April 7, 1964 E. B. RIETZ 3,128,360

INTERRUPTER STRUCTURE HAVING SPLITTER PLATES OF MALLEABLE MATERIAL

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FIG. 1

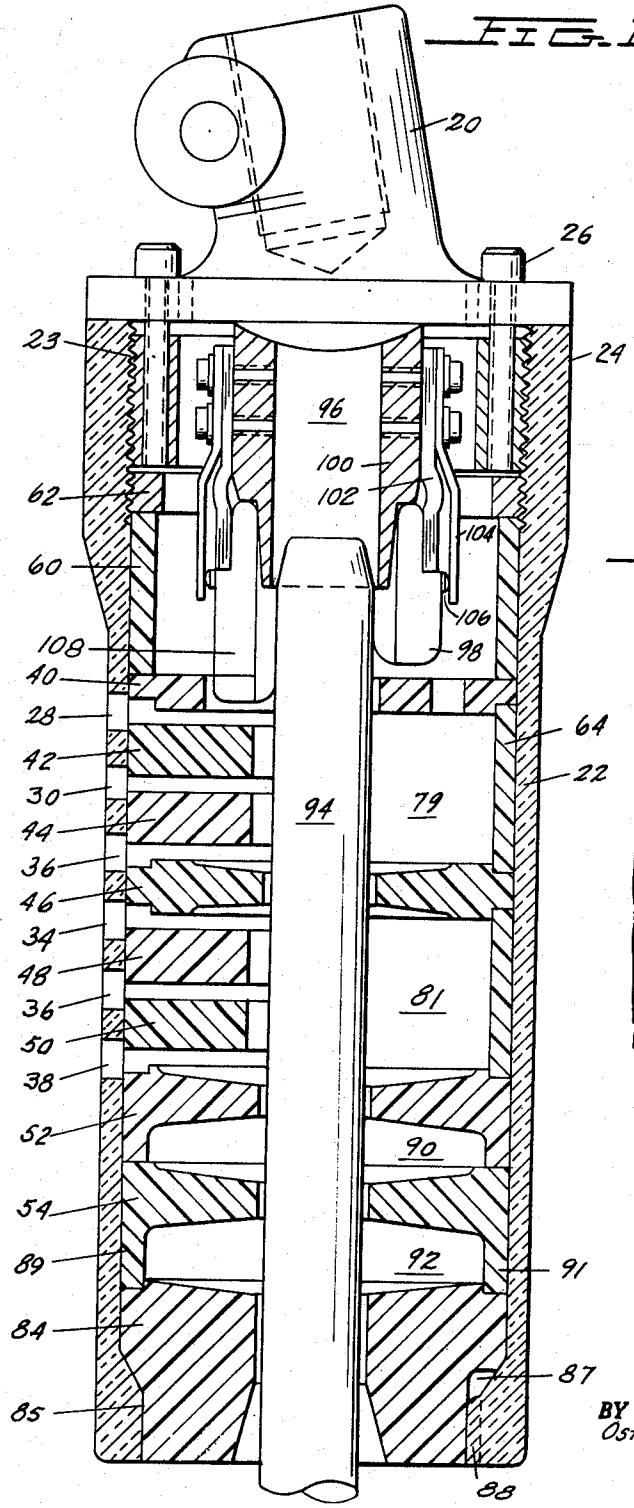
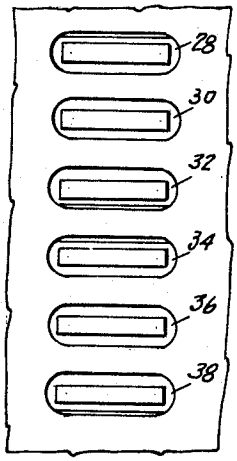


FIG. 2



INVENTOR.
EARL B. RIETZ

BY
OSTROLENK, FABER, GERB & SOFFEN

ATTORNEYS

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FIG. 3.

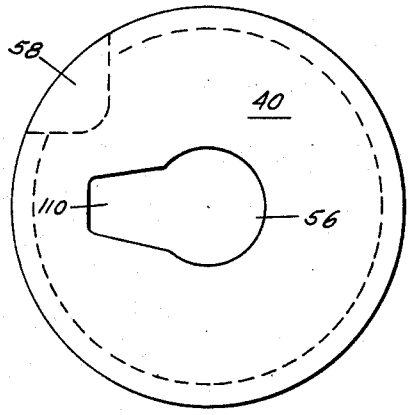


FIG. 6.

