United States Patent [19]

Gryctko

[11] **3,803,376**

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[54] **VENT FOR ARC CHUTE**

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[52] **U.S. Cl.** ..... **200/144 R,** 200/147 R

[51] **Int. Cl.** **H01h 33/08**

[58] **Field of Search** ..... 200/144 R, 147 R, 147 B

[56] **References Cited**

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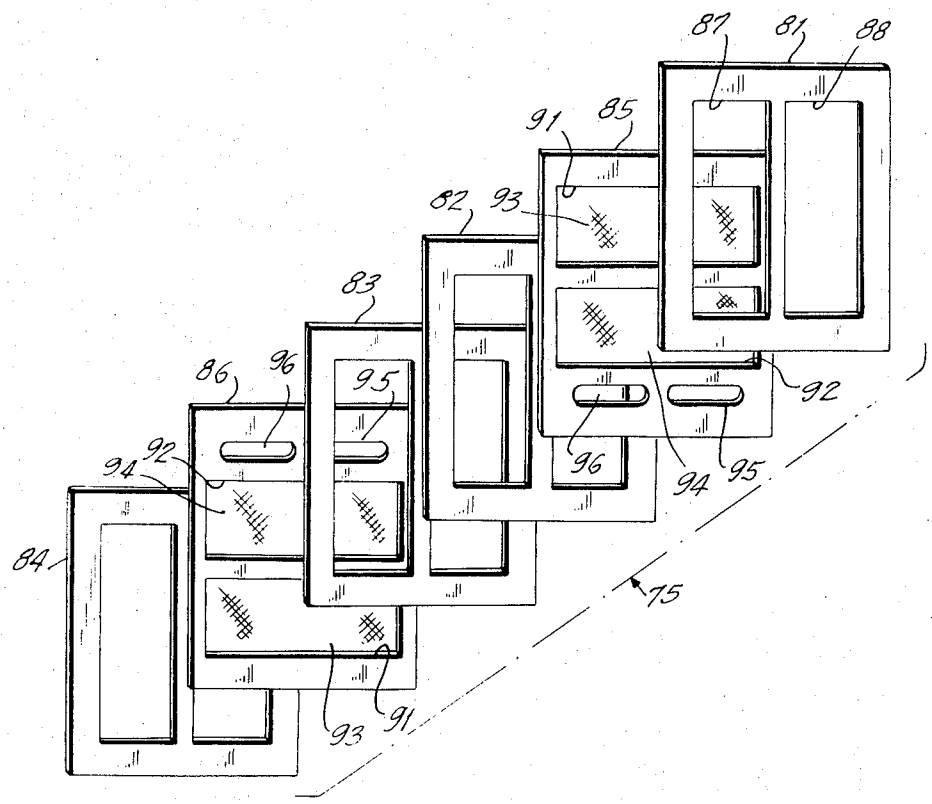
Primary Examiner—Robert S. Macon

Attorney, Agent, or Firm—Ostrolenk, Faber, Gerb & Soffen

[57] **ABSTRACT**

A circuit breaker having a spaced plate arc chute, with a V-shaped mouth region at the rear thereof, and separable arcing contacts positioned at this mouth region, is provided with venting control means stack positioned adjacent the front of the arc chute. The venting control means stack consists of a plurality of layers having screen sections and apertures, with the screen sections and apertures of different layers only partially overlapping to provide a tortuous path for arcing products emitted at the rear of the arc chute to rapidly deionize ionized portions of these arcing products.

