July 2, 1968 H. H. FAHNOE 3,391,368

CONDENSER FOR CIRCUIT INTERRUPTER CAUSING FLOW OF CONDENSIBLE GAS

Filed Jan. 22, 1968 3 Sheets-Sheet 1

Fig. 1

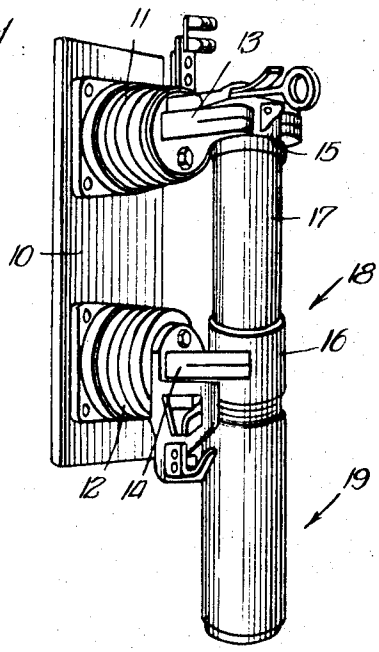


Fig. 2A

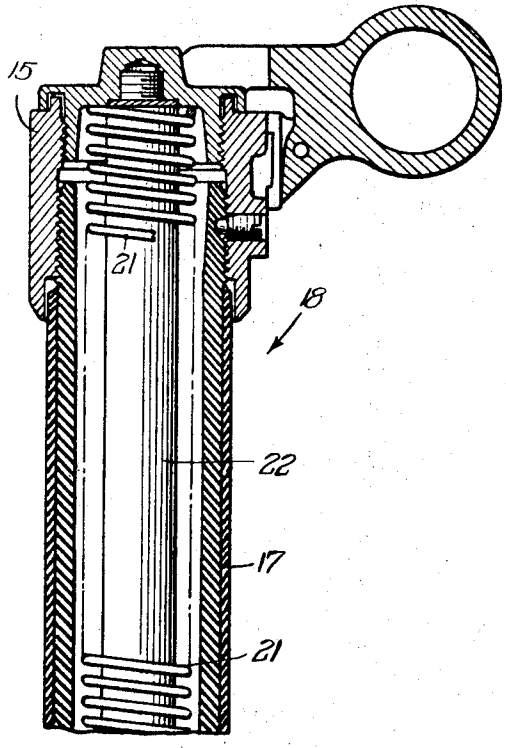
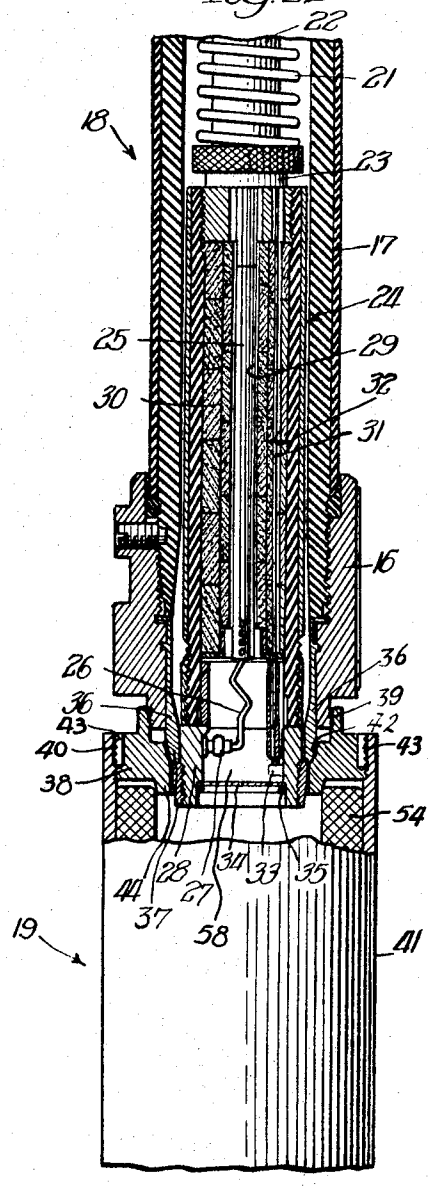


