May 18, 1943 H. A. TRIPLETT 2,319,277

CIRCUIT INTERRUPTING APPARATUS

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Fig. 1.

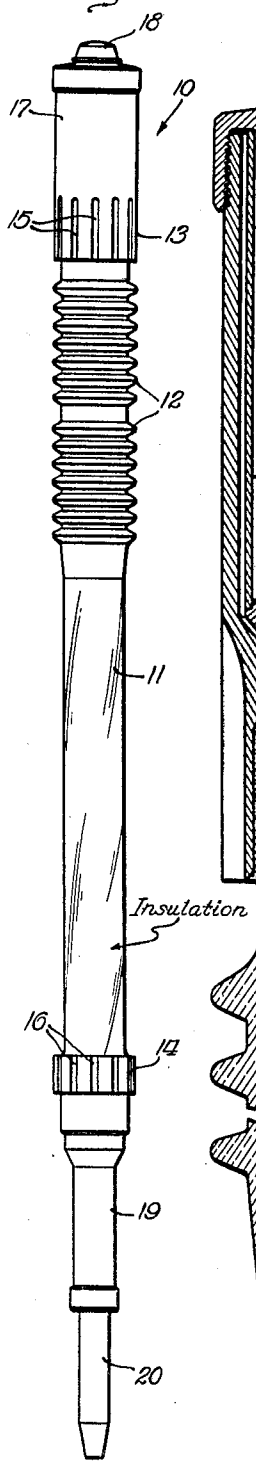


Fig. 2.

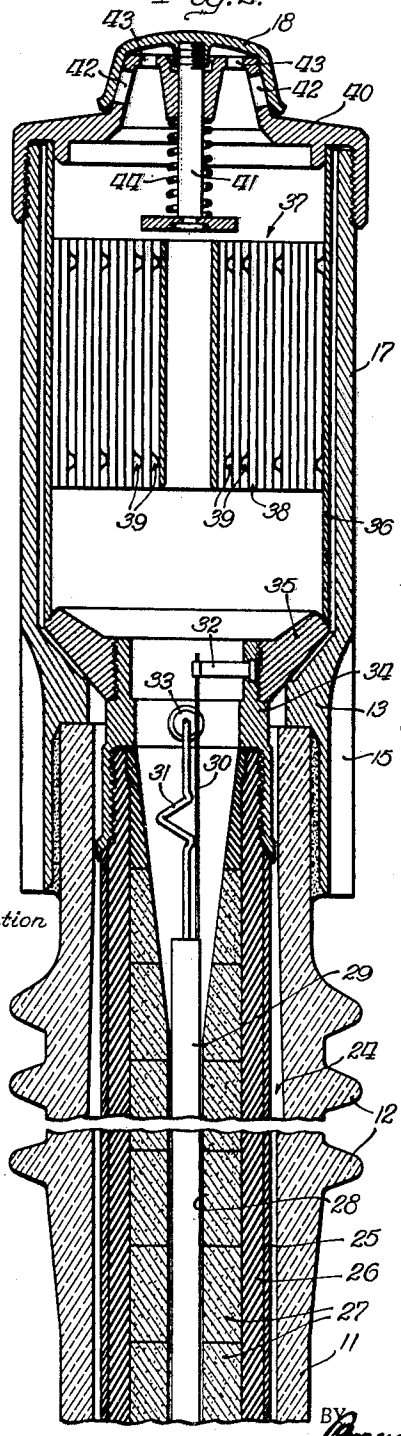
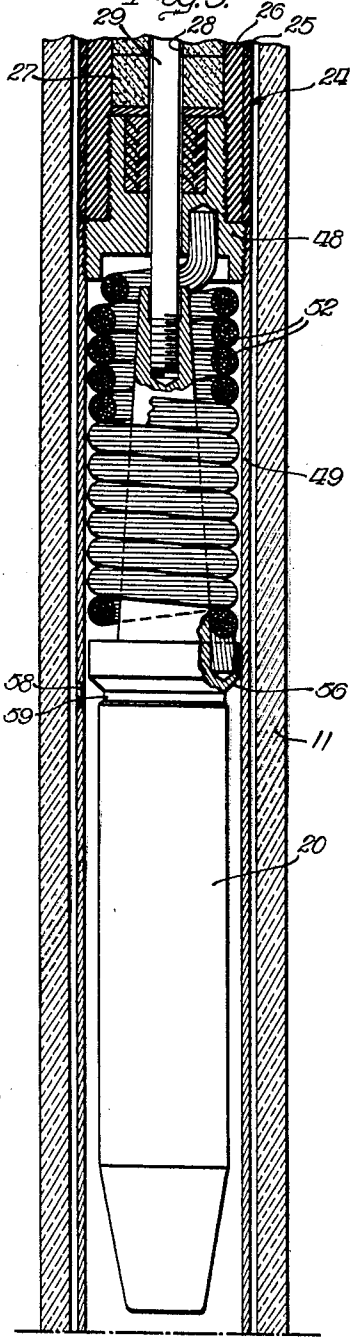


Fig. 3.



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CIRCUIT INTERRUPTING APPARATUS

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Fig. 4.

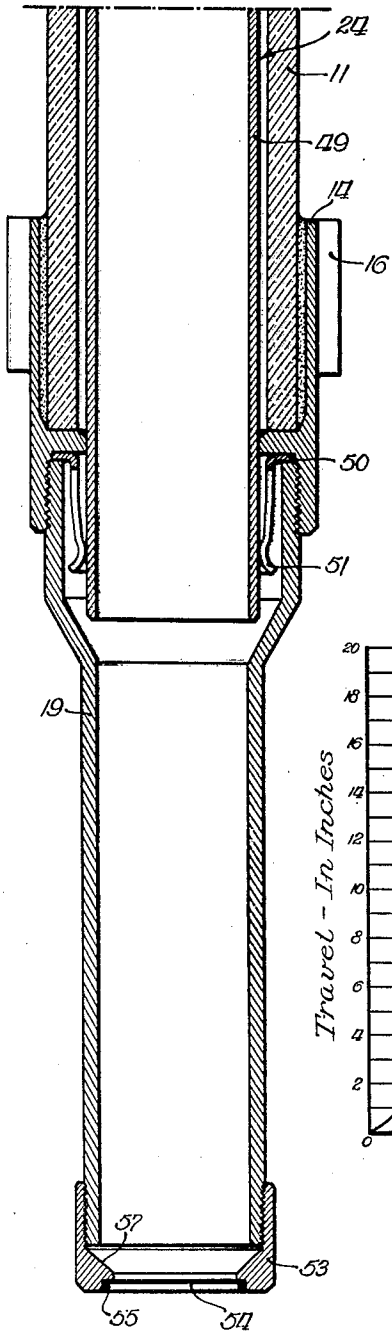


Fig. 5.

