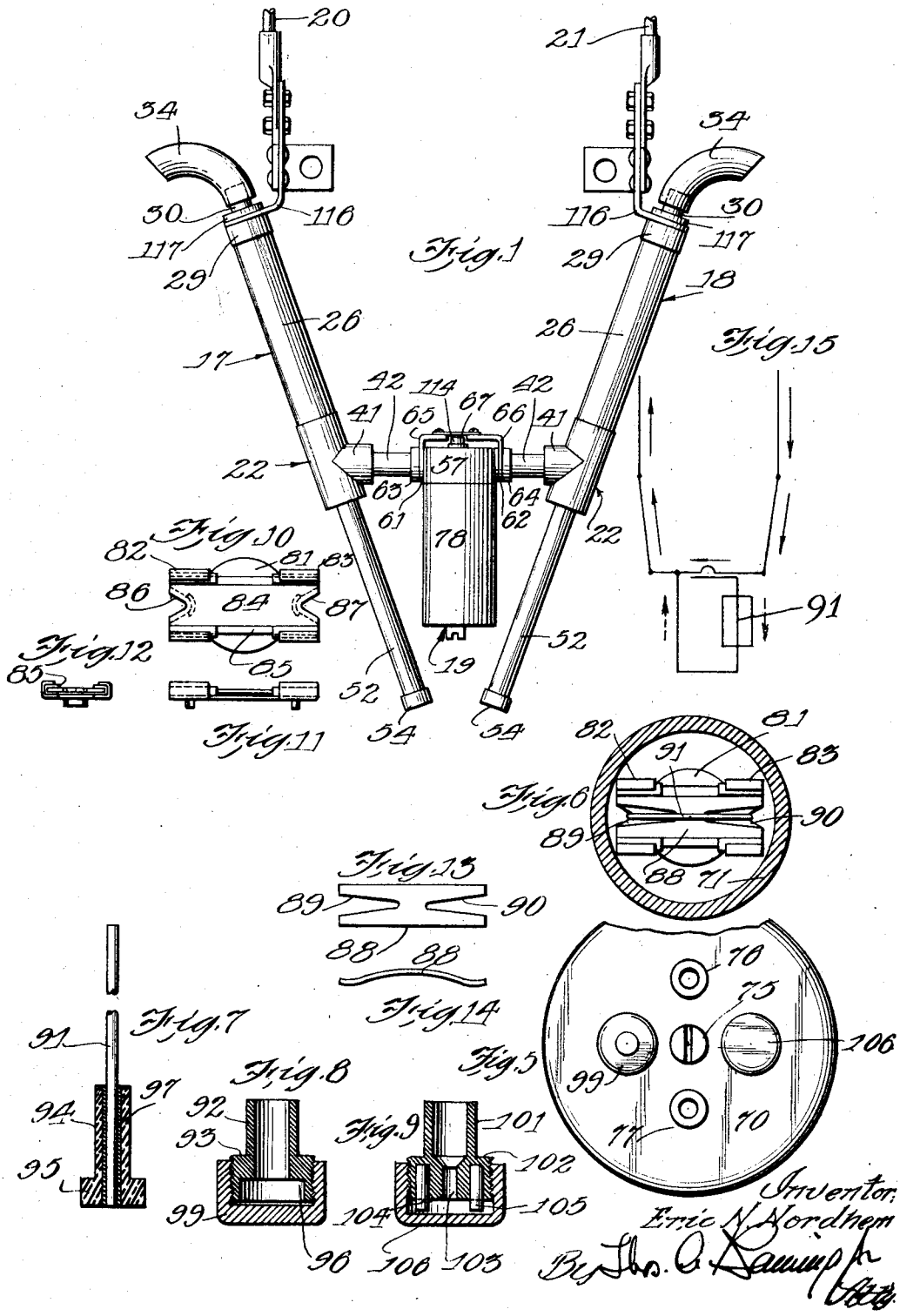
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HIGH TENSION CUT-OUTS AND THE LIKE

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HIGH TENSION CUT-OUTS AND THE LIKE