Fig. 2B



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Fig. 3

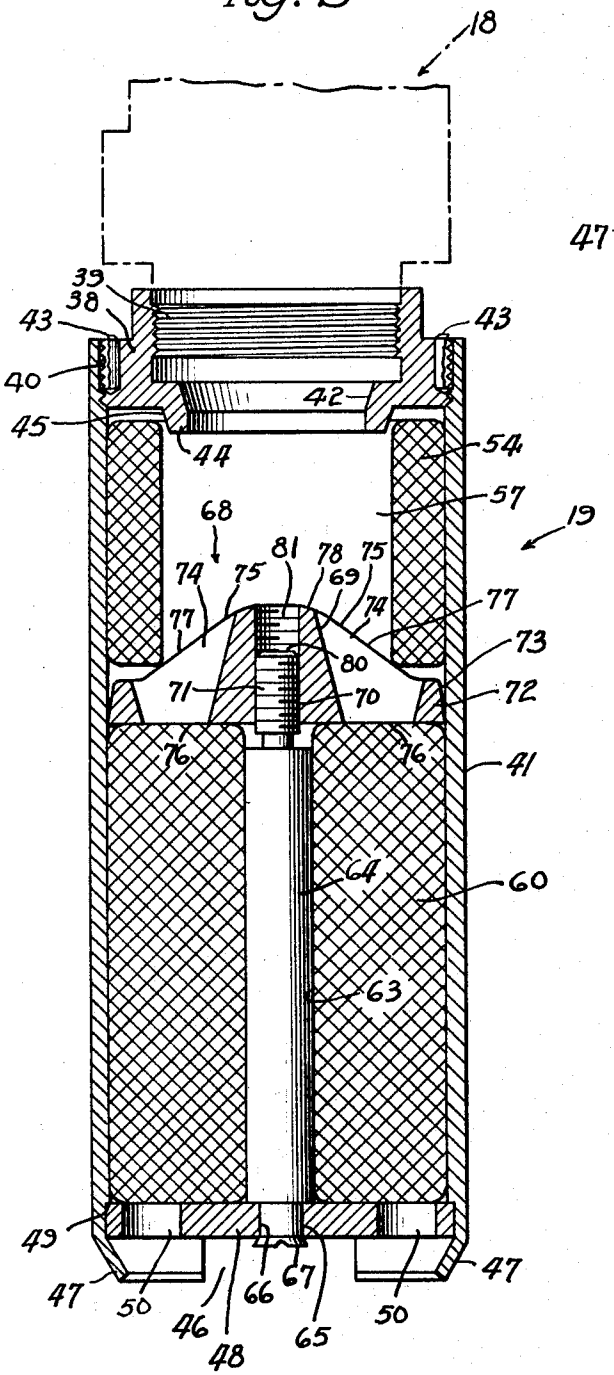


Fig. 4

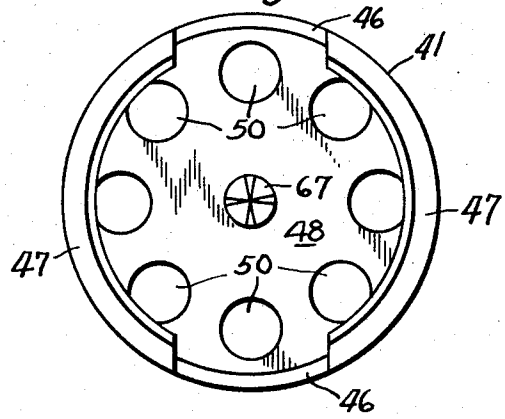


Fig. 5

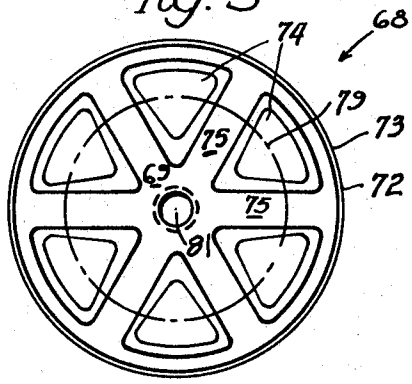
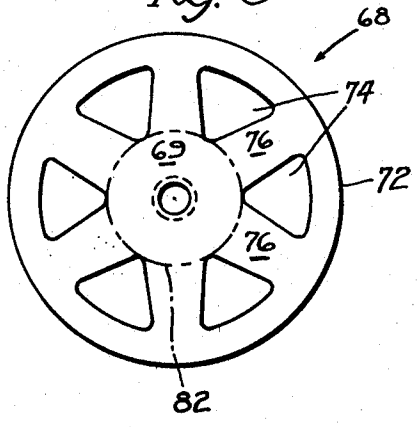