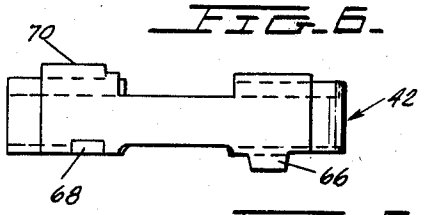


FIG. 5.

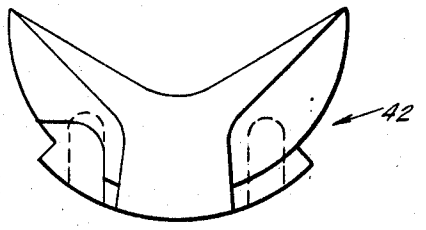


FIG. 4.

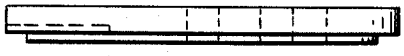


FIG. 7.

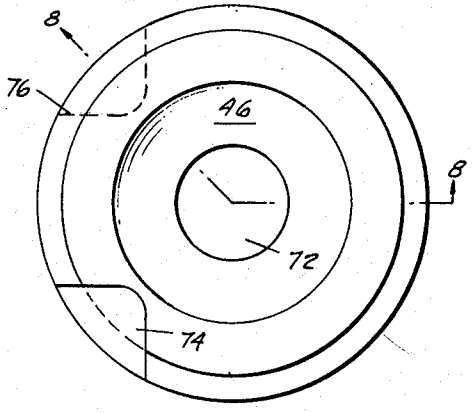


FIG. 9.

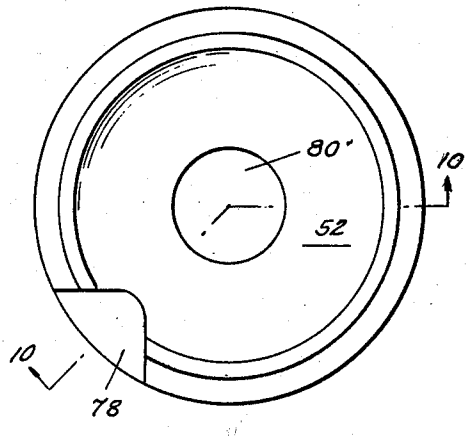


FIG. 8.

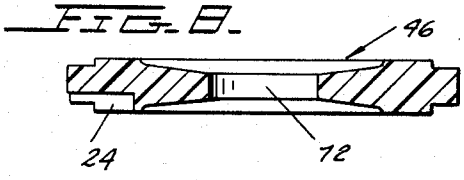
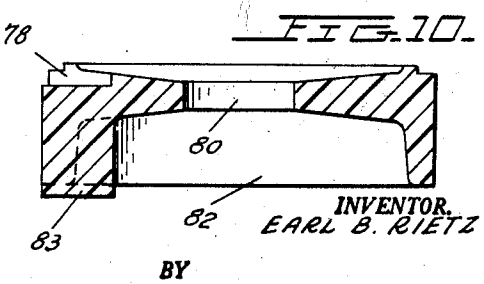


FIG. 10.



INVENTOR.
EARL B. RIETZ

BY

OSTROLENK, FABER, GERB & SOFFEN

ATTORNEYS

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INTERRUPTER STRUCTURE HAVING SPLITTER PLATES OF MALLEABLE MATERIAL

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FIG. 11.