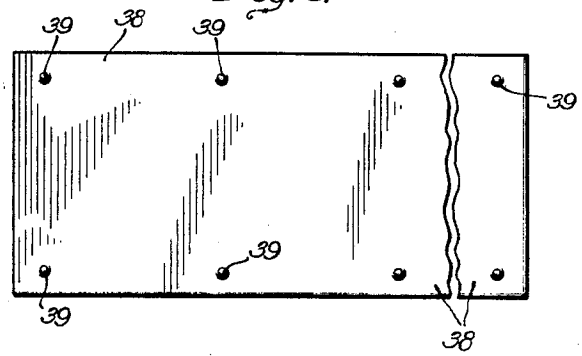
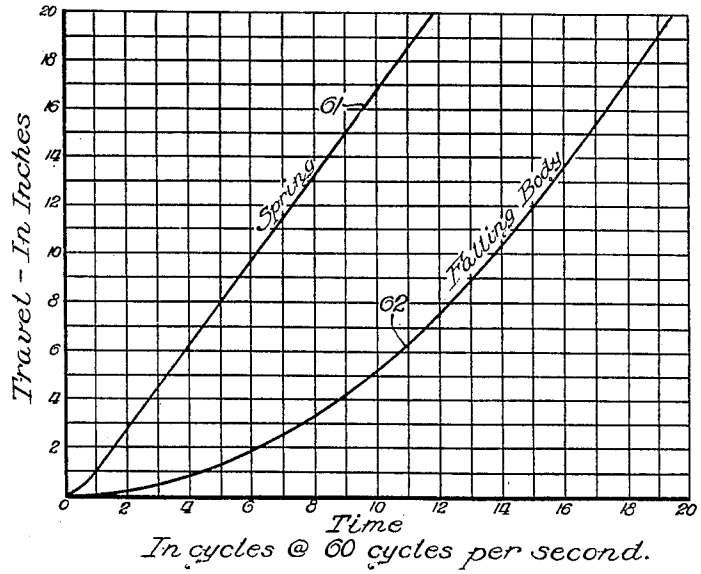


Fig. 6.

Fig. 7.



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CIRCUIT INTERRUPTING APPARATUS

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Fig. 8.

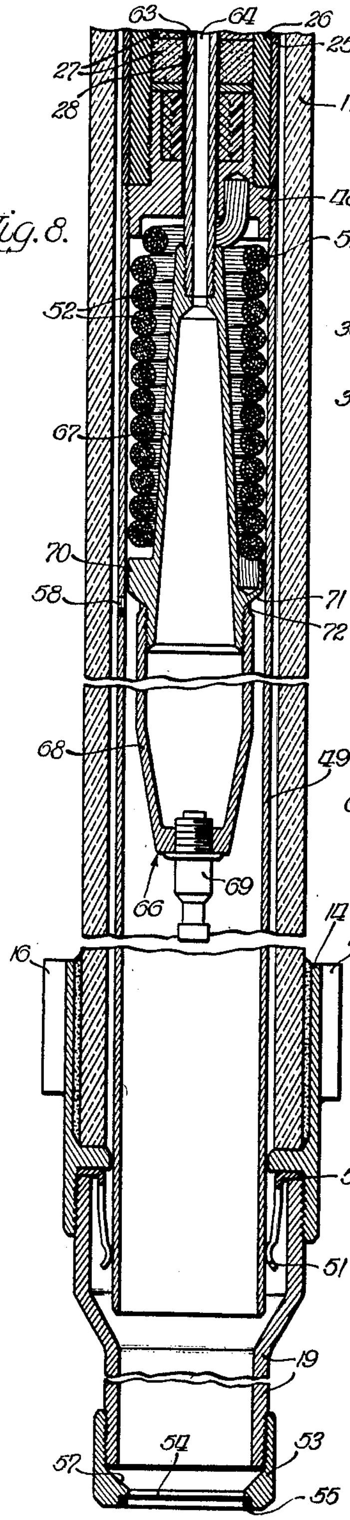


Fig. 9.

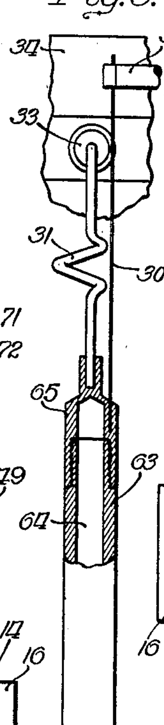
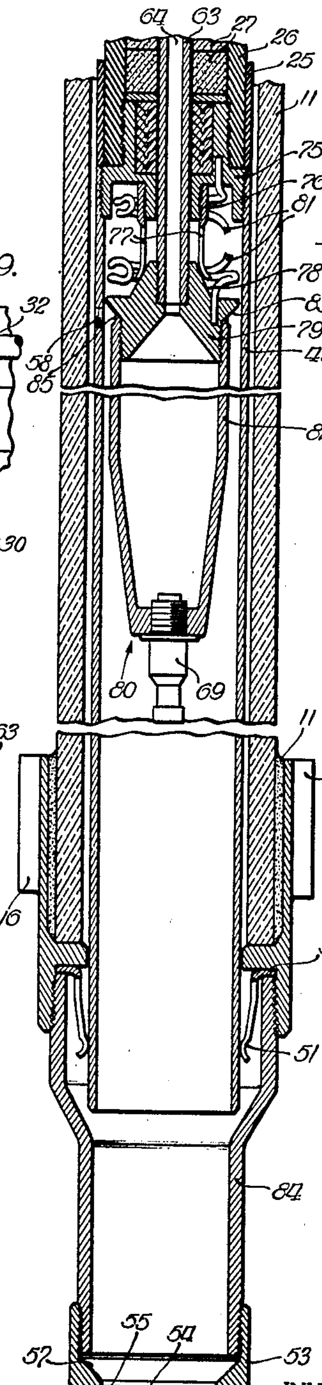


Fig. 10.