8 Claims, 5 Drawing Figures



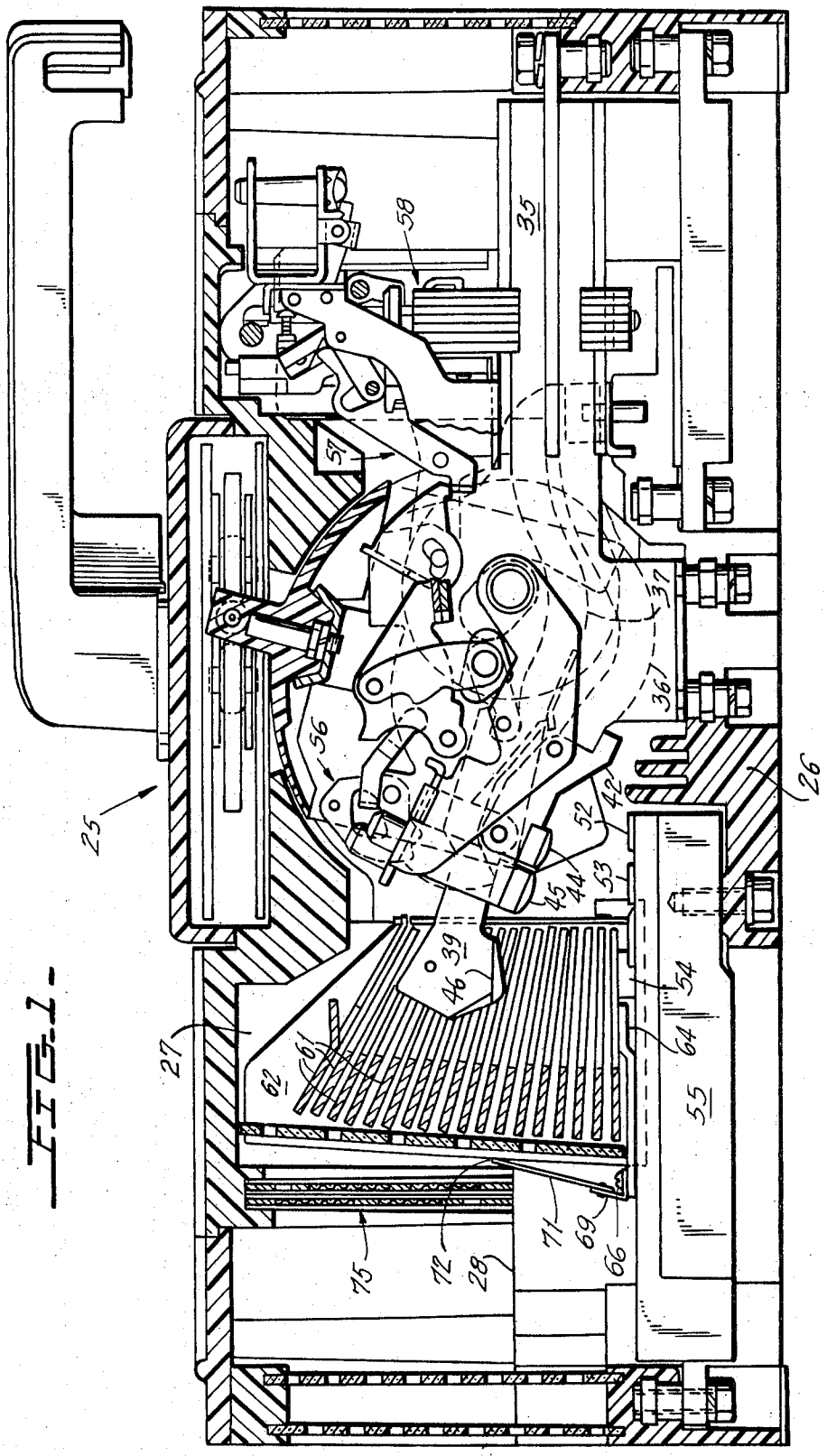

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FIG. 1

FIG. 2.

