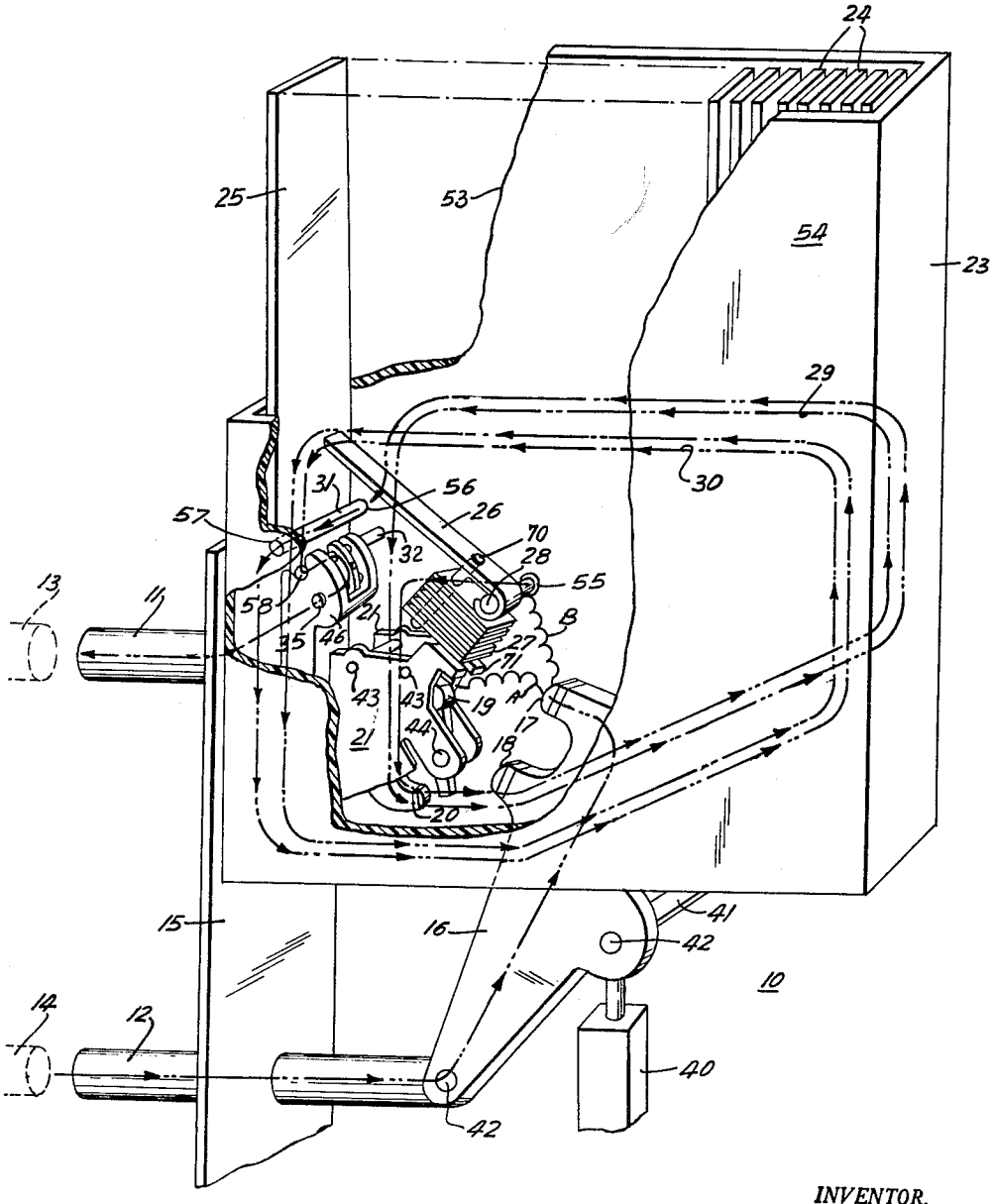
April 6, 1965 F. J. POKORNY 3,177,325

MECHANICAL AND ELECTRICAL PIVOT BETWEEN REMOVABLE ARC CHUTE AND STATIONARY CONTACT STRUCTURE

Filed Dec. 21, 1960 3 Sheets-Sheet 1

FIG. 1.