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CIRCUIT INTERRUPTING APPARATUS

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Fig. 11.

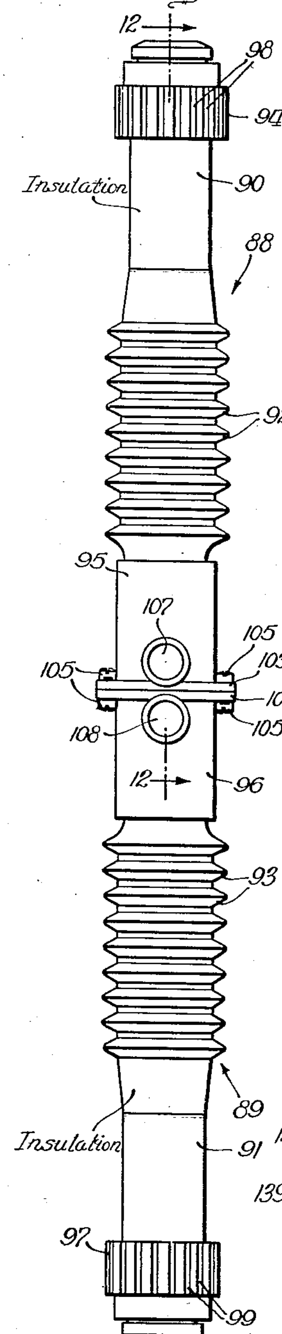


Fig. 12.

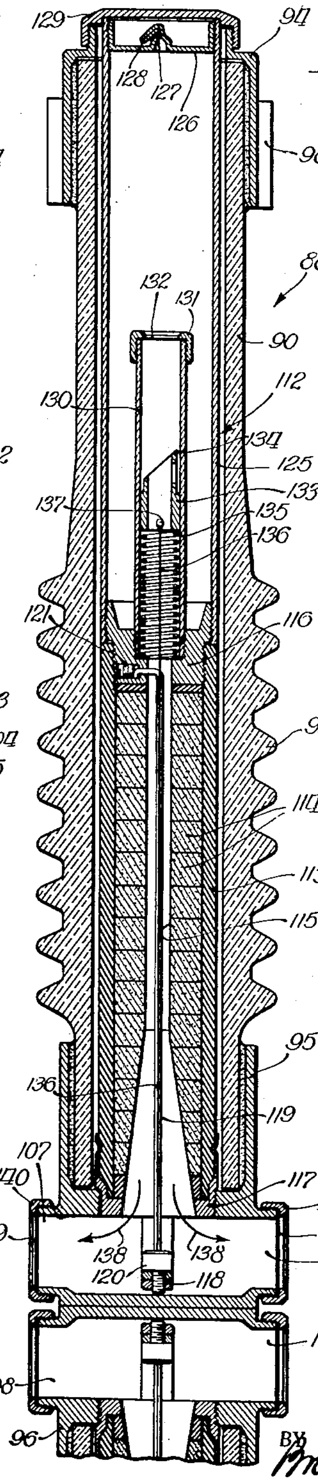
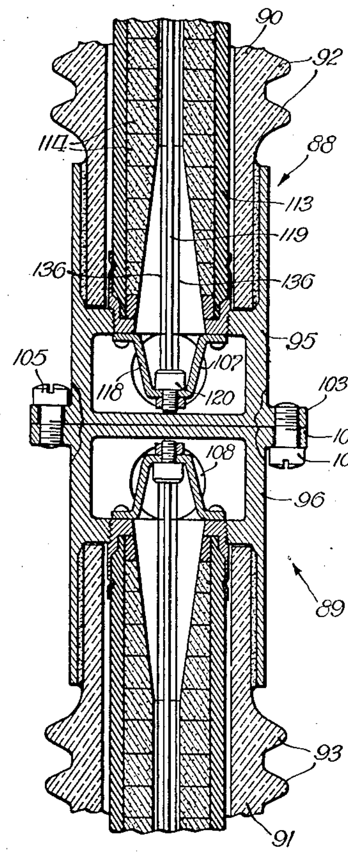


Fig. 13.



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Patented May 18, 1943 2,319,277

UNITED STATES PATENT OFFICE

2,319,277

CIRCUIT INTERRUPTING APPARATUS

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Application December 30, 1940, Serial No. 372,217

14 Claims. (Cl. 200—120)

This invention relates, generally, to circuit interrupting apparatus, and it has particular relation to such apparatus used for interrupting relatively large amounts of power in high voltage alternating current circuits.

An object of this invention is to provide a simple and relatively inexpensive condenser construction for high voltage, high power circuit interrupting devices.

Another object of this invention is to provide for increasing the inertia of the movable terminal of a fuse of the blast action arc extinguishing type so as to reduce the effect of the blast pressure thereon when the fuse blows in moving the terminal.

Still another object of this invention is to provide for indicating that a fuse has operated in a new and improved manner.

It is also an object of this invention to provide for releasing a gas into an arc confining passageway for assisting in extinguishing the arc and also scavenging the walls of the passageway.

It is another object of this invention to provide for discharging two serially connected blast type of circuit interrupters at their adjacent ends when they are placed in end-to-end relation.

Other objects of this invention will, in part, be obvious and in part appear hereinafter.