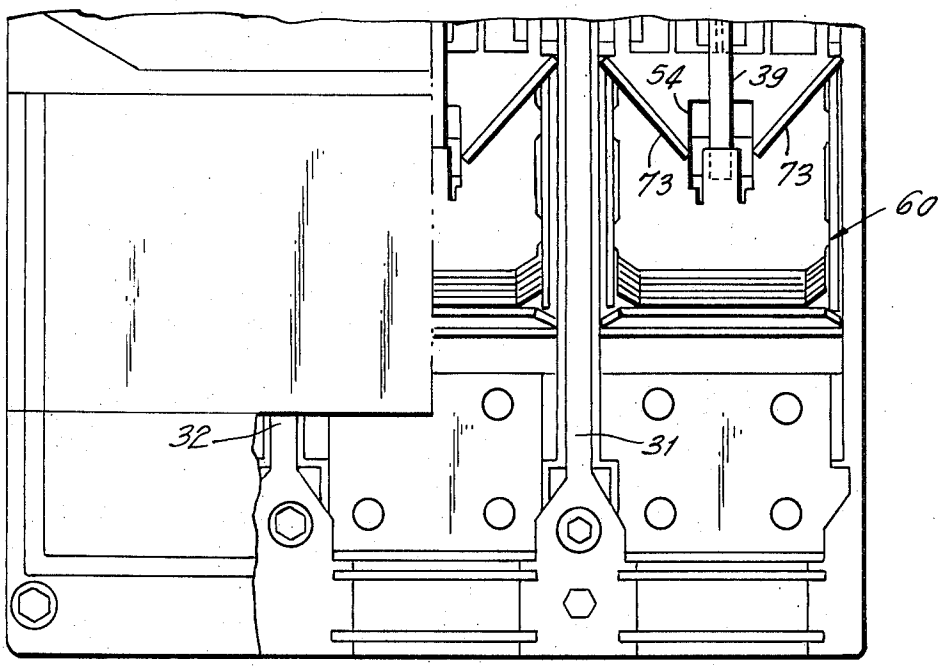


FIG. 5.