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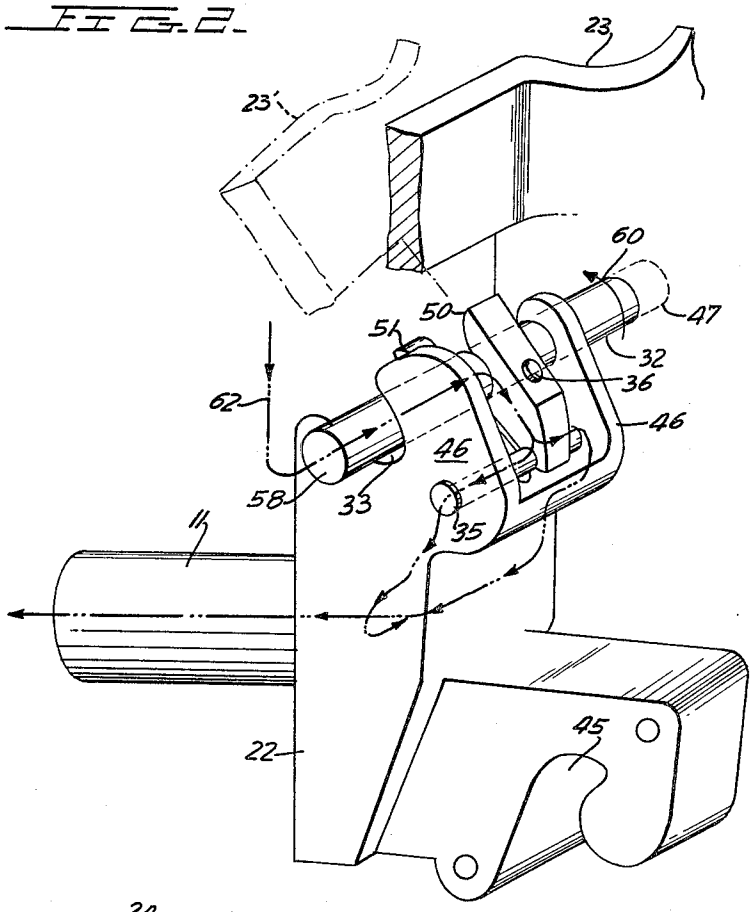
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MECHANICAL AND ELECTRICAL PIVOT BETWEEN REMOVABLE ARC CHUTE AND STATIONARY CONTACT STRUCTURE

Filed Dec. 21, 1960 3 Sheets-Sheet 2

FIG. 2.



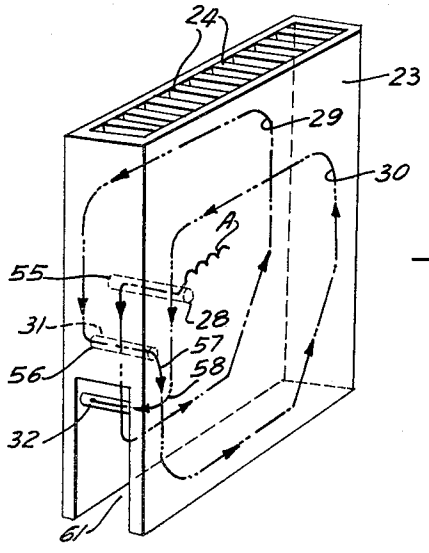


FIG. 4.