INVENTOR.
EARL B. RIETZ

BY
OSTROLENK, FABER, GERB & SOFFEN
ATTORNEYS

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INTERRUPTER STRUCTURE HAVING SPLITTER PLATES OF MALLEABLE MATERIAL

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FIG. 12

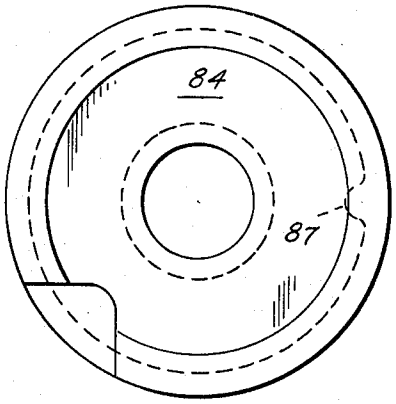


FIG. 13

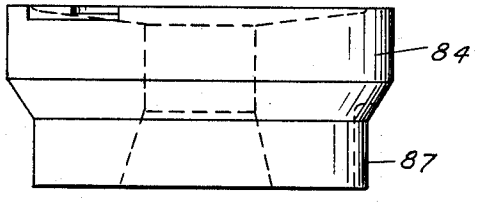
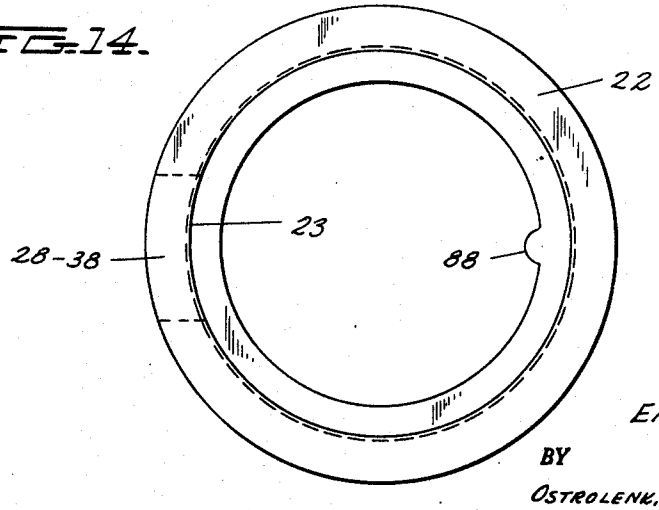


FIG. 14



INVENTOR.
EARL B. RIETZ

BY

OSTROLENK, FABER, GERB & SOFFEN

ATTORNEYS

United States Patent Office 3,128,360 Patented Apr. 7, 1964

3,128,360

INTERRUPTER STRUCTURE HAVING SPLITTER PLATES OF MALLEABLE MATERIAL

Earl B. Rietz, Glendale, Calif., assignor to I-T-E Circuit Breaker Company, Philadelphia, Pa., a corporation of Pennsylvania

Filed Jan. 14, 1960, Ser. No. 2,390
6 Claims. (Cl. 200—150)

This invention relates to fluid blast circuit interrupters for high speed circuit breakers, and more particularly relates to a novel interrupter assembly which uses a single pair of contacts.

The present invention is directed to an interrupter structure in which only a single pair of contacts are required for relatively high voltage ranges (of the order of 15–69 kilovolts) where the circuit being protected may be interrupted within a few half cycles.

In the preferred embodiment of the invention, the interrupter is formed of a stack of baffles which are sectionalized into an upper and lower interrupter chamber by a division baffle. A single arc generated by a single pair of contacts is drawn through a preferred portion of the interrupter structure which contains an upper chamber and a lower chamber. The upper chamber is especially adapted to promote rapid interruption of extremely large current arcs, while the lower chamber is especially adapted to promote the rapid interruption of medium current arcs.

A further novel configuration is provided below the two aforementioned chambers which is particularly useful in the interruption of extremely small current arcs.

Accordingly, the primary object of the present invention is to provide a novel interrupter structure of the fluid blast type which will open high power circuits within a few half cycles.

Another object of this invention is to provide a novel interrupter structure of the single contact type.

A further object of the invention is to provide a novel high speed interrupter structure which reduces arcing time to reduce contact erosion and oil deterioration.

A further object of this invention is to provide a novel interrupter structure wherein a high degree of control over the arc position and the pressure generated by the arc is obtained.

Another object of this invention is to provide a novel high speed interrupter wherein the arc splitters are relatively malleable whereby they will partially flow around the port openings to prevent communication between adjacent ports within the interrupter structure.

Yet another object of this invention is to provide a novel interrupter structure having an upper and lower chamber for high current and low current arc interruption respectively, with a still further chamber means below the two chambers for aiding in the interruption of extremely small current arcs.

Another object of this invention is to provide a novel interrupter structure formed of a plurality of keyed baffle plates to promote easy assembly of the interrupter.

A still further object of the invention is to provide a novel interrupter chamber construction wherein the entire chamber wall is made of a fibreglass type material with an appropriate binder.

It is another object of this invention to provide a novel interrupter structure of a plurality of easily assembled keyed baffle parts which are secured by a single locking means.

Yet another object of this invention is to provide a novel baffle structure for oil blast circuit breakers where the baffles are formed of a non-tracking, non-gas evolving, arc quenching material having a polyethylene base which can be formed by injection molding techniques.