Fig. 6



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Fig. 7

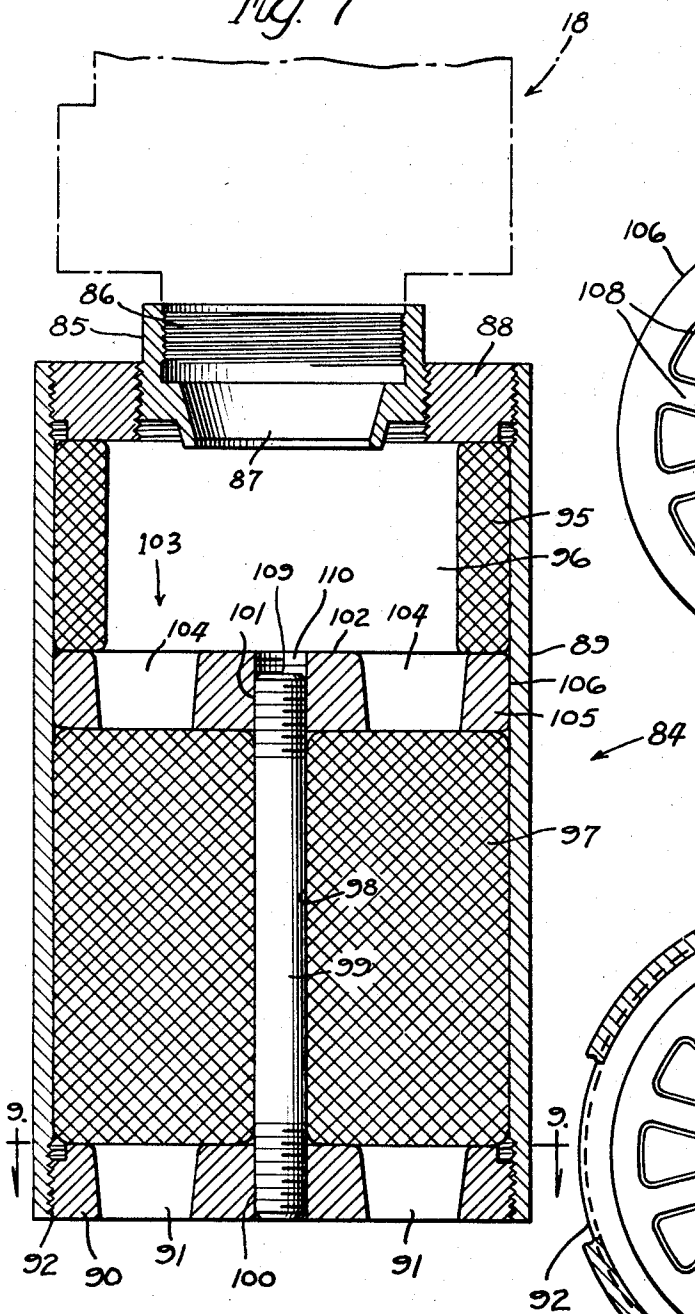


Fig. 8

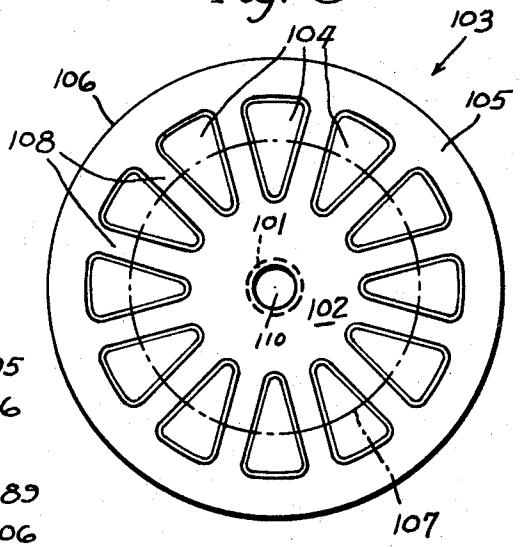
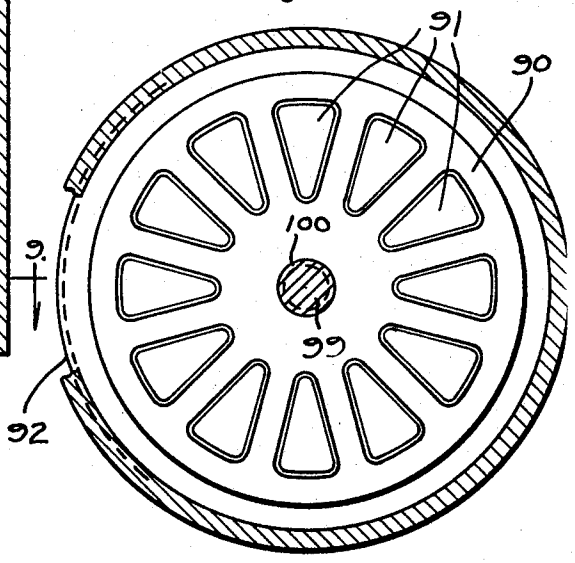


Fig. 9



United States Patent Office 3,391,368 Patented July 2, 1968

3,391,368

CONDENSER FOR CIRCUIT INTERRUPTER CAUSING FLOW OF CONDENSIBLE GAS

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Filed Jan. 22, 1968, Ser. No. 699,654
17 Claims. (Cl. 337—203)

ABSTRACT OF THE DISCLOSURE

Condenser for gas from a fuse has an arc products director interposed between sections of heavy wire screen in a housing.

This invention is an improvement over the constructions disclosed in Lindell U.S. Patent 3,230,331, issued Jan. 18, 1966.