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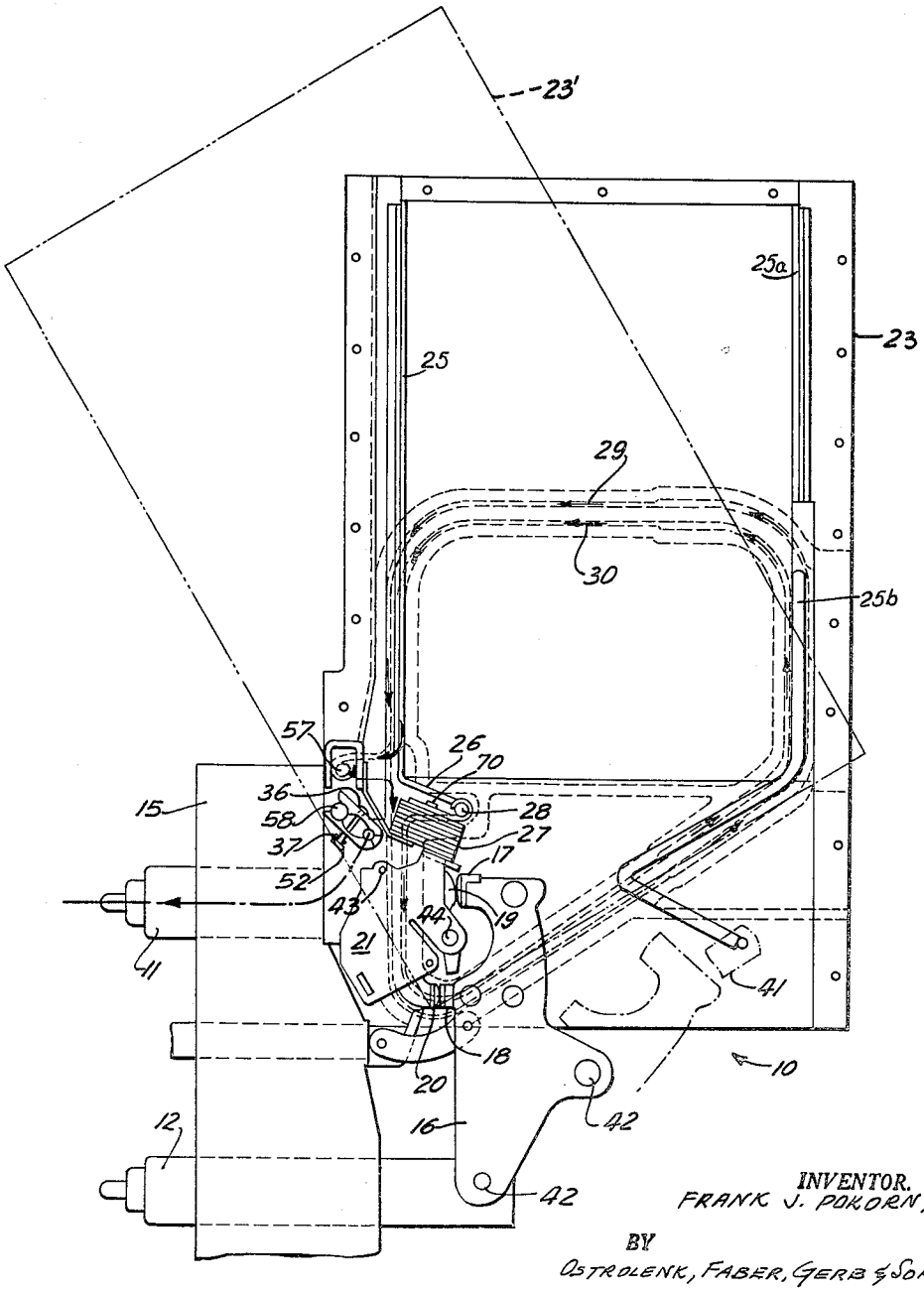
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April 6, 1965 F. J. POKORNY 3,177,325

MECHANICAL AND ELECTRICAL PIVOT BETWEEN REMOVABLE ARC CHUTE AND STATIONARY CONTACT STRUCTURE

Filed Dec. 21, 1960 3 Sheets-Sheet 3

FIG. 3.