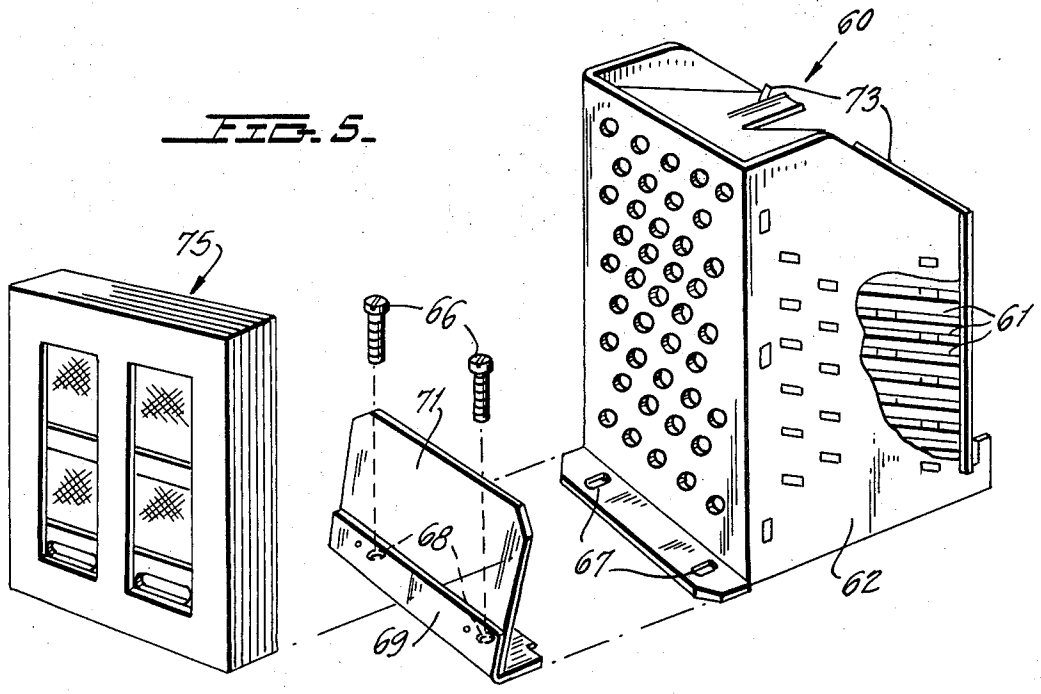


FIG. 3

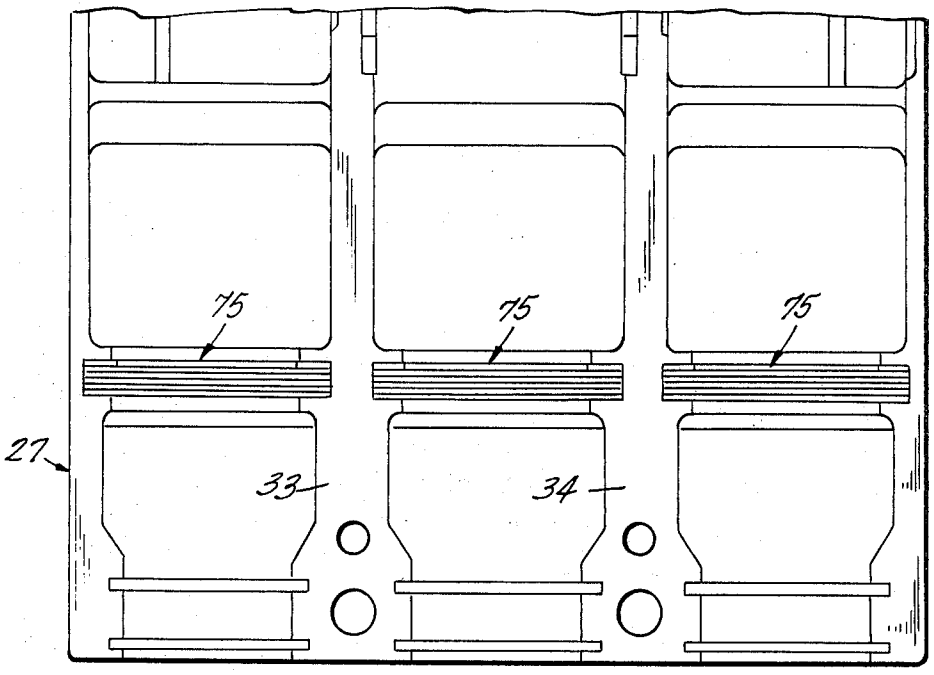
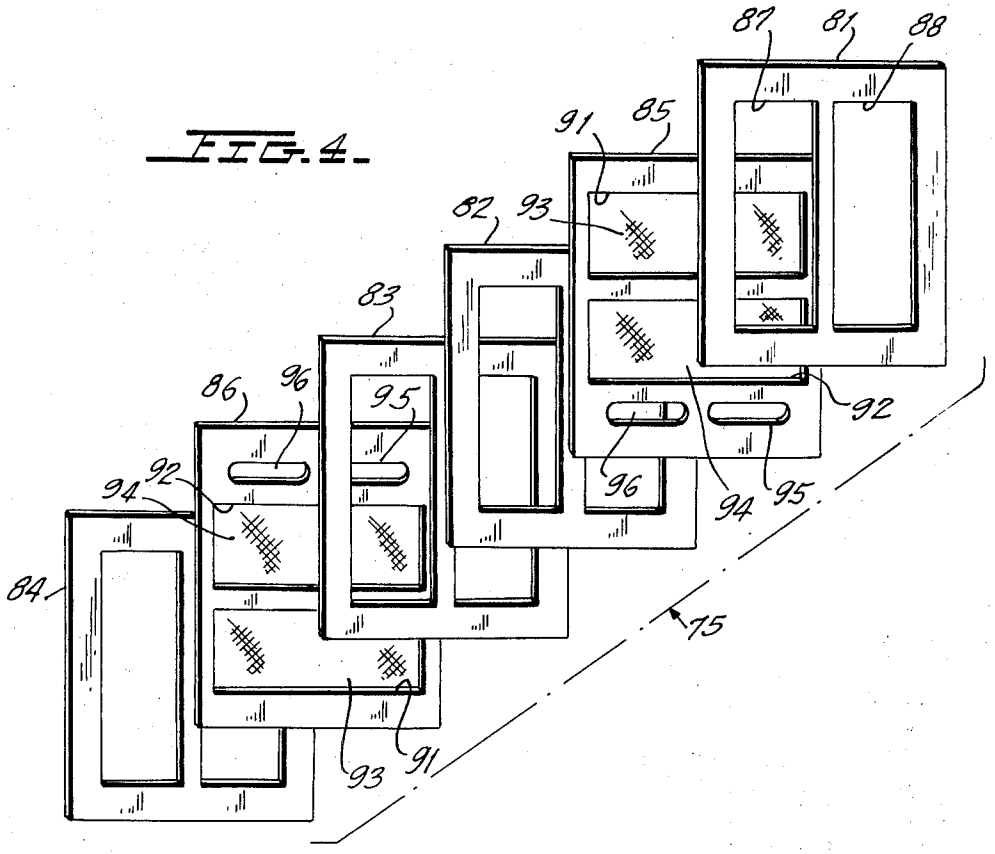

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FIG. 4


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VENT FOR ARC CHUTE

This invention relates to molded case circuit breakers in general and more particularly relates to novel means for preventing electric current arcs from bypassing a spaced plate type arc chute.

In high cirrent capacity molded case circuit breakers, spaced plate type arc chutes are often provided to receive and facilitate extinction of arcs generated during current interruption. When large quantities of ionized gases are vented out of an arc chute, there is great danger that flashover will occur between adjacent poles at the tops of the arc chutes thereof. The prior art has attempted to prevent flashover between poles by providing screening to cool and deionize arcing products exhausted from the arc chute. This has proven adequate for moderately high current interruption.