Among the objects of this invention are: To increase substantially the effectiveness of the construction of the aforesaid patent without substantially increasing the over all physical size thereof for a given rated fuse duty; to permit a substantial increase in the fault interrupting capacity of a solid material type fuse by equipping it with a gas and arc products condenser capable of handling the increased discharge due to the interruption of higher fault current; to increase substantially the number of maximum severity operations that can be withstood by a gas and arc products condenser used for receiving the same to reduce noise and emission of gas and metallic particles to the atmosphere at a given duty; to interpose between the heavy wire screen sections in a housing or a shell arranged to receive the gas and arc products from a solid material type fuse, an arc products director or arc transfer terminal having longitudinal openings for directing and distributing the exhaust flow of the gas and arc products into the wire screen therebelow, capable of absorbing a substantial portion of the energy therein, and thereby reducing erosion and vaporization of the wire screen sections; to transfer and hold the arc root substantially centrally of the director or arc transfer terminal by providing a pocket therein opening centrally thereof toward the source of the exhaust flow along the rim of which the arc root tends to remain; and to restrict and position the individual openings in the arc products director to avoid high back pressure in the fuse unit on high current interruption by permitting and distributing free total flow of the gas and arc products through the several openings into the wire screen section therebelow while preventing direct impingement from the fuse bore of these products and transfer of the arc root onto this wire section.

According to this invention a high thermal capacity good heat conductivity gas or arc products director is interposed between heavy wire screen sections in a housing or shell of a condenser or muffler secured to the discharge end of a solid material type fuse that may be called upon to interrupt alternating fault current flow of the order of several thousands of amperes. Because of the shape and construction of the director it acts both as an arc transfer terminal and as a shield for the wire screen section on which it rests. The director has openings through it which are so shaped as to permit free flow of gas and arc products therethrough to distribute them relatively uniformly and with a smooth flow pattern into this wire screen section with the result that high back pressure in the fuse bore is not developed. A pocket or cavity is provided in the central portion of the director and it opens toward the source of the arc establishing means to hold the arc root transferred thereto in the vicinity thereof thereby preventing its impingement on and accompanying erosion of the sections of wire screen.

In the drawings: FIG. 1 is a perspective view of a circuit interrupter in which the present invention is embodied. FIGS. 2A and 2B, taken together with the former placed above the latter, show a vertical longitudinal sectional view through the circuit interrupter illustrated in FIG. 1 and through a portion of the condenser therefor, the remaining portion of the condenser being shown in elevation. FIG. 3 is a vertical sectional view, at an enlarged scale, showing the details of construction of the condenser or muffler shown in FIG. 2B. FIG. 4 is a bottom plan view of the condenser shown in FIG. 3. FIG. 5 is a top plan view of the gas or arc products director. FIG. 6 is a bottom plan view of the director. FIG. 7 is a view, similar to FIG. 3, and shows another embodiment of the condenser or muffler. FIG. 8 is a top plan view of the gas or arc products director in FIG. 7. FIG. 9 is a horizontal sectional view taken generally along the line 9—9 of FIG. 7.

Referring now particularly to FIG. 1 of the drawings, it will be observed that the reference character **10** designates a base which may be a metal base carrying upper and lower insulators **11** and **12**. It will be understood that the length of the insulators **11** and **12** and their spacing apart depend upon the voltage of the system with which the present invention is employed. Upper and lower line contact clips **13** and **14** are carried by the insulators **11** and **12** at their outer ends for detachably receiving upper and lower terminals **15** and **16** that are mounted on the upper and lower ends of a tubular insulating housing or fuse holder **17** of a circuit interrupter that is indicated, generally, at **18**. Associated with the lower terminal **16** is a condenser or muffler **19** in which the present invention is embodied.

As shown in FIGS. 2A–2B a coil tension spring **21** and a flexible cable or conductor **22** interconnect the upper terminal **14** and a spring and cable fastener **23** which forms a part of a replaceable cartridge, shown generally at **24**. The replaceable cartridge **24** includes a rod-like terminal **25** which is connected at its upper end to the spring and cable fastener **23** and moves therewith upwardly under the influence of the coil tension spring **21** when it is released. At the lower end of the rod-like terminal **25** there is a fusible element **26** which is connected to a terminal fitting **27** that extends radially inwardly from a stationary terminal **28** at the lower end of the cartridge **24**. The rod-like terminal **25** moves upwardly through a bore **29** that is formed in a body **30** of arc extinguishing material which may be boric acid or other water containing dielectric material. In parallel with the rod-like terminal **25** and fusible element **26** is a strain element assembly **31**. It is connected at its upper end to the spring and cable fastener **23** and extends through an auxiliary bore **32** in the body **30** of arc extinguishing material and is connected at its lower end to a strain element pin **33** that extends radially inwardly from the stationary terminal **28**. The lower end of the cartridge **24** is closed by a frangible disc **34** that is held in place by a snap lock spring **35**. Connection between the terminal **28** and the lower terminal **16** is provided by contact fingers **36** depending from the latter and engaging the periphery of the former. The lower ends of the contact fingers **36** abut a locking ring **37** threaded on the terminal **28**.