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3,177,325

MECHANICAL AND ELECTRICAL PIVOT BETWEEN REMOVABLE ARC CHUTE AND STATIONARY CONTACT STRUCTURE

Frank J. Pokorny, Hatboro, Pa., assignor to I-T-E Circuit Breaker Company, Philadelphia, Pa., a corporation of Pennsylvania

Filed Dec. 21, 1960, Ser. No. 77,433
7 Claims. (Cl. 200—147)

This invention relates to circuit breakers and more particularly to a circuit breaker having a novel pivot means for mechanically and electrically connecting an arc chute to a circuit breaker.

Circuit breakers presently in use are designed to have cooperating arc chutes to provide rapid extinguishment of an electric arc during overload or short circuit conditions. The arc chute contains a blowout coil in which the number of turns of the coil coupled with the current flowing therethrough rapidly urges the electric arc upward through the arc chute. Arc plates disposed within the arc chute provide a tortuous path for the arc causing it to become rapidly extinguished.

The tremendous heat generated by an arc during the tripping operation often has harmful results upon the arc chute and the breaker elements. It is, therefore, important to make regular inspections of the breaker equipment to insure safe, trouble-free performance during any subsequent tripping operations. This requires an arc chute construction which may be easily and quickly removed from the circuit breaker to enable thorough inspection of the breaker and the arc chute. It is further necessary that the replacement of the arc chute be just as simple and rapid as its removal.

The blowout coils described above are housed in the arc chute and must be electrically connected across the upper and lower terminals of the circuit breaker in order to become energized. When the arc chute is removed for inspection purposes, the connection between the blowout coil and the upper and lower terminals must be severed. After the inspection is completed and the arc chute is replaced, the blowout coil must be re-connected across the upper and lower terminals of the circuit breaker to enable the coil to become energized during the tripping operation. Thus, in mounting the arc chute to the circuit breaker, a mechanical connection is needed to properly position and secure the arc chute in relation to the circuit breaker. Electrical connections are also needed to link the blowout coil to the upper and lower terminals of the circuit breaker. These connections must be designed to permit the arc chute to be easily removed for inspection or repairs and replaced quickly for immediate use in the protective system.

I have provided a circuit breaker which is so arranged to consolidate the required mechanical and electrical connecting means into one novel bracket structure. The bracket structure is fixedly mounted to the circuit breaker and is designed to provide a rigid support for the arc chute. The bracket structure consists of two slotted brackets which furnish the necessary mechanical support. A pair of spring biased contact fingers arranged between the two slotted brackets provides the electrical connection. A connector pin contained in the arc chute is fixedly secured to one terminal of the blowout coil. The connector pin is placed in the slots of the bracket which hold the arc chute firmly in place. The contact fingers automatically engage the connector pin when it is seated in the slotted brackets. The spring biasing the contact fingers against the connector pin insures firm contact between the contact fingers and the connector rod to provide a sufficient current path therebetween. The arc chute

may be rotated back upon the slotted bracket when the inspection does not require removal of the arc chute. When necessary, the arc chute may be removed simply by lifting it. The arc chute is replaced by seating the connector rod or pin in the slotted brackets. The connector pin is simultaneously engaged by the contact fingers. Thus, the arc chute is aligned both mechanically and electrically in one operation. No bolts or other fastening means are needed due to the novel design of the connecting means.

It is, therefore, one object of my invention to provide a circuit breaker having an arc chute which is so arranged to provide rapid removal and replacement of the arc chute.

Another object of my invention is to provide a circuit breaker with a novel means for mounting an arc chute thereto.

Another object of my invention is to provide a circuit breaker with a novel connecting means for electrically and mechanically connecting an arc chute thereto.

Another object of my invention is to provide a circuit breaker with a novel mounting means for pivotally mounting an arc chute to the circuit breaker.

Still another object of my invention is to provide a circuit breaker with a novel connecting means for mounting an arc chute thereto wherein the connecting means is simple in construction.