A still further object of this invention is to provide a novel interrupter for oil circuit breakers which is easily removable, and occupies a relatively small oil volume within the circuit breaker.

Another object of this invention is to provide a contact structure for high voltage interrupters wherein a stationary contact is positioned off-center to insure that the arc will be drawn adjacent to the ports of the interrupter chamber.

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 shows a side cross-sectional view of an interrupter structure constructed in accordance with the present invention.

FIGURE 2 shows a partial side plane view of the interrupter of FIGURE 1 as seen from the left to particularly show the venting ports.

FIGURE 3 is a top plan view of the first plate of the arc interrupter assembly.

FIGURE 4 is a side plan view of the plate of FIGURE 3.

FIGURE 5 is a top plan view of an arc splitter plate of the assembly of FIGURE 1.

FIGURE 6 is a front plan view of the arc splitter plate of FIGURE 5.

FIGURE 7 is a top plan view of the division baffle plate of FIGURE 1.

FIGURE 8 is a side plan view of the division baffle of FIGURE 7.

FIGURE 9 is a top plan view of the lower baffle plate of the interrupter of FIGURE 1.

FIGURE 10 is a side cross-sectional view of the plate of FIGURE 9 taken across lines 10—10 in FIGURE 9.

FIGURE 11 is an exploded perspective view of the interrupter of FIGURE 1.

FIGURE 12 shows a top view of the retaining bushing.

FIGURE 13 is a side view of FIGURE 12.

FIGURE 14 is a bottom view of the interrupter chamber tube.

Referring now to the drawings and particularly to FIGURES 1 and 11, the interrupting unit shown is supported within an oil filled tank from a conductor stud or adapter 20 which is adapted to connect to an inclined terminal bushing (not shown).

A pressure confining tube 22 is then rigidly connected to conductor stud 20, as will be described later, and the wall of tube 22 is provided with a plurality of ports 28, 30, 32, 34, 36 and 38 through which exhaust gases and oil are vented under pressure during arc interruption within the tube 22.

In the past, pressure confining tube 22 has been formed of a heavy walled paper tube. In accordance with the present invention, tube or chamber 22 is made of a fibreglass type material which can be made as strong as steel and as light as magnesium. Thus, the chamber 22 can be made of fibreglass having an epoxy or polyester resin binder.

The use of fibreglass further permits the incorporation of an upper internal thread 23 which threadably receives a clamp means to be described later and the conductor stud 20, as shown in FIGURE 1.

As an alternative, the tube 22 can have an intermediate casting of aluminum, for example, bonded thereto by a bonding means such as a bond formed of equal parts of Conley weld C1 and C2 and the aluminum casting can then receive the stud 20. This type of structure is shown in my copending application Serial No. 2,530, filed January 14, 1960, now abandoned, and assigned to the assignee of the present invention.

The baffle stack within the interrupter is formed of a plurality of axially spaced baffle members which are held in position with respect to one another by tubular spac-

ing means. More specifically, the baffle stack is formed of baffle members **40**, **42**, **44**, **46**, **48**, **50**, **52** and **54**. All of baffle members **40** through **54** have been previously made of a fibre-type of material. This type material has the disadvantages of not being stable dimensionally, requires machining to a proper contour, as it is not susceptible to molding.

In accordance with the present invention, selected baffle members may be made of materials other than fibre, such as a polyethylene base material which can be injection molded, and is characterized in being non-tracking, non-gas evolving, and arc quenching type material.

Referring more specifically to the baffle elements, baffle member **40** is shown in FIGURES 3 and 4 as comprising a disk which may be of a fibre material and has a key-shaped opening **56** therein for receiving the movable contact element of the interrupter and one of the stationary contact elements, as will be described hereinafter. Baffle member **40** is further provided with a keying notch **58** which receives a cooperating protrusion of the next lower baffle in order to hold the two members in alignment with respect to one another to insure proper alignment during assembly.

A fibre spacing tube **60**, best seen in FIGURES 1 and 11, is then positioned within container **22** and above baffle **40**, and has its upper end abutting against a locking ring **62** which is threadably carried by threads **23** of container **22**. Thus, the locking ring **62**, as will be hereinafter seen, may be tightened downwardly against spacer **60** after the complete baffle assembly is connected together to rigidly retain the baffle assembly in position.