When a circuit interrupter of the type illustrated at **18** and described hereinbefore operates to interrupt the flow of alternating fault current, particularly a relatively heavy fault current, a large amount of water vapor or gas is evolved from the bore **29** in the body **30** of arc extinguishing material. This vapor or gas together with arc plasma at extremely high temperature and pressure flows through the bore **29** and out of the lower end of the cartridge **24**. The frangible disc **34** initially is promptly expelled along with the metal vapors and arc plasma incident to the blow-

ing of the fusible element **25** and release of the strain element assembly **31** which permit the spring **21** to retract the rod-like terminal **25** into the bore **29**. When these arc products are permitted to flow directly to the atmosphere, no particular interruption problem is involved although care must be taken that the part of the highly ionized arc core that usually extends below the discharge end of the fuse cartridge **24** does not cause an external fault to another circuit or to ground or that the incident shock wave is not too severe in enclosed installations. When the circuit interrupter **18** is mounted within a relatively small enclosure, provision is made, according to this invention, by mounting the condenser **19** on the lower terminal **16** for confining the arc to the inner end of the condenser **19** and for limiting the discharge of arc products during the relatively short critical period when the high temperatures and pressures tend to be created with the result that the shock waves incident thereto are reduced to such an extent at a given current level that an ordinary enclosure can withstand them and the conductivity of the exhaust products is lowered so that large clearances or insulating shields are not necessary within such enclosure except at the very highest levels considerably in excess of the capabilities of the constructions disclosed in the above identified patent.

The condenser or muffler **19** includes an adapter **38**, which may be formed of brass, having an internal thread **39** for cooperation with an external thread on the lower terminal **16**. The adapter **38** has an external thread **40** to receive the upper end of an elongated cylindrical shell **41**. The adapter **38** also has a conical surface **42** for engaging the contact fingers **36** and clamping them against the terminal **28**.

FIGS. 3, 4, 5 and 6 show more clearly the details of construction of the elongated condenser or muffler **19** which is specially designed and proportioned for use with a fuse type circuit interrupter **18** having a continuous current rating of 200 amperes, a voltage rating of 15,000 volts and an interrupting rating at this voltage of 20,000 amperes. Here it will be observed that the adapter **38** is threaded into the upper end of the elongated cylindrical shell **41** which is formed of suitable high strength metal. Retaining pins **43** extend along the threads **40** to hold the shell **41** against rotation relative to the adapter **38**. The adapter **38** has a central depending flange **44** the outer surface **45** of which is conical for a purpose that will be apparent presently. The lower end of the shell **41** is slotted transversely as indicated at **46** for receiving a bar to facilitate the application or removal of the condenser **19** to or from terminal **16** at the lower end of the circuit interrupter **18**. The extreme lower end **47** of the shell **41** is deformed inwardly to hold in place a cover disc or closure **48** that may be formed of hot rolled steel plate. The upper peripheral surface of the cover disc or closure **48** bears against an annular shoulder **49** which is formed along the inner wall of the shell **41** and against which the cover disc or closure **48** is held when the lower end **47** is inturned. Exhaust ports **50**, of which there may be eight in number as shown in FIG. 4, are formed in the cover disc or closure **48** to provide a communication to the atmosphere.

At the upper end of the shell **41** there is positioned a first annular section **54** of wire screen. The section **54** of wire screen is relatively short and is formed of high heat conductivity relatively rigid convolutely wound 5 mesh wire screen that is formed by interweaving lengthwise extending wires and circularly extending wires of copper. The arrangement is such that a large diameter passageway **57** is provided centrally of the shell **41** and in alignment with and of larger diameter than the discharge opening **58** through the terminal **28**. The conical surface **45** of the central depending flange **44** fits snugly into the upper end of the passageway **57**. The large diameter passageway **57** provides a large area for receiving the initial blast from the circuit interrupter **18** on blowing of the fusible element **26** and the strain element assembly **31**. As shown, in FIG. 3 the outer periphery of the first wire screen section **54** is juxtaposed to the inner surface of the shell **41** and thus substantially fills the cross section thereof except for the large diameter passageway **57**.

Below and spaced slightly from the first wire screen section **54** is a second annular section **60** of wire screen which is substantially longer than the first section **54** and is formed in the same manner by convolutely winding relatively heavy wire screen of the same size as referred to above. The second wire screen section **60** is formed with a small diameter opening **63** therethrough which is substantially filled by a metallic stud **64** that preferably is formed of good heat conducting metal such as silicon bronze rod. The outer periphery of the second wire screen section **60** is such as to fit snugly against the inner surface of the shell **41** while the diameter of the opening **63** is such that the inner periphery fits snugly against the outer surface of the metallic stud **64**. Except for the metallic stud **64** the second wire screen section **60** substantially fills the cross section of the lower end of the shell **41**.

At its lower end the metallic stud **64** has a reduced diameter section **65** that extends through a central opening **66** in the cover disc or closure **48**. The outer end is peened over as indicated at **67** to secure the metallic stud **64** to the cover disc or closure **48**.