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

FIGURE 1 is a perspective view of a circuit breaker with an arc chute mounted thereto.

FIGURE 2 is a perspective drawing of the novel connecting means used in the circuit breaker shown in FIGURE 1.

FIGURE 3 is a side plan view of the circuit breaker and arc chute shown in FIGURE 1.

FIGURE 4 is a perspective view of the rear of the arc chute shown in FIGURE 1.

FIGURE 1 shows a circuit breaker **10** having upper **11** and lower **12** terminals which are connected in any suitable manner to the leads **13** and **14**, respectively, of the system to be protected. Upper **11** and lower **12** terminals are fixedly mounted to support **15** and electrically insulated therefrom. Movable conductive bridge **16** is pivotally mounted to lower terminal **12** at pivot **42**. A pushrod **40** connected to movable bridge **16** at pivot **42** operates movable bridge **16** between its open and closed positions under control of a breaker actuating mechanism (not shown). Arcing **17** and main **18** butt contacts are fixedly secured to the upper end of bridge **16**.

Upper terminal **11** is connected to conductive head **22** which can best be seen in FIGURE 2. A pair of side plates **21** are mounted upon conductive head **22** by means of bolts **43**. Arcing contact **19** is pivotally supported by side plates **21** at pivot **44**. Arcing contact **19** engages movable arcing butt contact **17** when circuit breaker **10** is in the closed position, as shown in FIGURE 3. Main contact **20** is pivotally mounted to conductive head **22** by means of slot **45** in conductive head **22**. A complete description of the breaker structure shown in FIGURE 1 is set forth in copending U.S. application Serial No. 79,425 entitled "Stationary Contact Structure for Circuit Breaker," filed December 29, 1960, by Frank J. Pokorny and George A. Wilson and assigned to the same assignee as this application and is hereby incorporated in this application. It is to be understood, however, that this invention may be used with other breaker contact structures since the invention does not rely upon the contact structure set forth herein for its novel operation.

When the circuit breaker **10** is in the closed position shown solid in FIGURE 3, main contact **20** engages main

butt contact 18 and arcing contact 19 engages arcing butt contact 17, establishing a current path from conductor 13, upper terminal 11, conductive head 22, side plates 21, main and arcing contacts 20–18 and 19–17, respectively, conductive bridge 16 and lower terminal 12 to conductor 14.

Referring now to FIGURE 2, the upper portion of conductive head 22 is comprised of two extended portions or brackets 46, each having a slot 33 (only one of which can be clearly seen in FIGURE 2). A pair of contact fingers 50 and 51 are positioned between brackets 46 and are electrically connected to brackets 46 by means of rod or pin 35, which rod has its opposite ends secured to the brackets 46 in any well known manner. Contact fingers 50 and 51 are secured together by a bolt 36 which passes through contact fingers 50 and 51. A nut 52 threadedly engages bolt 36. A spring 37, which is mounted upon bolt 36, is positioned so that its opposite ends bear against nut 52 and contact finger 51, respectively (see FIGURE 3), so as to urge the contact fingers toward one another. Although brackets 46 are shown as an integral part of conductive block 22, it should be understood that brackets 46 may be manufactured separately from the conductive head 22 and secured thereto in any well-known manner.

Arc chute housing 23 is pivotally mounted to circuit breaker 10 by brackets 46 in a manner which will be made more apparent in the ensuing description of FIGURES 2 and 3. Arc chute housing 23 contains front 25*a* and rear 25 arc runners positioned at opposite ends of the housing 23. A plurality of arc plates 24 are interposed between the front 25 and rear 25*a* arc runners. It should be understood that the arc plates occupy the entire space between arc runners 25*a* and 25 but some of the arc plates have been removed to expose the elements of the circuit breaker 10. The arc runners 25*a* and 25 and arc plates 24 may be secured to the arc chute housing 23 in any well-known manner such as, for example, the manner shown in U.S. Patent No. 2,761,934 entitled "High Voltage Circuit Breakers," issued September 4, 1952, to J. D. Wood et al. and assigned to the same assignee as the instant application or in U.S. Patent No. 2,941,060 entitled "Arc Extinguishing Means for High Voltage Circuit Breakers," issued June 14, 1960, to A. S. Casswell and assigned to the same assignee as the instant invention. It should be understood that arc plates 24 and arc runners 25, 25*a* may be mounted in any other well-known manner since the choice of mounting plays no part in the instant invention.