Immediately below baffle **40** is a first splitter plate **42**, best seen in FIGURES 5 and 6. As shown in FIGURE 11, the splitter plates **42** and **44** are contained within tubular spacer segment **64** which also abuts the upper baffle plate **40** and the lower baffle plate **46**. Splitter plates **42** and **44** are provided with upper and lower keying projections and depressions respectively, such as projection **66** and depression **68**, as well as semicircular projection **70** (see projection **70** of plate **42** in FIGURE 11). The projection such as projection **70** of FIGURES 6 and 11 for plate **42** is keyed to depression **58** of upper plate **40** of FIGURE 3 so that these elements are easily aligned with respect to one another within container **22**.

In a like manner, the splitter plates **42** and **44** are aligned with respect to one another by their cooperating projections and depressions **66** and **68**, shown in FIGURE 6.

While the splitter plates could be made of fibre, their complex shape would dictate complex and expensive fabrication. Moreover, it is important that the splitter plates be of a material that will not carbonize, is non-tracking and non-gas evolving.

In accordance with the present invention, the splitter plates such as plates **42** and **44** may be made of a non-tracking, non-gas evolving material having a polyethylene resin base, and is capable of fabrication by injection molding. By way of example, a material having a composition of 100 parts by weight of a polyethylene resin, 1 to 2 parts by weight of carbon-black, and 70 parts by weight of talcum has been found to give good results. In addition, this material is slightly malleable, the importance of which will be described hereinafter.

Next below the splitter plate **48** is a division baffle **46** of fibre material shown in FIGURES 7 and 8 as having two keying depressions **74** and **76**. For relatively high ratings, baffle **46** is made of a fibreglass material for added strength since it is subjected to very high pressures. The division baffle **46**, as will be seen hereinafter, creates an upper chamber **79** and a lower chamber **81**, as shown in FIGURE 1. Division baffle **46** is keyed with respect to lower splitter plate **44** by means of a projection, such as projection **70** of FIGURE 6, which is keyed into depression **76** of division baffle **46**. Splitter plates **48** and **50** which lie below division baffle **46** are constructed in a manner identical to that of plates **42** and **44** and are keyed with respect to one another and with respect to division baffle **46** in an identical manner.

The splitter plates **42**, **44**, **48** and **50** are, as stated above, identical in construction. Therefore, these plates are interchangeable with one another, and an increased number of exhaust ports can be formed by merely adding further splitter plates in the stacks.

Immediately below splitter plate **50** is the plate **52** which may be molded of a phenolic resin material. If desired, plate **52** may be made of a polyester glass compound to improve non-tracking and non-arcing characteristics. Plate **52**, as shown in FIGURES 9 and 10, has a keying depression **78** and a centrally aligned aperture **80**. One side of the plate **52** is provided with a hollow section **82** which forms an auxiliary chamber with respect to the adjacent plate **54** which, as shown in FIGURE 1, is identical to plate **54**. Plates **52** and **54** are keyed with respect to one another, even though they are symmetric to permit alignment of the port openings of the stack during assembly. Thus, plate **52** may have a keying projection **83** which cooperates with a depression of plate **54**, similar to depression **78** of plate **52**, as shown in FIGURES 9 and 10.

It will be noted that two auxiliary chambers or oil receiving pockets are created between members **54** and **84**, these chambers being chambers **90** and **92**, respectively.

The final member of the baffle stack is a fixed throat bushing or retaining bushing **84** which may be secured to the bottom of container **22** by screws, dowel pins, adhesives, or other fastening means which communicate between tube **22** and bushing **84**.

Throat bushing **84** is preferably of a phenolic resin material and serves the dual function of being the lower bushing and of supporting the baffle stack in tube **22** and prevents it from being blown out the bottom of tube **22**. Throat bushing **84** may also be molded of a polyester glass compound to improve non-tracking and non-arcing characteristics. It is also possible, if desired, to wind throat bushing **84** into the fibreglass chamber **22** to make it an integral part of the assembly. The bottom of tube **22** is formed with an inner shoulder **85** which receives the enlarged upper portion of throat bushing **84** as shown in FIGURE 1. Throat bushing **84** which is best seen in FIGURES 12 and 13 has a central opening **86** which receives the movable contact with close clearance, as will be described more fully hereinafter. A keying depression **87** of bushing **84** cooperates with a protrusion of baffle member **54** so that the baffle stack is keyed in position with respect to bushing **84**. The bushing is then keyed to tube **22** by means of a key slot **87** in the wall of bushing **84** which cooperates with a rib **88** (FIGURES 1 and 14) which is integral with tube **22**. Accordingly, the baffle stack port openings will be properly aligned with the openings in the tube **22**.