For a more complete understanding of the nature and scope of this invention, reference can be had to the following detailed description taken in connection with the accompanying drawings in which:

Figure 1 is a view, in side elevation, of one embodiment of the present invention, showing the weight in the position that it occupies after the device has operated so as to indicate that this has occurred;

Figures 2, 3 and 4, taken together and placed end-to-end, with Figure 2 on top, Figure 3 in the middle, and Figure 4 at the bottom, constitute a longitudinal sectional view of the circuit interrupter shown in Figure 1, the device being shown in the unblown condition;

Figure 5 is a plan view of a portion of the strip of sheet metal that is rolled up to form the condenser;

Figure 6 is a view, in elevation, of a set screw that is used in the cartridge shown in Figure 2, 3 and 4 before it is inserted into the housing;

Figure 7 shows curves which illustrate the operation of the device shown in Figures 2, 3, and 4, employing different means for effecting the movement of the rod-like terminal;

Figure 8 is a longitudinal sectional view of a modified form of construction of the lower portion of the device shown in Figures 2, 3, and 4;

Figure 9 is a detail view showing the construction of the upper end of the rod-like terminal for the device shown in Figure 8, and how the fusible and strain elements are connected thereto;

Figure 10 is a longitudinal sectional view showing certain details of construction different from those shown in Figure 8;

Figure 11 is a view in side elevation of a pair of serially connected blast action circuit interrupting devices arranged to discharge at their adjacent terminals which are clamped together so that the devices are placed end-to-end;

Figure 12 is a longitudinal sectional view, taken generally along the line 12—12 of Figure 11, of one of the devices shown in Figure 11, and a portion of the other device; and

Figure 13 is a detail longitudinal sectional view taken at right angles to the direction in which the view in Figure 12 is taken, and showing in more detail how the adjacent terminals are clamped together.

Referring now particularly to Figure 1 of the drawings, it will be observed that the reference character 10 designates, generally, one form of circuit interrupting device constructed in accordance with the present invention. The circuit interrupter 10 comprises a housing 11 of suitable insulating material, such as glass or porcelain. It is provided with radially extending corrugations 12 for increasing the creepage distance over its surface. At its ends, line terminals 13 and 14 are provided which, it will be understood, are arranged to be placed in suitable contact clips, not shown, that are connected to the line conductors. The line terminals 13 and 14 are longitudinally slotted as indicated at 15 and 16 for the reason set forth in McMahon et al. Patent No. 2,207,813. The upper line terminal 13 is provided with an integrally formed extension 17 which, as will hereinafter appear, houses a condenser. A valve 18 serves to close the upper end of the extension 17 and permits the exhaust of the same on opening under certain predetermined conditions. A guide tube 19 extends from the lower line terminal 14, and from it projects a weight 20 when the device has operated to indicate that such action has taken place. It will be understood that the circuit interrupter 10 is arranged to be mounted in a vertical position so as to permit the weight 20 to drop downwardly under the influence of gravity.

In Figures 2, 3, and 4 of the drawings, the de-

tails of construction of the circuit interrupter 10 are more clearly set forth. As there shown, a replaceable fuse cartridge, indicated generally at 24, is arranged to be inserted through the upper line terminal 13. The fuse cartridge 24 includes an insulating sleeve formed by an outer layer 25 of suitable material, such as a phenolic condensation product, and an inner layer 26 of suitable material, such as fiber. The sleeve 25—26 serves to hold a mass 27 of solid arc extinguishing material, such as boric acid or magnesium borate, which, for convenience, is preferably employed in the form of rings. The mass 27 of solid arc extinguishing material provides a longitudinally extending bore 28 therethrough in which a rod-like terminal 29 of copper or the like is mounted for movement. The terminal 29 has connected to its upper end a strain element 30 and a fusible element 31 which are connected, respectively, to arms 32 and 33 extending radially inwardly from an upper cartridge terminal 34 that is threaded on the upper end of the insulating sleeve 25—26. A flanged fitting 35 is threaded onto the cartridge terminal 34, as shown, and it bears against the upper line terminal 13 so as to have good contact engagement therewith. A metallic sleeve 36 bears against the flanged terminal 35, and it carries a condenser, shown generally at 37, for cooling and condensing the blast discharged from the fuse cartridge 24 on blowing of the strain and fusible elements 30 and 31.

The condenser 37 is preferably formed of a single strip 38 of sheet metal, such as copper, which is spirally wound and is placed in the metallic sleeve 36 and is suitably held therein with the turns of the spiral substantially parallel to the direction of the blast. The metallic strip 38 is shown in Figure 5 of the drawings before it is rolled up to form the condenser 37. It is, of course, desirable to space the turns of the spiral apart so as to permit the free flow of the blast between adjacent turns. For this purpose the strip 38 is upset as indicated at 39 to provide projections which bear against the surface of the adjacent turn so as to space the turns apart. It is then unnecessary to provide any additional spacing means between the successive turns of the spiral.

The extension 17 is closed by a cap 40 which is threaded thereon as indicated in Figure 2. The cap 40 carries the valve 18 which is mounted on a valve stem 41 that is slidably mounted in the cap 40. The valve 18 serves to close apertures 42 and 43 in the cap 40, and is held in the closed position by a coil compression spring 44 surrounding the valve stem 41. It will be understood that the valve 18 remains closed under the influence of the spring 44 until a predetermined pressure is reached in the chamber containing the condenser 37. This pressure is then sufficient to lift the valve 18 against the biasing force of the spring 44 and permits the discharge of the blast to the atmosphere through the apertures 42 and 43.

At the lower end of the insulating sleeve 25—26 of the fuse cartridge 24 there is provided a metal fitting 48 which is threaded into the sleeve, as shown. A metallic sleeve 49, forming a lower cartridge terminal, is threaded onto the fitting 48, and it is of sufficient length to extend downwardly through the lower line terminal 14. Contact engagement with the metal sleeve 49 is provided by a generally ring-like contact clip 50 which is provided with integrally formed inherently resilient contact fingers 51. The contact fingers 51 possess sufficient resiliency to provide relatively good contact engagement with the metallic sleeve 49. This contact construction is employed since it is not feasible to manufacture the fuse device 10 to extremely close tolerances. That is, the distances between the line terminals 13 and 14 may vary slightly because of variations in the length of the housing 11. Accordingly, while the upper cartridge terminal 34 may be considered to always occupy a given position, the lower cartridge terminal provided by the metallic sleeve 49 may occupy slightly different positions longitudinally with respect to the lower line terminal 14. By providing the contact clip 50 with the inherently resilient contact fingers 51 it is possible to take care of slight differences in position of the lower cartridge terminal 49 with respect to the lower line terminal 14, and still provide good contact engagement therebetween. As shown in Figure 4 of the drawings, the contact clip 50 is held in position by the guide tube 19 which is threaded into the lower end of the lower line terminal 14.