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Fig. 2

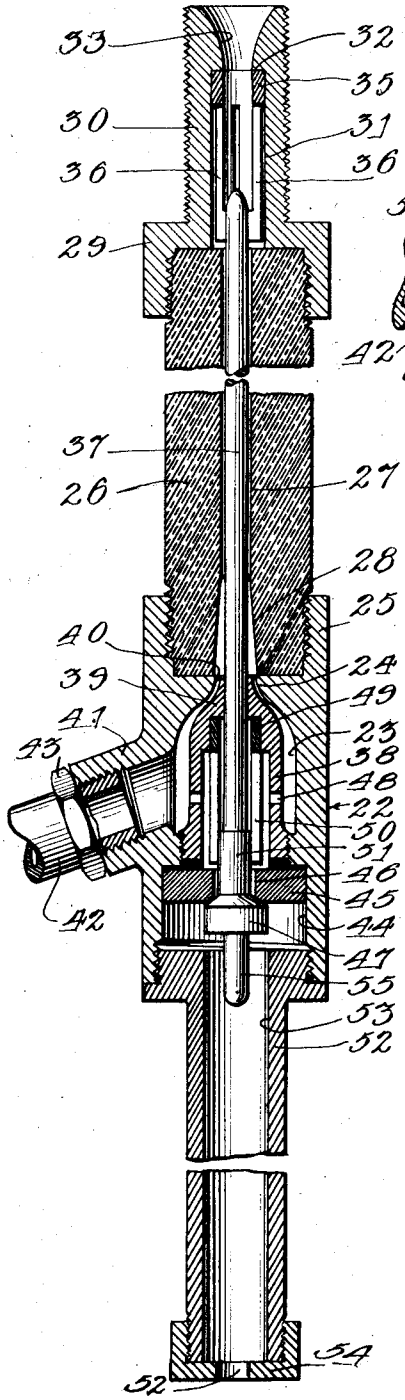


Fig. 3

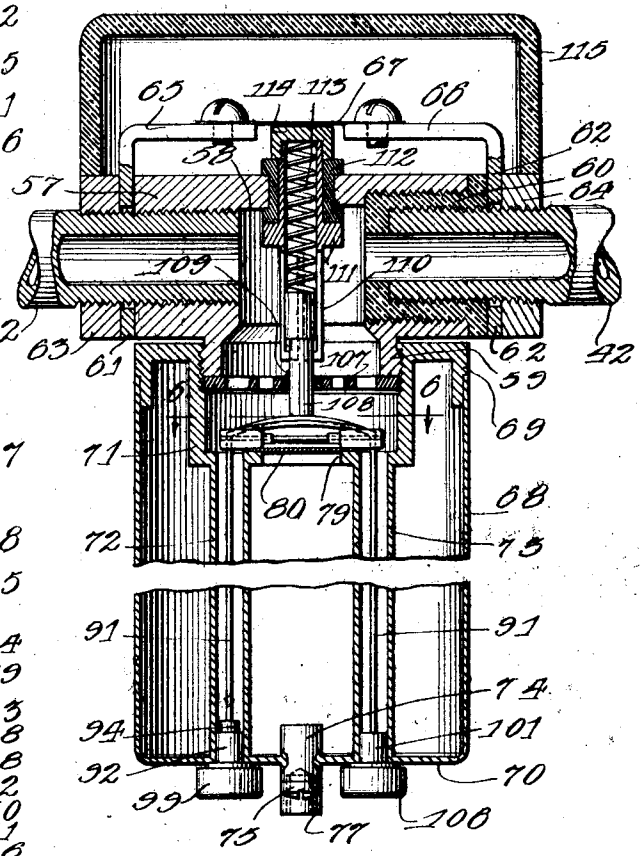
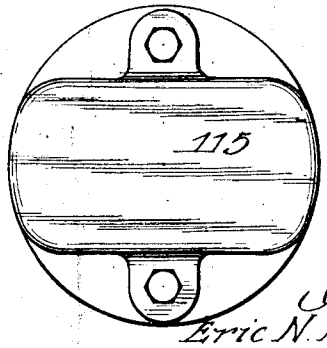


Fig. 4



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UNITED STATES PATENT OFFICE

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HIGH TENSION CUT-OUTS AND THE LIKE

Application filed July 26, 1930. Serial No. 470,944.