The assembly of the interrupter is apparent whereby the throat bushing **84** may be secured in keyed alignment in chamber **22** and the remaining baffle plates are then subassembled and pushed into place. The baffle assembly is then held in position by the clamping ring **62** which is threaded into thread **23** of tube **22** to apply pressure to the baffle assembly.

A movable contact rod **94** having an arc resistant material tip extends upwardly through the bottom of the baffle structure and toward a movable contact structure generally seen at **96** at the top of the interrupter structure. More specifically, the stationary contact structure is carried from, and is electrically connected to, adapter **20**, and is comprised of a plurality of angularly disposed contacts, such as contact **98** of FIGURES 1 and 11 which form a tulip-type cluster of contacts. Contact **98** is typical of the eight current carrying contacts and is supported from an electrically conductive hollow hub **100** by a flexible conductive strap **102** which is backed up by a high pressure leaf spring **104** which engages an insulating

button 106 carried from stationary contact 98. It will be noted that the insulating button 106 prevents current from flowing through the biasing spring 104, and confines it entirely to conductor 102 so that the spring will not be heated by current flow which could cause a change in the spring characteristic. Since each of the contacts is provided with its individual biasing spring, even contact pressure is assured.

If desired, the biasing springs for the stationary contacts could be provided by individual compression springs carried by a spring cage which surrounds the contact cluster. Here again the springs should be isolated from the current path. Furthermore, metal spacers (not shown) may be provided between fingers to prevent their being drawn together and welded under short circuit current conditions.

An arcing contact or arc positioning finger 108 which differs from the other stationary contacts in being longer and being (tipped) of an arc resistant material is provided to partially extend into the elongated portion 110 of opening 56 of plate 40, as shown in FIGURE 3.

The operating structure for contact 94 is not shown herein, but may be of any desirable type, and operates to withdraw the contact 94 (which is in the engaged position in FIGURE 1) downwardly and out of the stack of baffles to a position external of the interrupting chamber. Since the arc is most vulnerable when displaced sidewise and toward the exhaust ports 30 through 38, the arc is encouraged, from its inception, to assume this favorable displaced position because of the extended arcing contact 108 which is positioned along the side of the interrupting chamber 22 which contains these ports. Thus, the arc is drawn from the arcing finger or contact 108 for immediate displacement toward the exhaust ports to obtain instant blasting and pressure relief through the exhaust ports. During arcing, it will be noted that baffle plate 40 shields the end of the stationary contact fingers such as finger 98 to protect them from the arc.

The use of the division barrier 46 between chambers 79 and 81 inherently improves creepage path conditions, and functions to afford multiple arc extinguishing systems arranged closely in series which, namely, are the separated interrupting chambers 79 and 81.

Thus, for very heavy current interruption, intense pressure is generated from the inception of the arc, which pressure will immediately relieve itself through the upper exhaust ports 28, 30 and 36 in upper chamber 79 so that the arc will blast itself explosively to the left while the lower openings 34, 36 and 38 are still substantially closed off by the contact rod which is, although moving downwardly, still covering these port areas. It is to be noted that the center of rod 94 may have an axial opening therein for venting off excessive pressure developed during high arc current conditions.

In the event that the arc is a medium or low current arc, lower pressures are generated, and the arc will continue to be drawn downwardly into the lower chamber 81 where it will then be subjected to cross blast action from the fluid displaced from the upper chambers, as well as from the fluid contained in chamber 81.

In the past, and in the event that a very light current arc is drawn, insufficient pressure is developed in the chamber 81 to provide blast action, and the arc may continue after the end of contact 94 leaves the lower baffle plate 52. In the novel sub-chamber arrangement, however, when the arc reaches the sub-chambers 90 and 92 between the baffle stack and the throat bushing 84, some pressure will be generated in the sub-chambers 90 and 92 to produce a flow of fluid upwardly through the central opening and toward the exhaust ports. More important than this, however, the arc is exposed to the additional oil in the lower pockets whereby additional cooling of the arc results to aid in its interruption. By the time, then, that the tip of contact rod 94 leaves the interrupter, the circuit will be interrupted, regardless of whether the fault current is of an exceptionally heavy magnitude or an exceptionally small magnitude.