As shown in Figure 3 of the drawings, the weight 20 is fastened to the lower end of the rod-like terminal 29 and is movable therewith downwardly when the strain and fusible elements 30 and 31 (Figure 2) have blown. The mass of the weight 20 substantially increases the inertia of the movable parts, including the rod-like terminal 29 so that the pressure which is exerted on the upper end of the rod-like terminal 29 on blowing of the strain and fusible elements 30 and 31 is substantially ineffective to move it downwardly. The rod-like terminal 29 then falls through the bore 28 substantially only under the influence of gravity. This is desirable so as to expose a minimum of the bore 28 to the heat of the arc that is formed between the rod-like terminal 29 and the upper cartridge terminal 34 on blowing of the strain and fusible elements 30 and 31. As a result, lower pressures are generated within the device because of the arc, and consequently, the likelihood of the circuit interrupter 10 being blown to pieces is materially reduced.

With a view to interconnecting the weight 20 and rod-like terminal 29 with the lower cartridge terminal formed by the metallic sleeve 49, a flexible conductor 52 is coiled about the upper end of the weight 20 and the lower end of the rod-like terminal 29. As shown, the conductor 52 is secured at its upper end in the metallic fitting 48 and, at its lower end, in the upper portion of the weight 20.

As shown in Figure 4 of the drawings, a cap 53 is threaded onto the lower end of the guide tube 19. A frangible disc or diaphragm 54 is secured by a split ring 55 on the cap 53 for closing the opening in the same. When the strain and fusible elements 30 and 31 have blown, the rod-like terminal 29 moves downwardly together with the weight 20. The lower end of the latter engages the upper side of the disc or diaphragm 54, and either disrupts it or moves it bodily out of the groove in which it is held by the snap ring 55 and continues on to the position shown in Figure 1 of the drawings. The downward movement of the weight 20 is arrested when the shoulder 56 thereon (Figure 3) engages the inclined surface 57 (Figure 4) of the cap 53.

It will be noted that the metallic sleeve 49, Figure 3, is provided with a threaded aperture 58 which registers with a groove 59 in the weight 20. The threaded aperture 58 is adapted to receive

a set screw 60, Figure 6, when the cartridge 24 is outside of the housing 11. The set screw 60 serves to clamp the weight 20 securely against the opposite wall of the sleeve 49 so as to prevent breakage of the strain wire 30 during shipment and handling of the cartridge 24. The set screw 60 is arranged to project beyond the sleeve 49 far enough to prevent insertion of the cartridge 24 into the housing 11 until it is removed thereby insuring that it will be withdrawn before the circuit interrupter 10 is re-fused.

When the circuit interrupter 10 is to be refused, it is first removed from its terminal clips. The cap 40 is then removed together with the condenser 37. The guide tube 19 is then unscrewed from the lower line terminal 14, whereupon the cartridge 24 can be withdrawn through the upper line terminal 13. These steps are reversed in inserting an unblown fuse cartridge.

In Figure 7 of the drawings, curve 61 shows the relationship between the movement of the rod-like terminal 29 with respect to time as measured in cycles per second of alternating current. The curve 61 represents the speed at which the rod-like terminal 29 moves when it is biased by a spring under certain predetermined conditions. It will be observed that, after a slight initial movement, its movement bears a straight line relationship with respect to time. Thus, during the first few cycles after the strain and fusible element 30 and 31 have blown, relatively great movement of the rod-like terminal 29 in the bore 28 takes place. This exposes a considerable area of the bore 28 to the heat of the arc, and considerably more arc extinguishing medium may be evolved therefrom than is necessary for extinguishing the arc.

Curve 62 in Figure 7 of the drawings shows the relationship between the movement of the rod-like terminal 29 and the frequency of a 60-cycle alternating current source when the rod-like terminal 29 follows the law of a freely falling body. From curve 62 it will be observed that, during the first few cycles, only a relatively small movement of the rod-like terminal 29 takes place. As a result, during these first few cycles during which, experience indicates, most arcs are extinguished, only a relatively small amount of the arc extinguishing material 27 is exposed to the heat of the arc and, consequently, considerably less pressures are generated in the device.

In Figures 8 and 9 of the drawings there is shown a construction which can be employed in lieu of certain parts of the construction shown in Figures 2, 3, and 4 of the drawings. In Figures 8 and 9 of the drawings, a hollow rod-like terminal 63 has been substituted for the solid rod-like terminal 29 previously described. The hollow rod-like terminal 63 has a passageway 64 extending longitudinally therethrough which is closed at its upper end by a metal cap 65, preferably formed of silver, which is arranged to receive the lower ends of the strain and fusible elements 30 and 31. The cap 65 is calibrated so as to melt or fuse under different current conditions and open the upper end of the passageway 64.

The lower end of the passageway 64 in the rod-like terminal 63 opens into a reservoir, shown generally at 66, which is arranged to hold a gas, such as carbon dioxide or helium, under pressure. The reservoir 66 comprises upper and lower hollow members 67 and 68 which are threaded together, as shown. A valve 69 is provided in the lower member 68 to provide for filling the reservoir 66 with the gas and for holding the same under pressure. After the reservoir 66 has been filled, the lower end of the valve 69 can be dipped in solder so as to seal it completely and avoid any likelihood of the escape of gas from the reservoir 66.