This invention has to do with certain improvements in high tension cut-outs and the like. The construction herein disclosed is of that type in which the arc is extinguished by means of a blow-out of compressed air or other suitable gas such as carbon dioxide or nitrogen, as distinguished from that type in which the extinguishment of the arc is performed by the use of a liquid bath.

One object of the invention is to provide what may be termed a double break or double opening switch of the above type, the same being so constructed that the circuit is simultaneously opened at two points in series with each other, the arc being simultaneously extinguished at both of these locations. By this means the extinguishment of the arc is doubly effective since the two extinguishing operations are in series with each other.

Another object in connection with the foregoing is to provide an arrangement such that the compressed air or gas used for the extinguishment of both arcs is supplied from a common container or cartridge. Upon the existence of an overload condition, the compressed air or gas is liberated from this container and delivered to both of the circuit opening and arc extinguishing devices simultaneously so that the operations of both of these devices are perfectly harmonized and their effectiveness is equalized. At the same time assurance is had that both circuit opening and extinguishing devices will operate effectively at the same instant so that the operations of both of them are effectively superimposed on each other. This is of importance for the reason that in case of operation of either of said devices individually, the effectiveness thereof would be only one-half of the combined effectiveness of them both, and might in some cases not be sufficient to actually extinguish the arc.

Another feature of the invention relates to the provision of an arrangement in which the arc is subjected to the action of a cold blast of air or gas travelling at very high velocity in the proper direction to carry the arc away from the moving terminal. It will be understood that the conductivity of cold gas is much lower than that of hot or ionized gas, so that by the use of this cold blast arrangement the arc is much more readily and quickly extinguished than would otherwise be possible. At the same time, by directing this current of cold air in such direction as to carry the arc away from the moving terminal, the parts are caused to function with what may be designated a counter-current movement. In this way the danger of carrying the arc with the moving contact is greatly reduced. The space occupied by the arc is effectually de-ionized by the cold gas blast, at the instant the current passes zero. In order to re-establish the current again, the oncoming voltage wave would have to puncture the cold new gas which has entered.

Another feature of the invention relates to the provision of a structure of very simple and compact mechanical arrangement and one in which the various parts are readily produced and of such construction that standard parts may be used for both terminals of the device.

Other objects and uses of the invention will appear from a detailed description of the same which consists in the features of construction and combinations of parts hereinafter described and claimed.

In the drawings:

Figure 1 shows a side elevation of the assembled unit, the hood or cover being removed from the center section of the device;

Figure 2 shows a longitudinal section through one of the circuit opening members, portions thereof being broken away so as to shorten up the figure;

Figure 3 shows a vertical section through the cartridge or container for the compressed air or gas, the same being in normal condition, and a portion thereof being broken away so as to shorten up the figure;

Figure 4 shows a plan view corresponding to Figure 3, but on smaller scale;

Figure 5 shows a bottom view of the cartridge or container, a portion thereof being broken away;

Figure 6 shows a fragmentary section on the line 6—6 of Figure 3, looking in the direction of the arrows;

Figure 7 shows a longitudinal detail section

through the anchorage end of the tension wire and insulating sleeve;

Figure 8 shows a longitudinal detail section through the anchorage member into which the parts of Figure 7 are set;

Figure 9 shows a longitudinal detail section through the other anchorage member;

Figure 10 shows a top face view of the air or gas retainer for the cartridge;

Figure 11 shows a side view corresponding to Figure 10;

Figure 12 shows an end view corresponding to Figures 10 and 11;

Figure 13 shows a plan view of the spring member;

Figure 14 shows a side view corresponding to Figure 13; and

Figure 15 shows diagrammatically the electric circuit of the device.

Referring first to Figure 1, I have therein illustrated two of the high tension cut-out devices together with a single cartridge for compressed gas for operating both of them. These cut out devices are designated 17 and 18 respectively; and the compressed gas cartridge is designated by the numeral 19. In the arrangement illustrated, the two cut-out devices 17 and 18 are connected in series between the line wires 20 and 21, so that the power current passes through both cut-out devices in series and also passes through the unit 19 between them. It will presently appear that as far as certain features of the invention are concerned, a single high-tension cut-out device could be used instead of the two in series.