The lower end 26 of rear arc runner 25 slopes inward from the end of arc chute housing 23 and is secured to the inner surface of faces 53, 54 of housing 23 by pin or rod 28 which is inserted through the annular opening formed at the lower end of rear arc runner portion 26. A jump gap 27 is mounted immediately below arc runner portion 26 by means of bolt 70. The jump gap is positioned so that it lies immediately between the region defined by the lower end of rear arc runner portion 26 and the upper portion 71 of side plates 21 (see FIGURE 1). A pair of blowout coils 29 and 30 are imbedded in the rear 53 and front 54 faces, respectively, of arc chute housing 23. Blowout coils 29 and 30 (shown by dotted lines in FIGURES 1, 3 and 4) have been shown in FIGURE 1 as having two turns but it is to be understood that a greater or lesser number of turns may be used. The method of encapsulating the blowout coils in the arc chute housing faces is set forth in my copending U.S. application Serial No. 77,432 entitled "Arc Chute Side With Encapsulating Face Wound Blowout Coil," filed December 21, 1960, and assigned to the same assignee as the instant invention and plays no part in the instant invention.

Terminal 55 of blowout coil 29 is electrically connected to conductive pin or rod 28. The other terminal 56 of blowout coil 29 is electrically connected to conductive rod or pin 31 which is rigidly secured to the inner faces

of side walls (or faces) 53 and 54 of arc chute housing 23. Terminal 57 of blowout coil 30 is electrically connected to the end of conductive rod 31 which is secured to side wall 54. The other terminal 58 of blowout coil 30 is electrically connected to conductive rod or pin 32 which is rigidly secured to side walls 53 and 54 of arc chute housing 23 in the same manner as pins 28 and 31 described above.

An opening 61 (see FIGURE 4) is provided in arc chute housing 23 to enable housing 23 to be rotated counterclockwise about circuit breaker 10 as will be more fully described.

When arc chute housing 23 is in the position shown in FIGURE 1, conductive rod 32 is seated in the slots 33 of brackets 46. Brackets 46 thus provide the mechanical support for arc chute housing 23. Contact fingers 50 and 51 are aligned between brackets 46 so that they engage conductive rod 32 when conductive rod 32 is seated in slots 33 of brackets 46. Spring 37 urges contact fingers 50 and 51 into rigid engagement with conductive rods 32 and 35 to provide a current path between conductive rod 32 and upper terminal 11 as will be more fully described.

Referring to FIGURE 1, when circuit breaker 10 has been tripped due to an overload or short circuit condition, an arc A forms between the arcing contacts 19 and 17. The arc A in moving upward is transferred to the lower portion 26 of rear arc runner 25 and is drawn between rear arc runner 25 and arcing contact 17 of the movable bridge 16. At this time, the current path through the breaker is: lower terminal 12, movable bridge 16, arc B, conductive rod 28, rear blowout coil 29, conductive rod 31, front blowout coil 30, conductive rod 32, contact fingers 50 and 51, pin 35, conductive head 22, and upper terminal 11. The current path is shown by the phantom line of FIGURE 1 with the arrowheads bracing the current path. From the above it can be seen that conductive pin 31 serves to serially connect blowout coils 29 and 30 which are encapsulated in opposite side walls 53 and 54, respectively.