The upper member 67 of the reservoir 66 is provided with a flanged section 70 in which the lower end of the flexible conductor 52 is fastened. It also is provided with an inclined shoulder 71 that is arranged to engage the similarly inclined shoulder 57 on the cap 53 for limiting the downward movement of the reservoir 66 when the strain and fusible elements 30 and 31 have blown.

A groove 72 is provided at the upper end of the member 68 for receiving the set screw 60 through the threaded aperture 58 as previously described.

It will be understood that, under certain conditions—such as the blowing of the strain and fusible elements 30 and 31 under relatively light overload conditions—the cap 65 at the upper end of the hollow rod-like terminal 63 may not be fused sufficiently to permit exhaustion of the gas in the passageway 64 and the reservoir 66. However, on flow of sufficient current in the arc that is formed, the cap 65 will be melted and the gas will be permitted to flow endwise into the arc between the upper end of the rod-like terminal 63 and the upper cartridge terminal 34 so as to assist in blowing the same out and filling the arc space with a non-conducting medium. In addition, the gas flowing out of the upper end of the rod-like terminal 63 serves to provide a scavenging action on the walls of the bore 28 in the solid arc extinguishing material 27 to free them from deposits of conducting particles which may lower the leakage resistance over the surface of the solid arc extinguishing material 27 after the device has operated.

Preferably, the reservoir 66 is made sufficiently heavy so that it can function in the same manner as the weight 20, Figure 3, previously described, and increase the inertia of the moving parts so that the downward reaction of the blast has substantially no effect in driving the rod-like terminal 63 downwardly.

In Figure 10 of the drawings there is shown a construction which is modified somewhat from that shown in Figure 8 of the drawings. It will be understood that the construction of the upper end of the hollow rod-like terminal 63 in Figure 10 is the same as shown in Figure 9, and that for the remaining parts of the device the construction is the same as shown in Figure 2 of the drawings.

In Figure 10 of the drawings a fitting 75 is provided on the lower end of the sleeve 25—26 of the fuse cartridge that is somewhat different from the fitting 48 shown in Figures 3 and 8 of the drawings. The fitting 75 is arranged to receive a ring-like contact clip 76 having integrally formed, inherently flexible contact fingers 77 that are arranged to have contact engagement with an inclined contact surface 78 of a metallic cap 79 forming a part of a gas reservoir shown generally at 80. It will be observed that the contact fingers 77 provide for directly interconnecting the rod-like terminal 63 and the lower cartridge terminal which is formed by the metallic sleeve 49. Because of this, a flexible conductor 81 having a relatively small cross-sectional area can be employed for interconnecting the fitting 75 and the cap 79 to complete the circuit between the rod-like terminal 63 and the lower cartridge terminal 49 while the former is

moving after the strain and fusible elements 30 and 31 have blown. For illustrative purposes, only the end portions of the flexible conductor 81 are shown, the intermediate portion being omitted to show the adjacent details of construction more clearly.

It will be noted that the reservoir 80 includes a hollow section 82 which forms the major portion thereof.

The downward movement of the rod-like terminal 63 and the reservoir 80 is limited by a shoulder 83 on the cap 79 which is arranged to engage the inclined shoulder 57 on the cap 53. It will be observed that the guide member 84 shown in Figure 10 of the drawings is somewhat shorter than the guide member 19 shown in Figures 4 and 8 of the drawings.

The upper end of the section 82 has a groove 85 for receiving the set screw 60 through the threaded aperture 58 as previously set forth.

Referring now particularly to Figure 11 of the drawings, it will be observed that two circuit interrupting devices, shown generally at 88 and 89, are mounted in end-to-end relation. As will hereinafter appear, the fuse devices 88 and 89 are connected in series circuit relation and are arranged to provide two breaks or gaps in the circuit on the occurrence of an overload. The devices 88 and 89 can be mounted vertically, as illustrated, or they can be mounted in a horizontal position if desired.

Each of the devices 88 and 89 includes an insulating housing 90 and 91, formed of glass or porcelain, and each has corrugations 92 and 93 for increasing the length of the creepage path over its surface. Terminals 94 and 95 are provided at the ends of the housing 90, and terminals 96 and 97 are provided at the ends of the housing 91. It will be understood that terminals 94 and 97 are line terminals, and that terminals 95 and 96 are provided in order to permit the series connection of the devices 88 and 89. The line terminals 94 and 97 are provided with longitudinal slots or grooves 98 and 99 which are for the same purpose as the slots or grooves 15 and 16 in the line terminals 13 and 14 shown in Figure 1 of the drawings and described hereinbefore.

Each of the terminals 95 and 96 has a flange 103 and 104 integrally formed therewith which are arranged to be juxtaposed so as to provide good contact engagement therebetween, and they are held in this position by screws 105, as shown in Figures 11 and 13 of the drawings.

The devices 88 and 89 are arranged to discharge at their adjacent ends, and for this purpose ports or discharge openings 107 and 108 are provided in the terminals 95 and 96 as is shown more clearly in Figure 11 of the drawings. It will be understood that, when the discharge takes place intermediate the line terminals 94 and 97, the likelihood of a flash-over therebetween is materially reduced as compared to a construction in which the device discharges adjacent one line terminal. Also, the likelihood of a flash-over to an adjacent circuit is reduced.

Within each of the insulating housings 90 and 91 there is provided a replaceable fuse cartridge. Since the fuse cartridges are duplicates of each other, it is necessary to describe only one of them. The fuse cartridge indicated generally at 112 in Figure 12 of the drawings is illustrative of the cartridge that can be employed for both of the devices 88 and 89.

The replaceable fuse cartridge 112 includes a sleeve 113 of insulation, such as fiber or a phenolic condensation product, and it contains a mass 114 of solid arc extinguishing material such as boric acid or magnesium borate which is preferably in the form of rings and provides a bore 115 extending longitudinally therethrough. Terminals 116 and 117 are provided at the ends of the sleeve 113. It will be noted that the terminal 117 is threaded into the terminal 95 carried by the insulating housing 90. A bridge 118 is secured to the terminal 117 to which a fusible element 119 is connected. One end of the fusible element 119 is secured in a contact screw 120 that is threaded into the bridge 118. It will be noted that the fusible element 119 extends entirely through the bore 115 and is secured to the terminal 116 by means of a set screw 121 which is inserted in a suitable tapped opening therein.