Referring to Figure 2 in particular, the same illustrates a longitudinal section through one of the cut-out devices in detail. Portions thereof have been cut-away in order to shorten up the figure. The device therein illustrated includes a body member 22 having a central longitudinal chamber bore 23 which tapers in size to a contracted throat 24 at one end. The member 22 is provided with an internally threaded flange 25 beyond the position of the throat 24; and a tubular extension of insulating material 26 is threaded into the flange 25. This extension 26 is provided with a longitudinally extending bore 27 of relatively small size throughout the major portion of its length. At its lower end this bore 27 flares out slightly as shown at 28 so as to establish an inlet opening of size substantially the same as that of the throat 24.

The other end of the member 26 receives a nipple 29 which is threaded thereon, said nipple terminating in an externally threaded extension 30. There is a longitudinal bore 31 extending through the nipple and the extension 30, said bore terminating at the position of an inwardly facing shoulder 32. The bore 31 terminates in a flaring opening 33 beyond the position of the shoulder 32, through which flaring opening 33 the gases are discharged.

In some cases deflector horns such as 34 (see Fig. 1) may be threaded on to the projecting portions 30 of the nipples so as to throw the gases sidewise or to some direction where they will not be objectionable, and to prevent entrance of rain or snow.

There is a ring 35 set into the bore 31 up to the position of the shoulder 32. Said ring has a series of downwardly extending fingers 36 which constitute spring contact fingers. There is a movable contact rod 37 which normally extends throughout the length of the bore 27, and when the circuit is closed the upper end of said rod makes contact with the fingers 36 as shown in Figure 2. Upon drawing the rod 37 downwards, the circuit is broken and the amount of circuit opening increases as the rod 37 moves downwardly. The length of the member 26 and the amount of movement of the rod 37 may be made as large as desirable for the operating conditions encountered.

The rod 37 is slightly smaller in size than the bore 27 to thereby leave a relatively thin annular clearance between these parts. Such fact is well illustrated in Figure 2. Consequently, any compressed gases entering the bore 27 at the point 28 will flow along through this relatively thin clearance and thereby cool the rod 37 due to the expanding condition of said gases; and as the rod 37 retreats down through the bore, the gases flowing through this thin clearance will continuously wash the rod and also the end thereof and subject said end to the action of a cold out-flowing discharge of high velocity gases. In this connection, it will be noted that as the gases flow past the retreating end of the rod 37, said gases then enter directly into the path of the arc which has been drawn between the end of the rod and the contact fingers 36. The arc is thus subjected to a high velocity blast of cold gases which are flowing out across the path of the arc, and thus the arc is swept away from the rod and is brought out through the horn or discharge orifice.

Referring to Figure 2 in particular, there is a nipple 38 which sets into the chamber or bore 23 of the body member 22. The lower end of this nipple is, for this purpose, externally threaded as shown in Figure 2. The upper portion of the nipple is contracted in size somewhat conformably to the opening 24 but a relatively thin annular orifice 40 is thereby established around the discharge end of the nipple 39 and the opening 24.

There is a side connection 41 leading from the body member 22 sidewise at an angle as indicated in Figures 1 and 2. A pipe or tube 42 connects into said extension 41, a lock nut 43 preferably being provided to secure the parts more permanently together. The gases entering through the pipe or tube 42 flow into

the chamber 23 and thence to the annular orifice 40.

The lower portion of the body member 22 is provided with a relatively large cylindrical opening 44 within which is located a disk shaped piston 45. Said piston has a central opening 46 through which the rod 37 or an extension thereof reaches with a suitable clearance as shown in Figure 2. A relatively small piston 47 is provided on the lower portion of the rod 37 below the position of the disk piston 45. The upper face of said piston 47 is bevelled and seats against a bevelled downwardly facing seat at the lower end of the bore 46.