With a view to absorbing a substantial amount of heat energy from the arc products that flow through the large diameter passageway **57** from the circuit interrupter **18** on operation thereof and for protecting the wire screen section **54** and especially the wire screen section **60** from erosion due to impingement thereon of the high temperature gas and arc products or transfer of the lower arc root thereto, there is provided between the juxtaposed ends of the wire screen sections **54** and **60** a gas or arc products director that is indicated, generally, at **68**. It is shown in cross section in FIG. 3 and in more detail in FIGS. 5 and 6. The gas or arc products director **68** preferably is formed of high heat conductivity cast copper alloy and has a relatively great heat capacity. Accordingly, it is capable of absorbing a relatively great amount of heat energy from the arc and withstanding the blast of gas and arc products without excessive erosion or vaporization. Also the director **68** provides momentarily a terminal for the root of the arc that may be transferred to it from the terminals **27** and **28** of the fuse type circuit interrupter **18** by the blast of arc products and magnetic forces as the arc extends in hairpin fashion from these terminals.

The configuration of the gas or arc products director **68** is important. It has a central generally truncated conical section **69** which is in alignment with the discharge opening **58** through the terminal **28** and which in the lower capacity rating (200 amperes) projects a substantial distance into the lower end of the large diameter passageway **57**. The conical section **69** is threaded at **70** for receiving a threaded reduced diameter upper end **71** of the stud **64**. The director **68** also has a rim **72** that is generally trapezoidal in cross section with a generally cylindrical outer surface **73** which is juxtaposed to the inner surface of the shell **41**. Openings **74** are formed in the director **68** between radially extending ribs **75** which taper from base sections **76** adjacent the upper end of the wire screen section **60** to curved upper ends **77**. The cross sectional configuration of the director **68**, as shown in FIG. 3, has a generally arcuate shape **78** along the upper end for the purpose of providing together with the tapered ribs **75** a streamline flow for the gas and arc products that are discharged through the large diameter passageway **57** in the first wire screen section **54**. The lateral dimension of each of the openings **74** along their pitch circle **79**, FIG. 5, is not substantially greater than the longitudinal dimension of each opening **74** at the pitch circle **79** for the purpose of preventing the arc from looping downwardly past the ribs **75** and impinging on the upper end of the screen section **60**. However, the area of the openings **74** is such as to permit sufficient flow therethrough

of the gas and arc products that the back pressure in the bore **29** of the circuit interrupter **18** does not become excessive.

It is important that the arc root or the terminal of the arc drawn on blowing of the fusible element **26** and strain element assembly **31** that is blown into the condenser or muffler **19** remain on the gas or arc products director **68** and particularly on the central section **69** thereof to minimize erosion of the annular sections **54** and **60** of wire screen. It is for this purpose that the upper end **80** of the stud **64** is spaced from the upper end of the threaded opening **70**, thereby providing a cavity or pocket **81** along the periphery of which there is a great tendency for the arc root or terminal to locate in contradistinction to the outer surface of the central section **69** or any other part of the gas or arc products director **68** or of the annular sections **54** and **60** of wire screen.

In FIG. 6 the broken line circle **82** encloses the area of the central section **69** adjacent the second section **60** of wire screen. This area is about the same as the area of the discharge opening **58** through the terminal **28**, FIG. 2B. This relationship minimizes the impingement of the arc products onto the upper end of this wire screen section.

In assembling the elongated condenser or muffler **19**, the adapter **38** is threaded into the upper end of the shell **41** and then is secured in place by the pins **43**. Next the first wire screen section **54** is inserted into the shell **41** which, for assembly purposes, is turned upside down. The upper end of the large diameter passageway **57** overlies the central depending flange **44**. The second wire screen section **60**, mounted on the cover disc or closure **48** around the metallic stud **64** and held in place by the director **68**, next is inserted with the central conical section **69** projecting into the large diameter passageway **57**. Finally the lower inturned end **47** is formed to the shape indicated at the lower end of FIG. 3 to securely hold the assembly in place.

The arrangement just described provides for a relatively streamline flow of the gas and arc products from the discharge opening **58** in the terminal **28** through the large diameter passageway **57** and through the openings **74** in the director **68** for equal distribution through the interstices of the second wire screen **60**. In addition as the arc products and gas flow through the openings **74** into the wire screen section **60**, a substantial amount of heat energy is absorbed therefrom. Also the central upper end of the section **69** acts as a stationary arc transfer terminal. Due to the cavity or pocket **81**, the arc root centers in or around it and erosion due to direct impingement of the arc products or the arc takes place here rather than on the first wire screen section **54** or the underlying screen section **60**. Because the gas and arc products are so well distributed with a relatively smooth flow pattern, the wire screen sections **54** and **60**, and particularly the latter, are more efficiently used. A substantial portion of the heat is absorbed before the gas and arc products are discharged through the exhaust ports **50** in the cover disc or closure **48**. The net result is a limited volume of relatively cool gases that is finally discharged at lower pressures with reduced flame and sound and shock waves as an incident to maximum value of the current flow that is interrupted by the interrupter **18**. This makes the over all assembly much more suitable for relatively smaller and lighter enclosures, especially when higher interrupting capacities are required.

