute in its normal position.

6. A circuit interrupter comprising a channel-shaped housing of one-piece molded insulating material, spaced terminal studs mounted on and extending into said housing, insulating bushings surrounding said terminal studs, said bushings having beveled surfaces thereon engaging beveled surfaces on said housing to position and align said terminal studs, stationary contact means mounted within said channel-shaped housing on the inner end of one of said terminal studs, cooperating movable contact means pivotally mounted within said channel-shaped housing on the other of said terminal studs, operating means for said movable contact means, a pivotally supported arc chute, the insulating side walls of said arc chute engaging the insulating side walls of said channel-shaped housing to form continuous vertical barriers between the poles of said interrupter, said vertical barriers extending outward beyond said movable contact means in the open position thereof.

7. A circuit interrupter comprising a channel-shaped member of one-piece molded insulating material, spaced terminal studs mounted on and extending into said channel-shaped member, stationary contact means mounted within said channel-shaped housing on the inner end of one of said terminal studs, movable contact means pivotally mounted within said channel-shaped housing on the inner end of the other of said terminal studs cooperating with said stationary contact means, operating means for said movable contact means, an arc chute pivotally supported on said stationary contact means, the insulating side walls of said arc chute engaging the insulating side walls of said channel-shaped member to form continuous vertical barriers between the poles of said interrupter extending beyond said movable contact means in the open position thereof, and the line of separation of said arc chute and said channel-shaped member being below the top of said movable contact means.

8. A circuit interrupter comprising a channel-shaped housing of molded insulating material, spaced terminal studs mounted on and extending into said channel-shaped housing, insulating bushings surrounding said terminal studs, said bushings having beveled surfaces thereon engaging beveled surfaces on said channel-shaped housing to position said terminal studs, resilient washers between the beveled surface on said housing and the beveled surface on said bushing to compensate for any irregularities on said surfaces, separable contact means mounted on the inner ends of said terminal studs within said insulating housing, and a hinged arc chute having insulating side walls engaging the side walls of said channel-shaped housing to form continuous barriers between the poles of said interrupter extending beyond said contact means in the open position thereof.

9. In a multi-pole circuit interrupter, a housing for each pole unit comprising a rear wall of insulating ma-

terial at the back of each pole unit and side walls of insulating material between the pole units, a pair of spaced terminal studs of conducting material extending through the rear wall of insulating material for each pole, a bushing of insulating material surrounding said terminal studs at the back of the rear wall of insulating material but not at the front thereof, a contact hinge member supported on one of said terminal studs of each pair substantially against the front of the rear wall of insulating material, a contact member supported on the other of said terminal studs of each pair substantially against the front of the rear wall of insulating material, a switch arm hingedly supported adjacent one end on said contact hinge member on said one of the terminal studs, and a movable contact adjacent the other end of the switch arm engageable with said contact member supported on the other of the terminal studs.

10. In a multi-pole circuit interrupter, a rear wall of insulating material at the back of each pole unit, side walls of insulating material between the pole units, a pair of spaced terminal studs of conducting material extending through the rear wall of insulating material for each pole, a bushing of insulating material surrounding said terminal studs at the back of the rear wall of insulating material but not at the front thereof, a contact hinge member supported on one of said terminal studs of each pair substantially against the front of the rear wall of insulating material, a contact member supported on the other of said terminal studs of each pair substantially against the front of the rear wall of insulating material, a switch arm hingedly supported adjacent one end on said contact hinge member on said one of the terminal studs, a movable contact adjacent the other end of the switch arm engageable with said contact member supported on the other of the terminal studs, an arc chute positioned over said switch arm with the rear end wall of the arc chute approximately in line with the aforesaid rear wall of insulating material.

11. In a multi-pole circuit interrupter, a channel-shaped member of insulating material for each pole, each of said channel-shaped members having a back wall and side walls between the pole units, a pair of spaced terminal studs of conducting material extending through the rear wall of the channel-shaped member of insulating material for each pole, a bushing of insulating material surrounding said terminal studs at the back of the rear wall of said channel-shaped member but not of the front thereof, a contact hinge member supported on one of said terminal studs of each pair substantially against the front of the rear wall of said channel-shaped member of insulating material, a contact member supported on the other of said terminal studs of each pair substantially against the front of the rear wall of each of said channel-shaped members, a switch arm hingedly supported adjacent one end on said contact hinge member on one of the terminal studs, and a movable contact adjacent the other end of the switch arm engageable with

said contact member supported on the other of said terminal studs.

12. In a multi-pole circuit interrupter, a channel-shaped member of insulating material for each pole, each of said channel-shaped members having a back wall and side walls between the pole units, a pair of spaced terminal studs of conducting material extending through the rear wall of the channel-shaped member of insulating material for each pole, a bushing of insulating material surrounding said terminal studs at the back of the rear wall of said channel-shaped members but not of the front thereof, a contact hinge member supported on one of said terminal studs of each pair substantially against the front of the rear wall of said channel-shaped member of insulating material, a contact member supported on the other of said terminal studs of each pair substantially against the front of the rear wall of each of said channel-shaped members, a switch arm hingedly supported adjacent one end on said contact hinge member on one of the terminal studs, a movable contact adjacent the other end of the switch arm engageable with said contact member supported on the other of said terminal studs, and a hinged arc chute having the axis of the hinge approximately in the plane of the rear wall of said channel-shaped member, the sides of said arc chute meeting the sides of said channel-shaped member.

13. In a multi-pole circuit interrupter, a channel-shaped member of molded insulating material for each pole, each of said channel-shaped members having a rear wall and having side walls between the poles, a pair of spaced terminal studs of conducting material extending through the rear wall of each of said channel-shaped members, a bushing of insulating material surrounding said terminal studs at the back of the rear wall of said channel-shaped members, the rear walls of said channel-shaped members having integral portions of insulation surrounding and overlapping a portion of the insulating bushings surrounding said terminal studs, stationary contact means on one of said terminal studs inside the back wall of said channel-shaped member, and cooperating movable contact means mounted on the other of said terminal studs inside said channel-shaped member.

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