The nipple member 38 is provided with a series of openings 48 through which the gas pressure within the chamber 23 is communicated to the interior of the nipple member 38 and thence downwardly against both of the pistons. A ring 49 is seated into the upper portion of the nipple member 38 and has a series of downwardly extending contact fingers 50 which normally engage an enlarged portion 51 on the rod 37 to establish electrical connection at that point. Thus the rod 37 is also normally electrically connected to the body member 22.

There is a downwardly extending tubular extension 52 which is connected to the lower end of the cylindrical bore 44. The bore 53 of this extension 52 is of proper size to receive the smaller piston 47 with a sliding fit, and the length of extension 52 is sufficient to allow the rod 37 and the small piston 47 to travel clear down far enough to bring the upper end of the rod substantially flush with the upper end 39 of the nipple member 38. A cap 54 on the lower end of the extension 52 limits the downward travel of the rod and piston 47. If desired a finger 55 may be provided on the lower end of the rod 37, the same being adapted to extend through an opening 56 of the cap 54 and thus give a visual indication of the fact that the device has functioned.

The operation of this arrangement is as follows:

Upon the introduction of compressed air or other gas through the pipe 42 into the chamber 23, said compressed gas immediately operates in both directions. It operates upwardly through the annular orifice 40 and around the rod 37 in the manner already explained herein; and it also acts downwardly against the combined area of the pistons 45 and 47.

This combined area is sufficient with the gas pressure available to start the rod downward, notwithstanding the frictional engagement of the fingers 36 and 50. The amount of travel within the cylinder 44 is sufficient to cause complete disengagement from said fingers. Thereupon the disk piston 45 comes to rest at the lower end of the enlarged cylinder 44; but by this time the smaller piston 47 has entered into the bore 53 so that the gas pressure continues to be exerted against the area of said smaller piston. This pressure on the smaller piston is sufficient to continue the downward movement of the rod until the full amount of such movement has been completed.

The introduction of compressed air or other gas through the pipe 42 may be brought about in any convenient manner. Sometimes this will be done by manual control; and sometimes by automatic functioning of parts under overload conditions. The latter condition is disclosed herein. For this purpose the cartridge member 19 located between the two devices 17 and 18 is so constituted that upon the existence of the overload condition said cartridge member functions to release compressed gas through both of the pipes 42 (see Figures 1 and 3) leading in both directions to the two devices 17 and 18. I will now explain the construction of this device in detail.

The same includes a body member 57 having a transversely extending bore 58 and also having a downwardly extending hollow nipple 59, the interior of which is in communication with said bore 58. The pipes 42 are threaded into the bore 58 from opposite directions. One of these pipes threads directly into the member 57 so as to establish electrical connection therewith, but the other pipe threads primarily into an insulating bushing 60 which in turn threads into the body member 57 so that the two pipes are thus electrically insulated as far as the body member is concerned.

Washers 61 and 62 are set over the two pipes 42, one of them against the body member 47 and the other one against the insulating bushing 60. These washers are held in place by nuts 63 and 64 respectively which are threaded on to the pipes 42.

Fingers 65 and 66 reach upwardly and towards each other from the two washers 61 and 62, but said fingers are separated a sufficient distance to receive a fusible link 67 by which they are normally connected together in service. The current thus is normally compelled to flow through this fusible link.

A tubular chamber 68 has its upper end closed by a cap 69 and its lower end closed by a cap 70. The central portion of the cap 69 is flanged downwardly as shown at 71 so as to establish a small central chamber which is in communication with the bore 58 of the body member 57. A pair of tubes 72 and 73 reach vertically between the lower cap member 70 and the central portion of the cap member 69 so as to establish vertical passages reaching through the body of the container but isolated therefrom in gas-tight fashion.

The interior of the container may be charged with compressed gas through the medium of a fitting 74 which includes a check valve, and said check valve can be held and made perfectly gas-tight by sweating a screw 75 in place after the chamber has been charged. A pair of bosses 76 and 77 reach downwardly from the lower end 70 of the chamber; and a hood 78 of insulating material such as bakelite may be set up over the chamber 68 and then secured in place by screws threaded up into the bosses 76 and 77.