In FIGS. 7, 8 and 9 there are shown details of construction of a modified form of elongated condenser or muffler that is indicated, generally, at **84**. It is arranged to be used in conjunction with a circuit interrupter **18** of the fuse type described hereinbefore having a continuous current rating of 400 amperes, a voltage rating of 15,000 volts, and an interrupting rating at this voltage of 40,000 amperes. An adapter **85** is employed having an internal thread **86** for mounting the condenser or muffler **84** on the lower terminal **16** of the circuit interrupter **18**. The adapter **85** has a conical opening **87** and is threaded into an adapter extension ring **88** which, in turn, is threaded into the upper end of an elongated cylindrical shell **89** that may be formed of high strength metal such as steeel. At its lower end the shell **89** has a cover disc or closure **90** that may be formed of steel or brass. For example the closure **90** may be a copper alloy casting and it is provided with sector shaped openings **91**. The lower end of the shell **89** is threaded at **92** for receiving the cover disc or closure **90**.

At the upper end of the shell **89** and below the adapter extension ring **88** there is provided a first annular section **95** of wire screen. It is formed of the same material as the first annular section **54** of wire screen referred to hereinbefore. The section **95** of wire screen is wound so as to provide a large diameter passageway **96** into which the gas and arc products from the circuit interrupter **18** are discharged on operation thereof to interrupt the circuit in which it is connected. Below and spaced from the first annular section **95** of wire screen is a second annular section **97** of wire screen which is relatively long. Both sections **95** and **97** of wire screen are juxtaposed to the inner surface of the shell **89** and substantially fill the same except for the large diameter passageway **96** in the former and a small diameter opening **98** in the latter. A metallic stud **99** of copper alloy substantially fills the small diameter opening **98** through the section **97** of wire screen. At its lower end the stud **99** is threaded as indicated at **100** in the cover disc or closure **90** centrally thereof. At its upper end the stud **99** is threaded, as indicated at **101**, into the central section **102** of a gas or arc products director **103**. Thes arc products director **103** is formed preferably of high heat conductivity material such as cast copper alloy. For the purpose of placing the large diameter passageway **96** in communication with the space below the gas or arc products director **103** which is filled by the second annular section **97** of wire screen and the metallic stud **99**, sector shaped openings **104** are provided between a rim **105** of the gas or arc products director **103** and the central section **102** thereof. The sector shaped openings **104** are tapered from the side that faces the second annular section **97** of wire screen to a larger area opening at the upper end. The rim **105** is generally trapezoidal in cross section and it has a generally cylindrical surface **106** which has a snug fit with the juxtaposed inner surface of the shell **89**. The sector shaped openings **91** in the cover disc or closure **90** are tapered similar to the taper for the openings **104** from a minimum at the outer side to a maximum at the top side.

The lateral dimension of each of the sector shaped openings **104** in the gas or arc products director **103** along their pitch circle **107** is not substantially greater than the longitudinal dimension of each opening **104** at the pitch circle **107**. The reason for this, as previously pointed out for the gas or arc products director **68**, is to prevent the arc from looping downwardly past ribs **108** which interconnect the central section **102** and the rim **105** and impinging on the upper end of the screen section **97** therebelow. However, the area of the sector shaped openings **104** is such as to permit sufficient flow therethrough of the gas and arc products that the back pressure in the bore **29** of the circuit interrupter **18** does not become excessive which would impede the exhaust from the bore **29** and would tend to prolong arcing.

It is important that the root of the arc that is blown into the large diameter passageway **96** be held on the central section **102** of the gas or arc products director **103** and not be permitted to wander to the first annular section **95** of wire screen or through the sector shaped openings **104** to impinge on the annular section **97** of wire screen therebelow. Accordingly, the passageway **96** in the first annular section **95** is larger than the exhaust opening **58** in the terminal **28** and is greater than the area of the central section **102** of the director **103**. Further, the upper end **109** of the metallic stud **99** is threaded only part

way into the central section **102** with the result that a cavity or pocket **110** is provided at the upper end in the central section **102** along the periphery of which the arc root tends to remain. Any erosion that takes place here can be readily accommodated since the central section **102** has a relatively large cross section as does the metallic stud **99**.

Instead of threading the upper end of the metallic stud **99** into the central section **102** of the gas or arc products director **103**, the upper end of the metallic stud **99** can be juxtaposed to the underside of the central section **102** which would be imperforate but would have the cavity **110** formed in the upper side by drilling part way through. The principal reason for securing the ends of the metallic stud **99** to the cover disc or closure **90** and to the gas or arc products director **103** is for convenience in assembly.

What is claimed as new is:

1. In a circuit interrupter

means for establishing an arc and causing an exhaust flow of condensible gas and arc products at high temperature and pressure,

an elongated cylindrical shell joined to said arc establishing means and providing a cylindrical chamber for receiving said exhaust flow at one end and centrally thereof,

a closure at the other end of said chamber secured to said shell and having exhaust ports venting said chamber to the atmosphere,

a first annular section of wire screen at said one end of said chmaber with its outer periphery juxtaposed to the inner surface thereof and its inner surface out of the direct path of said exhaust flow and defining a passgaeway having a relatively large diameter for receiving said exhaust flow,

a second annular section of wire screen in said chamber in engagement at one end with said closure, spaced at its other end from said first annular section, having its outer periphery juxtaposed to said inner surface of said chamber, and having a relatively small diameter opening extending centrally thereof, and

metallic arc products director means interposed between the juxtaposed ends of said sections of wire screen, extending into juxtaposition with said inner surface of said shell, having a solid central portion in the direct path of said exhaust flow, and having openings therethrough between said central portion and the periphery of said director means for directing said exhaust flow from said relatively large diameter passageway in said first section of wire screen into said second section of wire screen to be cooled and condensed and to flow through said exhaust ports in said closure.