It will be noted that chambers 79 and 81 form relatively large oil reservoirs to provide space for the formation of a gas bubble during interruption and to supply oil to the volume evacuated by the contact rod 94. This is of great importance where the interrupter is for reclosing and a second interruption may occur immediately after the first.

As previously stated, the arc splitter plates are preferably of a material which is slightly malleable. This feature will cause the plates to flow around the lips of the port openings whereby the adjacent port openings are positively isolated from one another within the interrupter chamber and the possibility of arc gas seeping between the casing 22 and arc splitter to cause communication between two ports is prevented.

Although this invention has been described with respect to its preferred embodiments, it should be understood that many variations and modifications will now be obvious to those skilled in the art, and it is preferred, therefore, that the scope of this invention be limited not by the specific disclosure herein but only by the appended claims.

What is claimed is:

1. A container for an interrupter; said container being an elongated cylinder having a plurality of venting ports in the wall thereof; said container being comprised of a fibreglass material having a polyester resin binder; said container having a plurality of integral threads at one end thereof for receiving a clamping means, and a restricted internal section at its other end for receiving a throat bushing means inserted from said one end of said container; said clamping means being operable to clamp a stack of baffle plates against said throat bushing means within said container.

2. In an interrupting chamber for an oil blast circuit breaker; a hollow cylindrical container having a venting port therein and a first and second arc splitter plate; said first and second arc splitter plate being disposed adjacent one another and being supported with respect to said container; said first and second arc splitter plate having a configuration defining a channel from an internal portion of said container to said venting port; edge portions of said first and second arc splitter plates being positioned adjacent the top and bottom respectively of said venting port; said first and second arc splitter plates being of identical construction and being interchangeable with respect to one another; said first and second arc splitter plates being of a malleable material whereby said edge portions of said first and second arc splitter plates will flow over the upper and lower portions of said venting port to seal the engagement between said first and second arc splitter plates and the container portion carrying said venting port.

3. In an interrupting chamber for an oil blast circuit breaker; a hollow cylindrical container having a venting port therein and a first and second arc splitter plate; said first and second arc splitter plate being disposed adjacent one another and being supported with respect to said container; said first and second arc splitter plate having a configuration defining a channel from an internal portion of said container to said venting port; edge portions of said first and second arc splitter plates being positioned adjacent the top and bottom respectively of said venting port; said first and second arc splitter plates being of identical construction and being interchangeable with respect to one another; said arc splitter plates being molded of a non-tracking, non-gas evolving material having a polyethylene base; said first and second arc splitter plates being of a malleable material whereby said edge portions of said first and second arc splitter plates will flow over the upper and lower portions of said venting port to seal the engagement between said first and second arc splitter

plates and the container portion carrying said venting port.

4. In an interrupting chamber for an oil blast circuit breaker; a hollow cylindrical container having a first and second venting port therein and a first, second and third arc splitter plate disposed in a stack and supported with respect to said container; said first, second and third arc splitter plates being identical in construction and being interchangeable with respect to one another; said first and second arc splitter plate defining a first channel which communicates from an internal portion of said container to said first port; said second and third arc splitter plate defining a second channel which communicates from an internal portion of said container to said second port; edge portions of said first and second arc splitter plates being positioned adjacent the top and bottom respectively of said first port; edge portions of said second and third arc splitter plates being positioned adjacent the top and bottom respectively of said second port; said first and second and third arc splitter plates being of malleable material whereby said edge portions of said plates will flow around the edges of their respective ports to thereby seal off possible communication between said first and second ports between the inner wall of said container and said second arc splitter plate.

5. The device substantially as set forth in claim 2 which further includes a stationary contact and a movable bayonet type contact movable between an engaged and disengaged position with respect to said stationary contact; said stationary contact being positioned within said interrupter chamber; said stationary contact including a contact finger, leaf spring biasing means for biasing said contact finger toward engagement with respect to said movable contact rod, a contact hub and flexible connecting means; said contact hub being electrically connected to said contact finger by said flexible connecting means; one end of said leaf spring biasing means being connected to said contact hub, the other end of said leaf spring biasing means engaging said contact finger; said contact finger having an insulated button extending therefrom; said leaf spring engaging said insulating button.

6. The device substantially as set forth in claim 2, wherein said first and second arc splitter plates have a crescent-like shape with said edge portions being centrally of the circular portion of said crescent and forming an oil receiving pocket at the cut-away portion defining said crescent.

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