In connection with the foregoing, it will be noted that the entire assembly including the chamber 68 and hood 78 can be readily unthreaded from the nipple 59 of the body member 57 for replacement or recharging.

The downward extension 71 of the upper cap 69 is provided with a central opening 79 through which the compressed gas will be discharged upwardly when said opening is uncovered. Said opening is normally sealed in gas-tight fashion by means of a disk 80 which may be soldered over opening 79 and held in place by the device illustrated in detail in Figures 6, 10, 11, 12, 13, and 14. This includes a circular plate 81 having end extensions 82 and 83. The plate 81 is of proper size to engage the edges of the gasket 80. A plate 84 is set on to the plate 81, but is separated therefrom by a layer of paper or the like 85 which serves to insulate the two parts from each other. The end portions 82 and 83 of the plate 81 are then clamped over the end portions of the plate 84 together with the paper which is folded up over said end portions sufficient to maintain the insulation between the parts. The ends of the plate 84 are inwardly notched as shown at 86 and 87; and the plate 81 is also notched inwardly but to a greater extent as shown by the dotted lines in Figure 10.

A spring plate 88 shown in Figures 13 and 14 is set on to the plate 84. Said spring plate is inwardly notched at its ends as shown at 89 and 90, and the central portion of said spring plate is bulged or flared upwardly as best shown in Figure 14.

A tension wire 91 passes up through the tube 72 and then through the notch 89 of the spring plate 88 and then over the spring plate and down through the notch 90 of the spring plate. The lower ends of said wire are anchored to the bottom cap 70 in the manner presently to be explained and with the wire under sufficient tension to hold the cap in gas-tight sealing fashion on to the gasket 80.

The anchorage of the two ends of the wire is performed by the devices shown in Figures 7, 8, and 9. At one end there is provided a nipple 92 which sets up into the lower end of the tube 72 but has a shoulder 93 to limit its upward movement. A bushing 94 of insulating material is provided with an encircling flange 95 which sets down into a recess 96 in the member 92. The lower end of the wire 91 has a sleeve 97 soldered or brazed or otherwise secured to said wire, and the extreme lower end 95 of said sleeve 97 is flanged outwardly as shown in Figure 7. A cap 99 is threaded up on to the member 92 over the flange 95.

The other end of the wire is secured by the fixture shown in Figure 9. This includes a nipple 101 which reaches up into the lower end of the tubular member 73 until limited by a shoulder 102. The wire passes through a central opening 103 and is then wrapped or twisted around the studs 104 and 105 on the member 101 so as to secure the wire. A cap 106 is then threaded on to the lower end of the member 101 so as to enclose and seal the end of the wire in place. The parts 92 and 101 are preferably soldered or otherwise secured into the lower ends of the tubes 72 and 73 in gas-tight fashion.

A grid or perforated plate 107 is preferably set immediately beneath the flange 59 (see Figure 3) so as to prevent the wire 91 or the gasket 80 or the retainer device from being blown up into the bore of the body member 57 when the device functions.

The functioning of the device is accomplished in the following manner:

A pin 108 is slidably mounted through the center of the grid pate 107 from which said pin is electrically insulated as shown at 109 in Figure 3. This pin is slidably contacted by downwardly extending fingers 110 on a ring 111 which is in turn carried by an insulating bushing 112 extending through the body member 57. Above the ring 111 there is established a small central chamber in which is located a spring 113 which presses down against the upper end of the pin 108. A cap 114 closes the upper end of this small chamber and receives the thrust of the spring 113. Said cap 114 is located slightly below the position of the fuse 67 so that electrical connection does not normally exist between these parts. Sometimes it may be desirable to place the layer of paper or the like between the fuse 67 and the cap 114 so as to prevent accidental premature electrical connection between these parts.