Referring to FIGURE 2, it should be noted that contact fingers 50 and 51, which serve as the conductive path for current flow between pivot pin 32 and pin 35, each carry current. Since the current flow in the substantially parallel aligned contact fingers is in the same direction a blow-on effect is created between the two contact fingers which aids the spring means 37 in urging contact fingers 50 and 51 into rigid engagement with pins 32 and 35 to provide an adequate current path for the arc current during the interruption operation.

To remove the arc chute housing 23 from circuit breaker 10, simply tilt are chute housing 23 counter clockwise as shown by arrow 60 in FIGURE 2. Arc chute housing 23 pivots about conductive rod 32 which is seated in the slots 33 of brackets 46. Opening 61 in arc chute housing 23 permits the housing 23 to be rotated counter clockwise without touching any of the elements of circuit breaker 10. The arc chute housing is shown in FIGURES 2 and 3 (by dotted line 23^1) in the tilted position. Pivoting arc chute housing 23 in this manner permits the breaker elements to be inspected without removing the arc chute housing 23 from the circuit breaker 10. Arc chute housing 23 may be removed from circuit breaker 10 simply by lifting housing 23 upward. There are no fastening means to be removed in order to remove housing 23 from circuit breaker 10.

In order to mount arc chute housing 23 upon circuit breaker 10, conductive rod 32 is placed in slots 33 of brackets 46. Simultaneously therewith conductive rod or pin 32 is forced between contact fingers 50 and 51, the upper portions of the contact fingers being in alignment with slots 33. Spring 37 urges contact fingers 50 and 51 together exerting pressure on both pin 32 and pin 35 to ensure a good current path as shown by dotted line 62 in FIGURE 2, which path extends from pin 32, contact fingers 50 and 51, lower pin 35, brackets 46 and conduc-

tive head **22** to upper terminal **11**. Thus, it can be seen that pin **32** serves as both the mechanical and electrical connection between arc chute housing **23** and circuit breaker **10**. Also the spatial alignment of brackets **46** and contact fingers **50, 51** avoids the need for separate mechanical and electrical mounting operations to connect the arc chute to the circuit breaker.

Thus, it can be seen that I have provided a mechanical and electrical pivot between a removable arc chute and a stationary contact structure which is simple in design, has fewer parts than was required in prior art devices and which permits removal and mounting of the arc chute housing to be performed with relative ease.

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

I claim:

1. In combination, a circuit breaker having a pair of cooperating contacts, one of said contacts being stationary, an arc chute having a pivot pin and blow-out coil means electrically connected to said pivot pin, conductive bracket means being slotted for receiving said pivot pin; means integral with said bracket means for electrically connecting said bracket means to said circuit breaker stationary contact; contact finger means positioned within said bracket means; conductive means electrically connecting said contact finger means to said bracket means; said contact finger means making electrical contact with the arc chute pivot pin when said pivot pin is supported by said slotted bracket means to establish a conductive path between said stationary contact and said blow-out coil means.

2. In combination, an arc chute having a conductive rod and blow-out coil means electrically connected to said conductive rod; a circuit breaker having upper and lower disconnects, a stationary contact coupled to said upper disconnect; a cooperating movable contact pivotally connected to said lower disconnect, pivot means comprising first means coupled to said stationary contact for receiving said conductive rod; said conductive rod being rotatable upon said first means to pivot said arc chute upon said first means; finger means electrically coupled to said first means and being positioned to rigidly engage said conductive rod providing an electrical path between said upper disconnect and said blow-out coil means.

3. In combination, an arc chute having a conductive rod and blow-out coil means electrically connected to said conductive rod; a circuit breaker having upper and lower disconnects, a stationary contact coupled to said upper disconnect; a cooperating movable contact pivotally connected to said lower disconnect, pivot means comprising first means coupled to said stationary contact for receiving said conductive rod; said conductive rod being rotatable upon said first means to pivot said arc chute upon said first means; finger means electrically coupled to said first means and being positioned to rigidly engage said conductive rod providing an electrical path between said upper disconnect and said blow-out coil means; biasing means connected to said contact finger means for urging said contact finger means into rigid engagement with said conductive rod.