However, for circuit breakers of extremely high continuous current ratings, say 2,000 amperes and more, the quantity, temperature, and degree of ionization of the arcing products exiting from the arc chute is so intense that it is not unusual for a conducting path to form from the top of the innermost arc plate to the prior art screen hereinbefore referred to, across the screen, and back to the movable arcing contact arm. In effect, this conducting path causes the arc chute to be bypassed or shorted so that the arc chute becomes ineffective.

The instant invention solves this last noted problem by providing a labyrinth of relatively small screen sections, insulated and staggered with respect to each other, and positioned along the arc chute bypass path previously described. This screen formed labyrinth arrangement appears to rapidly deionize those ionized arcing products exiting from the arc chute at high values of available current experienced by circuit breakers of very high continuous current rating, thereby preventing the arc chute from being bypassed by the arcs drawn during current interruption.

Accordingly, a primary object of the instant invention is to provide novel means by which to prevent arcing products from short-circuiting an entire arc chute or some plates thereof.

Another object is to provide means of this type including a labyrinth of relatively small screen sections, insulated and staggered with respect to each other, and positioned at the end of the arc chute remote from the separable contacts.

These objects as well as other objects of this invention will become readily apparent after reading the following description of the accompanying drawings in which:

FIG. **1** is a longitudinal cross-section showing the mechanism for one pole of a multipole molded case circuit breaker.

FIG. **2** is a fragmentary plan view of the circuit breaker of FIG. **1**, with a portion of the cover removed.

FIG. **3** is a bottom view of the circuit breaker cover at that portion of the circuit breaker illustrated in FIG. **2**.

FIG. **4** is an exploded perspective of the labyrinth forming elements.

FIG. **5** is an exploded perspective of the arc chute and elements used to control arcing products as they exit from the arc chute.

Now referring to the figures. Multipole very high current capacity molded case circuit breaker **25** includes

base **26** and cover **27** secured to one another in abutting relationship at interface **28.** In a manner well known to the art, base **26** is provided with longitudinal partitions **31, 32** which cooperate with longitudinal partitions **33, 34** of cover **27** to provide three longitudinally extending compartments within circuit breaker housing **26, 27,** with each of these compartments containing duplicates for most elements of the single pole shown in FIG. **1.**

The current path for each pole of circuit breaker **25** extends from load terminal block **35** through flexible conductors **36, 37** to the respective sets of lower and upper movable contact arms **42, 43.** Each of the contact arms **42** mounts an individual movable main contact **44** engageable with stationary main contact strip **52,** and each of the arms **43** mounts an individual movable main main contact **45** engageable with stationary main contact strip **53.** Main contact strips **52, 53** are mounted to the upper surface of line terminal block **55.**

Arcing contact arm **39** mounts arcing contact **46** at the left end thereof, with the right end of arm **39** being connected through flexible conductors to load terminal **35.** Movable arcing contact **46** is engageable with stationary arcing contact **54** mounted to the upper surface of line terminal **55** and spaced forward of stationary main contact strip **53.** Operating mechanism **56** is used to move contacts **44–46** into and out of engagement with stationary contact **52–54,** latch system **57** is used to maintain mechanism **56** in contact operating condition, and trip device **58** is used to automatically release latch system **57** upon the occurrence of predetermined overload conditions for automatic opening of circuit breaker **25.**

Arc chute **60,** having a plurality of spaced metal plates **61** disposed within the U-shaped configuration formed by the front and sides of insulating housing **62,** is positioned forward of main stationary contact **53.** Stationary arcing contact **54** is disposed in the mouth region formed by the V-notches in the rear edges of arc chute plates **61** and partially closed by insulating sheets **73.** Magnetic arc runner **64** at the bottom of arc chute **60** is secured to the upper surface of line terminal **55** by a pair of screws **66,** which extend through clearance apertures **67** in arc runner **64** and through another pair of clearance apertures **68** in one leg of angle **69.** Relatively stiff, yet flexible, insulating sheet **71** is riveted to the other leg of angle **99.** Upper edge **72** of sheet **71** extends to the region of interface **28** and is in close proximity to the apertured front surface of arc chute housing **62.**