The operation of this device is as follows:

The current normally flows from one of the pipes 42 to the other by being conducted across the fuse 67. Upon the existence of an overload condition said fuse blows and a heavy arc is created at the position of the fuse. This arc will flash down on to the cap 114 so that the entire power current will thus be diverted down to the pin 108 which is in contact with the central portion of the wire 91 where it passes over the spring plate 88. This current will then flow through the wire 91 and be grounded at one end thereof and will flow through the chamber 68 and up into the body

member 57 and thence to the other pipe 42. This current will be sufficient to burn off the wire 91 and thus release the cap which holds the gasket 80 in place. Immediately the compressed gas will blow the cover 80 off from the opening 79 and said gas will then operate up through the bore of the body member 57 and in both directions through both of the pipes 42 to both of the devices 17 and 18 which will then function in the manner already explained.

If desired, a hood 115 of insulating material may be placed over the body member 57 and the fuse 67 so as to protect the same. It will also be understood that both of the line wires 20 and 21 may be electrically connected to the nipples 30 as readily evident in Figure 1, such connections being made by the use of clips 116 held in place by nuts 117.

While I have herein shown and described only a single embodiment of the features of my present invention, still I do not intend to limit myself thereto except as I may do so in the claims.

I claim:

1. In a device of the class described, the combination of a body member having a longitudinally extending passage, one end of said passage being of contracted size, and the other end of said passage being of relatively large cylindrical form, a disk piston located in the cylindrical portion of the passage, a contracted nipple extending through the bore of the device and terminating in the central portion of the contracted end of the passage first mentioned to thereby establish a relatively thin annular orifice facing away from the body member, a longitudinally extending cylindrical member of insulating material reaching outwardly away from said annular passage and adapted to receive compressed gas discharged from the annular passage, a movable contact rod having one end extending through the disk piston and provided with a relatively small piston member in connection with the back face of the disk piston, a longitudinally extending cylinder member in alignment therewith adapted to receive said relatively small piston for continued travel thereof under gas pressure beyond the limit of movement of the disk piston, the contact rod being of smaller size than the bore of the cylindrical extension of insulating material to thereby establish a thin annular passage throughout the length of and around the rod, stationary contacts in position to engage the rod when in the initial or fully inserted position and means for introducing compressed gas into the bore of the body member, whereby said gas exerts pressure on the piston members to thereby draw and move the rod away from the stationary contacts and longitudinally of the bore of the member of insulating material, and to thereby cause a counter current flow of cooling gas from the thin annular orifice aforesaid throughout the length of the rod to the position of the arc created by separation from the stationary contacts, substantially as described.

2. In a device of the class described, the combination of a body member having a longitudinally extending bore terminating at one end in a contracted portion and terminating at the other end in a cylinder bore, a piston member located in said cylinder bore, a cylindrical extension of insulating material extending longitudinally from the contacted end of the bore of the body member and having a longitudinally extending passage for a movable contact rod, a contact rod having one end connected to the piston aforesaid, said rod reaching through the contracted end of the body member and lengthwise through the bore of the extension of insulating material, stationary contacts in position to engage the outer end of the rod, and means for introducing compressed gas into the bore of the body member, to thereby cause said gas to exert pressure on the piston for the purpose of drawing the rod downwardly away from the stationary contacts and lengthwise of the bore of the member of insulating material, and to also simultaneously cause counter current flow of said gas through the contracted opening of the body member around the rod and lengthwise of the rod to thereby subject the rod to the influences of a cold stream of gas flowing in the direction opposite to the movement of the rod away from the stationary contact, substantially as described.

3. In a device of the class described, the combination of a cylindrical member of insulating material having a relatively small rod passage extending throughout its length, a movable contact rod extending longitudinally through said passage and of slightly smaller size than the passage, to thereby establish a thin annular passage around the rod, stationary contacts located at one end of said passage and engaged by the rod, a piston member connected to the rod at the other end of the passage, a cylinder wherein said piston member travels, and means for introducing compressed gas simultaneously into said cylinder and into the passage around the rod, to thereby draw the rod lengthwise of the passage and simultaneously subject the rod to the influence of a cold stream of expanding gas traveling in a direction opposite to the direction of travel of the rod, away from the contacts, substantially as described.