The terminal 116 is provided with an extension 125 in the form of a metallic tube which forms a reservoir for gas under pressure, such as carbon dioxide or helium. The end of the sleeve 125 opposite the terminal 116 is closed by a threaded plug 126 which has an aperture 127 therein through which the gas can be introduced into the reservoir. The gas is introduced through a suitable inlet 128 which, as shown, is afterward crimped over to prevent the escape of gas therethrough. If desired, the inlet 128 may be dipped in solder to further insure that the reservoir is sealed.

The metal sleeve 125 not only forms a reservoir for gas, but also it forms a terminal for the replaceable fuse cartridge 112 in order to connect the same to the line terminal 94. A cap 129, threaded onto the line terminal 94 and into engagement with one end of the metallic sleeve 125, provides the necessary interconnection with good contact engagement between the interfitting parts.

It is, of course, desirable to retain the gas in the reservoir 112 under pressure until the fusible element 119 blows. For this purpose, a guide sleeve 130 extends from the terminal 116 in alignment with the bore 115 in the solid arc extinguishing material 114. The sleeve 130 is closed at one end by a cap 131 and a frangible disc 132. Within the guide tube 130 is a plunger 133 having a knife edge 134 for rupturing the disc or diaphragm 132. A coil compression spring 135 is provided within the guide tube 130 for biasing the plunger 133 to rupture the disc or diaphragm 132. The plunger 133 is restrained from movement by a pair of strain wires 136 which are secured at one end to a pin 137 extending transversely across the plunger 133. At their other ends, as shown in Figure 13, the strain wires 136 are secured to the contact screw 120 to which one end of the fusible element 119 is also secured.

It will be understood that, as long as the fusible element 119 remains intact, the strain wires 136 will also remain intact and the plunger 133 will be held in the position shown in Figure 12 of the drawings. On the occurrence of an overload, the fusible element 119 is blown and the flow of current is transferred to the strain wires 136 which are promptly blown, whereupon the plunger 133 is released for movement under the influence of the coil compression spring 135. The knife edge 134 ruptures the disc or diaphragm 132 and permits the flow of gas from the reservoir 125 through the guide tube 130 and the bore 115. This flow of gas assists in extinguishing the arc formed in the bore 115 and also

to scavenge its walls so as to improve the dielectric properties thereof.

The blast, formed in part by the fused metal particles of the fusible element 119 and the strain wires 136, in part by the arc extinguishing medium that is evolved from the walls of the bore 115 and in part by the gas from the reservoir 125, is discharged as indicated by the arrows 138 out of the ports 107. Normally the ports 107 are closed by frangible discs or diaphragms 139 which are held in place by caps 140. The discs or diaphragms 139 are ruptured when sufficient pressure is generated by the blast on operation of the device, and thereby permit free flow of the blast to the atmosphere.

It will be understood that both of the circuit interrupting devices 88 and 89 will be blown at the same time on the occurrence of an overload since it is intended that the fusible elements of both shall have the same operating characteristics.

Since certain further changes can be made in the foregoing constructions and different embodiments of the invention can be made without departing from the scope thereof, it is intended that all matter shown in the accompanying drawings and described hereinbefore shall be interpreted as illustrative and not in a limiting sense.

What is claimed as new is:

1. In circuit interrupting apparatus, in combination, a fuse tube, a mass of solid arc extinguishing material in said tube having a relatively long narrow bore extending vertically therethrough, a relatively infusible terminal at the upper end of said bore, a rod-like terminal substantially filling and movable downwardly through said bore, fusible means interconnecting said relatively infusible terminal and the upper end of said rod-like terminal and preventing downward movement of the latter, and a weight attached to the lower end of said rod-like terminal to provide sufficient inertia therefor so that when the same is released on blowing of said fusible means the downward reaction of the resulting blast does not materially increase the rate at which said rod-like terminal is accelerated over that due to the force of gravity acting alone, said weight being disposed wholly within said fuse tube as long as said fusible means remains intact and being arranged and adapted to have at least a portion thereof project out of said fuse tube after said fusible means has blown to indicate that the same has occurred.

2. In circuit interrupting apparatus, in combination, a fuse tube, a mass of solid arc extinguishing material in said tube having a relatively long narrow bore extending vertically therethrough, a relatively infusible terminal at the upper end of said bore, a rod-like terminal substantially filling and movable downwardly through said bore, fusible means interconnecting said relatively infusible terminal and the upper end of said rod-like terminal and preventing downward movement of the latter, a weight attached to the lower end of said rod-like terminal to provide sufficient inertia therefor so that when the same is released on blowing of said fusible means the downward reaction of the resulting blast does not materially increase the rate at which said rod-like terminal is accelerated over that due to the force of gravity acting alone, and a frangible closure member at the lower end of said fuse tube, said weight being disposed wholly within said fuse tube as long as said fusible means remains intact and being arranged and adapted to disrupt said frangible closure member and to have at least a portion thereof project out of said fuse tube after said fusible means has blown to indicate that the same has occurred.

3. In circuit interrupting apparatus, in combination, a mass of solid arc extinguishing material having a bore therethrough, a stationary terminal at one end of said bore, a rod-like terminal substantially filling and movable endwise through said bore, fusible means interconnecting said terminals and adapted to be blown on the occurrence of an overload whereupon an arc is formed therebetween, and means for discharging fluid under pressure through said rod-like terminal for assisting in extinguishing said arc and scavenging the walls of said bore.

4. In circuit interrupting apparatus, in combination, a mass of solid arc extinguishing material having a bore therethrough, a stationary terminal at one end of said bore, a rod-like terminal substantially filling and movable endwise through said bore, fusible means interconnecting said terminals and adapted to be blown on the occurence of an overload whereupon an arc is formed therebetween, a reservoir carried by and movable with said rod-like terminal for holding fluid under pressure therein, and a discharge passageway in said rod-like terminal for directing a flow of said fluid from said reservoir into said arc for assisting in extinguishing it and scavenging the walls of said bore.