Labyrinth assembly **75,** having three edges thereof secured within appropriate recesses of cover **27,** is constructed of four insulating spacer layers **81–84** (see FIG. **4**) and two screened layers **85, 86.** Each of the spacer layers is of identical construction and includes a pair of rectangular windows **87, 88,** having their major axes disposed vertically with respect to FIG. **4.** Each of the screen layers **85, 86** is of identical construction and includes rectangular windows **91, 92** in an insulating frame. Screen segments **93, 94** are disposed within the respective windows **91, 92** and the major axes of windows **91, 92** are at right angles to the major axes of windows **87, 88.** The major axes for windows **91, 92** of layer **85** are laterally offset from the major axes for windows **91, 92** of layer **86.** Each of the layers **85, 86** also includes a pair of aligned elongated

apertures **95, 96,** extending parallel to the longitudinal axes of windows **91, 92,** with window **92** being interposed between window **91** and apertures **95, 96.** Apertures **95, 96** of layer **85** are positioned at one end of assembly **75,** and apertures **95, 96** of layer **86** are disposed at the other end of assembly **75.**

All of the windows **87** are in alignment as are all of the windows **88.** Two spacer layers **82, 83** are interposed between screen layers **85, 86.** Spacer layers **81** and **84** are positioned at the front and back of assembly **75** and act primarily to retain screened segments **93, 94.** Screen segments **93, 94** and apertures **95, 96** of layers **85, 86** only partially overlap, so that arcing gases leaving arc chute housing **62** through apertures in the front thereof, after passing through one of the screen layers, are to a great extent forced to move at right angles to their original flow path in searching for paths through screen layer **86.** The arcing gases forced to take the tortuous paths are substantially deionized and will not provide flashover paths at the front of arc chute **60.**

For those features of construction in circuit breaker **25** that have not been described in detail herein, reference is made to one or more of the copending applications Ser. Nos. 275,568, 275,577, 275,446, 275,578, 275,507, 275,454, 275,508, 275,621, 275,623, 275,624, 275,569, 275,522, all filed of even date herewith, and all assigned to the assignee of the instant invention.

Although there has been described a preferred embodiment of this novel invention, many variations and modifications will now become apparent to those skilled in the art. Therefore, this invention is to be limited not by the specific disclosure herein but only by the appending claims.

The embodiments of the invention in which an exclusive privilege or property is claimed are defined as follows.

1. A circuit breaker including fixed contact means; movable contact means positioned above said stationary contact means and operable into and out of engagement therewith; arc extinguishing arc chute means having a mouth region at the rear thereof; said movable and said stationary contact means being operatively positioned at said mouth region whereby electric current arcs drawn between said movable and said stationary contact means enter said arc chute; and labyrinth forming means, including a plurality of partially overlapping screen sections, positioned adjacent the front of said arc chute to deionize arcing products leaving said arc chute at the front thereof.

2. A circuit breaker as set forth in claim **1** in which there is a forwardly deflectable insulating member adjacent the front of said arc chute at the bottom region thereof; said labyrinth means being at the top region of said arc chute.

3. A circuit breaker as set forth in claim **1** in which the labyrinth means includes a plurality of thin layers sandwiched together; a first and a second of said layers being spaced from one another, with each of said first and second layers including a first and a second of said screen sections; said first and second screen sections being laterally spaced.

4. A circuit breaker as set forth in claim **3** in which the first and second screen sections are spaced rectangles with the major axes of both screen sections of said first layer being parallel to each other and parallel to the major axes of both screen sections of said second layer and laterally offset therefrom.

5. A circuit breaker as set forth in claim **4** in which each of the first and second layers includes an apertured section, with said first screen section being interposed between said second screen section and said aperture section; said aperture sections of said first and second layers overlapping the second screen sections of said second and first layers, respectively.

6. A circuit breaker as set forth in claim **5** in which each of said first and second layers includes a separator section interposed between said first and second screen sections; said separator sections of said first and second layers overlapping said first screen sections of said second and first layers, respectively.

7. A circuit breaker as set forth in claim **6** in which there is a forwardly deflectable insulating member adjacent the front of said arc chute at the bottom region thereof; said labyrinth means being at the top region of said arc chute.

8. A circuit breaker as set forth in claim **6** in which a third of said layers is interposed between said first and second layers; said third layer having first and second rectangular windows having their major axes disposed at right angles to the major axes of said screen sections.

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