4. In combination, an arc chute having a conductive rod and blow-out coil means electrically connected thereto; a circuit breaker having upper and lower disconnects; a stationary contact coupled to said upper disconnect; a cooperating movable contact pivotally connected to said lower disconnect; pivot means comprising first means coupled to said stationary contact for receiving said conductive rod; said conductive rod being rotatable upon said first means to pivot said arc chute upon said first means; finger means electrically coupled to said first means and being positioned to rigidly engage said conductive rod providing an electrical path between said upper disconnect and said blowout coil means; said first means comprising conductive means being slotted for receiving said conductive rod; a second conductive rod secured within said slot; said finger means being positioned within said slot and being pivotally connected to said conductive rod; said finger means providing a current path between said circuit breaker upper terminal and said blow-out coil means when said first conductive rod is seated within said slotted conductive means.

5. In combination, an arc chute having a conductive rod and blow-out coil means electrically connected thereto; a circuit breaker having upper and lower terminals; a stationary contact coupled to said upper terminal; a cooperating movable contact pivotally connected to said lower terminal; pivot means comprising first means coupled to said stationary contact for receiving said conductive rod; said conductive rod being rotatable upon said first means to pivot said arc chute upon said first means; finger means electrically coupled to said first means and being positioned to rigidly engage said conductive rod providing an electric path between said upper terminal and said blow-out coil means; said first means further comprising a conductive slotted member; a second conductive rod secured to said first means within said slot; said finger means being positioned within said slot and being pivotally connected to said second conductive rod; said finger means providing a current path between said circuit breaker upper terminal and said blow-out coil means when said first conductive rod is seated within said slotted conductive member; biasing means connected to said finger means for urging said finger means into rigid engagement with said first and said second conductive rods to provide an adequate current path therebetween.

6. In combination, a circuit breaker having a pair of cooperating contacts and upper and lower terminals, an arc chute positioned to receive an electric current arc drawn between said contacts upon separation thereof, first and second blowout coils each contained in opposite sides of said arc chute, said blowout coils each having first and second terminals, a first conductive rod secured to said arc chute transverse to the planes of said blowout coils for connecting said first terminal of said first blowout coil to said first terminal of said second blowout coil, a second conductive rod connected to said arc chute parallel to said first conductive rod, said second terminal of said first blowout coil being connected to said second conductive rod, a pair of arc runners placed at opposite ends of said arc chute, said second terminal of said second blowout means being connected to one of said arc runners, means for supporting said second conductive rod connected to one terminal of said circuit breaker, said supporting means including a slotted bracket and a pair of contact fingers, said contact fingers being electrically connected to said circuit breaker upper terminal, said contact fingers providing a current path between said first and second blowout coils and said circuit breaker upper terminals when said second conductive rod is supported by said slotted bracket.

7. In combination, a circuit breaker having a pair of cooperating contacts and upper and lower terminals, an arc chute positioned to receive an electric current arc drawn between said contacts upon separation thereof, first and second blowout coils each contained in opposite sides of said arc chute, said blowout coils each having first and second terminals, a first conductive rod secured to said arc chute transverse to the planes of said blowout coils, said first terminal of said first blowout coil being connected to said first conductive rod, a second conductive rod connected to said arc chute parallel to said first conductive rod, said second terminal of said first blowout coil being connected to said second conductive rod, a pair of

arc runners placed at opposite ends of said arc chute, said second terminal of said second blowout coil being connected to one of said arc runners, means for supporting said second conductive rod connected to said upper terminal of said circuit breaker, said supporting means including a slotted bracket and a pair of contact fingers, said contact fingers being electrically connected to said circuit breaker upper terminal, said contact fingers providing a current path between said first and second blowout coils and said circuit breaker upper terminal when said second conductive rod is supported by said slotted bracket, and biasing means connected to said contact fingers for urging said contact fingers into rigid engagement with said second conductive rod to provide an adequate current path therebetween.

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