5. In circuit interrupting apparatus, in combination, a mass of solid arc extinguishing material having a bore therethrough, a stationary terminal at one end of said bore, a rod-like terminal substantially filling and movable endwise through said bore and having a longitudinal passageway therein closed at one end and open at the other, fusible means interconnecting said stationary terminal and the closed end of said rod-like terminal and adapted to be blown on the occurrence of an overload whereupon an arc is formed therebetween, and a reservoir carried by and movable with said rod-like terminal and communicating with said passageway therein for holding fluid under pressure, said closed end of said rod-like terminal being adapted to be opened when the current flow through said arc generates sufficient heat to melt the same whereupon said fluid is discharged from said reservoir into said arc for assisting in extinguishing it and scavenging the walls of said bore.

6. In circuit interrupting apparatus, in combination, a fuse tube, a mass of solid arc extinguishing material in said tube having a relatively long narrow bore extending vertically therethrough, a relatively infusible terminal at the upper end of said bore, a rod-like terminal substantially filling and movable downwardly through said bore and having a longitudinal passageway therein closed at its upper end and open at its lower end, fusible means interconnecting said relatively infusible terminal and the upper end of said rod-like terminal and preventing downward movement of the latter and adapted to be blown on the occurrence of an overload whereupon an arc is formed therebetween, and a reservoir of substantial mass attached to the lower end of said rod-like terminal and communicating with said passageway therein for holding fluid under pressure and to provide sufficient inertia therefor so that when the rod-like terminal is released on blowing of said fusible means the downward reaction of the resulting blast does not materially increase

the rate at which it is accelerated over that due to the force of gravity alone, said closed end of said rod-like terminal being adapted to be opened when the current flow through said arc generates sufficient heat to melt the same whereupon said fluid is discharged from said reservoir into said arc for assisting in extinguishing it and scavenging the walls of said bore.

7. In circuit interrupting apparatus, in combination, terminals between which an arc may be drawn, a body of solid arc extinguishing material in confining relation to said arc and adapted to have evolved from its surface an arc extinguishing medium, a reservoir for holding fluid therein under pressure and adapted to be placed in communication with the arc space, a frangible diaphragm sealing said reservoir, and means operable on the formation of said arc for disrupting said diaphragm to permit said fluid to flow into said arc space for assisting in extinguishing said arc and scavenging the adjacent walls of said arc extinguishing material.

8. In circuit interrupting apparatus, in combination, a mass of solid arc extinguishing material having a bore therethrough, terminals between which an arc may be drawn in said bore, fusible means interconnecting said terminals, a reservoir for holding fluid therein under pressure and adapted to be placed in communication with said bore, a frangible diaphragm sealing said reservoir, and means adapted to be released on blowing of said fusible means for rupturing said diaphragm to permit said fluid to flow into said bore for assisting in extinguishing said arc and scavenging the walls of said bore.

9. In circuit interrupting apparatus, in combination, a pair of terminals between which an arc may be drawn, one of said terminals being rod-like in character and having an aperture extending longitudinally therethrough, a body of insulating material having a bore through which said one terminal is movable to extend said arc therein, and means for discharging fluid through said aperture into said bore for assisting in extinguishing said arc.

10. In circuit interrupting apparatus, in combination, a body of insulating material having a bore with a discharge end, a pair of terminals between which an arc may be formed in said bore, a reservoir for holding fluid under pressure and adapted to be placed in communication with the other end of said bore, frangible means sealing said reservoir, and means released on the formation of said arc for rupturing said frangible means to permit said fluid to flow through said bore and out of its discharge end to assist in extinguishing said arc.

11. In circuit interrupting apparatus, in combination, a pair of terminals, fusible means interconnecting said terminals between which an arc is formed on blowing of said fusible means, a body of insulating material having a bore in which said arc is formed, said bore having a discharge end, a reservoir for holding fluid under pressure and adapted to be placed in communication with the other end of said bore, frangible means sealing said reservoir, and means released on blowing of said fusible means for rupturing said frangible means to permit said fluid to flow through said bore and out of its discharge end to assist in extinguishing said arc.

12. In circuit interrupting apparatus, in combination, insulating means providing a bore from the surface of which an arc extinguishing medium is adapted to be evolved due to the heat of an arc, a pair of relatively movable terminal members between which an arc is adapted to be formed, one of said terminal members being located adjacent one end of said bore and the other being rod-like in character and movable through said bore, a reservoir for holding material which when released is in the form of an arc extinguishing fluid, and means for releasing said fluid into said bore on the occurrence of an arc between said terminal members and into the space occupied by the arc for assisting in extinguishing the same and scavenging the walls of the bore after the arc is extinguished.

13. In circuit interrupting apparatus, in combination, insulating means providing a bore from the surface of which an arc extinguishing medium is adapted to be evolved due to the heat of an arc, a pair of relatively movable terminal members between which an arc is adapted to be formed, one of said terminal members being located adjacent one end of said bore and the other being rod-like in character and movable through said bore, means for moving said rod-like terminal member away from the other terminal member to extend an arc drawn therebetween into said bore, a reservoir for holding material which when released is in the form of an arc extinguishing fluid, and means for releasing said fluid into said bore on the occurrence of an arc between said terminal members and into the space occupied by the arc for assisting in extinguishing the same and scavenging the walls of the bore after the arc is extinguished.

14. A replaceable fuse cartridge intended for insertion into a housing of a circuit interrupter, said cartridge comprising an insulating sleeve, terminals for said sleeve, fusible means interconnecting said terminals, weight means tensioning said fusible means and movable relative to said sleeve on blowing of said fusible means for extending the arc incident thereto, and clamping means for clamping said weight means in the cartridge to prevent overstressing of said fusible means, said clamping means comprising a clamping member disposed when in operative position to prevent insertion of said cartridge into the housing of the circuit interrupter whereby removal of said clamping member with resulting release of said weight member and conditioned of the cartridge for operation is necessitated prior to placement of the cartridge in the interrupter housing.

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