4. In a device of the class described, the combination of a cylindrical member of insulating material having a longitudinal bore, a movable contact rod located in said bore and movable lengthwise thereof and of slightly smaller size than the bore to thereby establish a relatively thin annular gas passage around the rod, means for moving the rod lengthwise of said bore to thereby draw the rod through

the bore, stationary contacts at one end of the bore for engagement by the rod, and means for introducing compressed gas into the bore around the rod during the movement of the rod and in a direction contrary to the direction of travel of the rod, to thereby subject the rod to the influence of a layer of relatively cold expanding gas travelling in a direction opposite to the direction of rod movement during the circuit opening operation, substantially as described.

5. In a device of the class described, the combination of a cylindrical member of insulating material having a longitudinally extending through bore, a movable contact rod located in said bore and movable lengthwise thereof, said rod being of slightly smaller size than the bore to thereby establish a relatively thin annular passage around the rod and throughout the length thereof, stationary contacts at one end of said passage normally engaged by the rod to close the circuit, means at the other end of the device for drawing the rod through the bore, away from the stationary contacts aforesaid to open the circuit, and means at said end for introducing a current of cold expanding gas into the passage around the rod, said gas travelling at a direction opposite to the direction of travel of the rod, substantially as described.

6. In a device of the class described, the combination of a cylindrical member of insulating material having a longitudinally extending through bore, a longitudinally extending contact rod reaching through said bore, and establishing a relatively thin annular passage around the rod, means for moving the rod lengthwise of the bore in one direction during the circuit opening operation, and means for causing flow of cooling and arc extinguishing gas lengthwise of the rod through said passage in the other direction during the circuit opening operation, substantially as described.

7. In a device of the class described, the combination of a pair of circuit opening devices each including a longitudinally extending body member of insulating material having a longitudinally extending through bore of relatively small size, contact rods working in said portions, stationary contacts at the outer ends of said bores normally engaged by the rods aforesaid, and means for simultaneously drawing both of the rods downwardly through their bores away from said contacts, said means including a single cartridge of compressed gas, gas connections from said cartridge to the operating ends of both of the rods for subjecting them simultaneously to the operation of compressed gas, and electrical connections extending between both of the rods and through the cartridge, effectively to release gas from the cartridge under overload conditions to both devices, substantially as described.

8. In a device of the class described, the combination of a pair of circuit opening devices, each of which includes a longitudinally extending member of insulating material having a longitudinally extending through bore, contact rods working in both of said bores, stationary contacts at the outer ends of both of said bores, normally engaged by said rods, compressed gas means for moving the rods lengthwise of said bores for the circuit opening operation, a common gas connection for delivery of compressed gas simultaneously to both of said devices, and means for introducing compressed gas into said connection under overload conditions to thereby insure simultaneous operation of both of the devices, substantially as described.

9. In a device of the class described, the combination of a pair of circuit opening devices, each of which includes a movable contact member and a stationary contact member normally engaged thereby, each of said devices including compressed gas means for causing movement of the movable device, a common gas connection to both of said means, a cartridge for compressed gas in conjunction with said connection, and means for releasing compressed gas from said cartridge into said connection under overload conditions to thereby insure simultaneous operation of both of the devices, substantially as described.

10. In a device of the class described, the combination of a pair of circuit opening devices each of which includes a movable contact member and a stationary contact member normally engaged thereby, each of said devices including compressed gas means for causing movement of the movable device, a common gas connection to both of said means, a cartridge for compressed gas in conjunction with said connection, and means for releasing compressed gas from said cartridge into said connection to thereby insure simultaneous operation of both of the devices, substantially as described.

11. In a device of the class described, the combination of a pair of circuit opening devices, each of which includes a movable contact member, a stationary contact member normally engaged thereby, and compressed gas means for moving said movable devices, together with means for simultaneously insuring operation of both of said devices, said means including a cartridge for compressed gas and means for releasing the compressed gas therefrom to both of said devices simultaneously under overload conditions, substantially as described.

12. In a device of the class described, the combination of a pair of circuit opening devices each of which includes a movable contact member, a stationary contact member normally engaged thereby, and compressed

gas means for moving said movable devices, together with means for simultaneously insuring operation of both of said devices, said means including a cartridge for compressed gas and means for releasing the compressed gas therefrom to both of said devices simultaneously, substantially as described.

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