2. The circuit interrupter according to claim **1** wherein

a metallic stud extends through said relatively small diameter opening in said second annular section of wire screen and substantially fills it, and

means secure one end of said stud to said closure and the other end of said stud to said arc products director means.

3. The circuit interrupter according to claim **1** wherein said arc products director means has a circumferential rim that is juxtaposed to the inner surface of said shell and overlies said second annular section of wire screen.

4. The circuit interrupter according to claim **1** wherein

said openings in said arc products director means are located between ribs that extend radially from said central portion thereof to a rim juxtaposed to said inner surface of said shell, and

the lateral dimension of each of said openings along their pitch circle is not substantially greater than the longitudinal dimension of each opening at said pitch circle.

5. The circuit interrupter according to claim **4** wherein said openings are sector shaped.

6. The circuit interrupter according to claim **1** wherein said arc products director means has a central generally truncated conical section with the smaller end projecting into said relatively large diameter passageway.

7. The circuit interrupter according to claim **1** wherein said arc products director means includes

a central generally truncated conical section with the smaller end projecting into said relatively large diameter passageway,

a rim having a cylindrical outer periphery, and

ribs extending radially between said central section and said rim, said ribs decreasing in thickness from a maximum adjacent said second section of wire screen.

8. The circuit interrupter according to claim **1** wherein

said arc products director means is a circular metallic plate having ribs extending radially from said central portion thereof to a rim juxtaposed to the inner surface of said shell, and

said openings are located between said ribs and are sector shaped.

9. The circuit interrupter according to claim **8** wherein said ribs decrease in thickness from a maximum adjacent said second section of wire screen.

10. In a circuit interrupter

means for establishing an arc and causing an exhaust flow of condensible gas and arc products at high temperature and pressure,

an elongated cylindrical shell joined to said arc establishing means and providing a cylindrical chamber for receiving said exhaust flow at one end and centrally thereof,

a closure at the other end of said chamber secured to said shell and having exhaust ports venting said chamber to the atmosphere,

a first annular section of wire screen at said one end of said chamber with its outer periphery juxtaposed to the inner surface thereof and its inner surface out of the direct path of said exhaust flow and defining a passageway having a relatively large diameter for receiving said exhaust flow,

a second annular section of wire screen in said chamber in engagement at one end with said closure, endwise from said first annular section, having its outer periphery juxtaposed to said inner surface of said chamber, and having a relatively small diameter opening extending centrally thereof, and

metallic arc products deflector means interposed between the juxtaposed ends of said sections of wire screen, and having a solid central portion in the direct path of said exhaust flow, a cavity in said central portion opening toward said arc establishing means to hold the arc root incident to operation of said circuit interrupter substantially in the vicinity of said cavity and openings placing said large diameter passageway in communication with said second section of wire screen,

11. The circuit interrupter according to claim **10** wherein said arc products deflector means extends into juxtaposition with said inner surface of said shell and said openings are located between said central portion and the periphery of said deflector means for directing said exhaust flow from said relatively large diameter passageway in said first section of wire screen into the other end of said second section of wire screen to be cooled and condensed and to flow through said exhaust ports in said closure.

12. The circuit interrupter according to claim **11** wherein

a metallic stud extends through said relatively small diameter opening in said second annular section of wire screen and substantially fills it, and

means secure one end of said stud to said closure and the other end of said stud to said arc products director means.

13. The circuit interrupter according to claim 11 wherein

said openings in said arc products director means are located between ribs that extend radially from said central portion thereof to a rim juxtaposed to said inner surface of said shell, and

the lateral dimension of each of said openings along their pitch circle is not substantially greater than the longitudinal dimension of each opening at said pitch circle.

14. The circuit interrupter according to claim 11 wherein said arc products director means has a central generally truncated conical section with the smaller end projecting into said relatively large diameter passageway.

15. The circuit interrupter according to claim 11 wherein said arc products director means includes

a central generally truncated conical section with the smaller end projecting into said relatively large diameter passageway,

a rim having a cylindrical outer periphery, and

ribs extending radially between said central section and said rim, said ribs decreasing in thickness from a maximum adjacent said second section of wire screen.

16. The circuit interrupter according to claim 11 wherein

said arc products director means is a circular metallic plate having ribs extending radially from said central portion thereof to a rim juxtaposed to the inner surface of said shell, and

said openings are located between ribs and are sector shaped.

17. The circuit interrupter according to claim 11 wherein said ribs decrease in thickness from a maximum adjacent said second section of wire screen.

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