March 19, 1968 R. J. BRONIKOWSKI 3,374,329

FUSE CUTOUT

Filed Oct. 31, 1966

Fig. 1

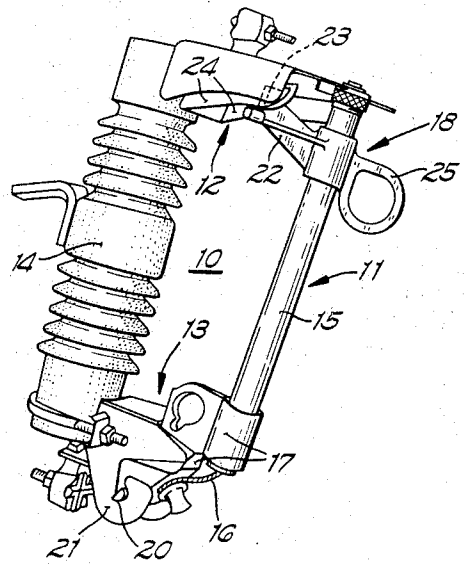


Fig. 2

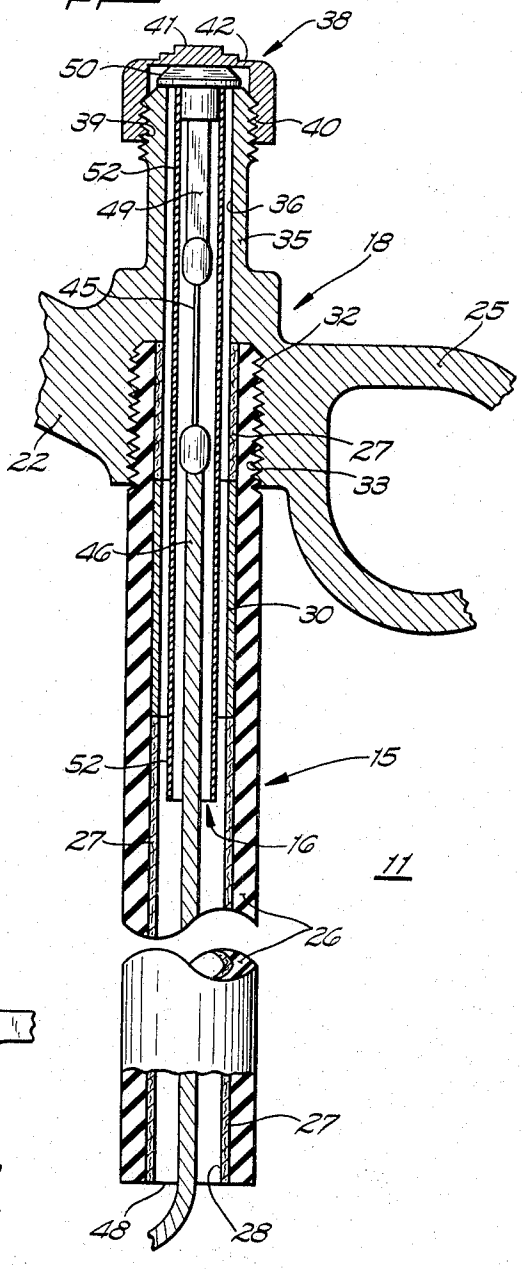


Fig. 3

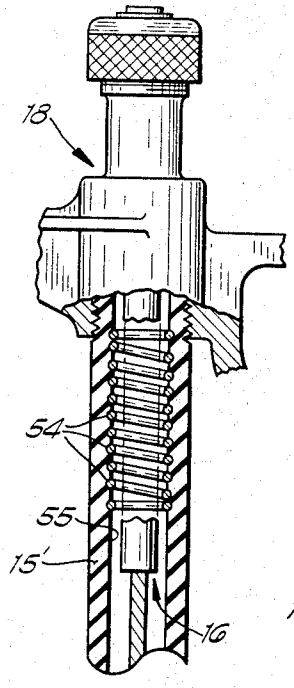
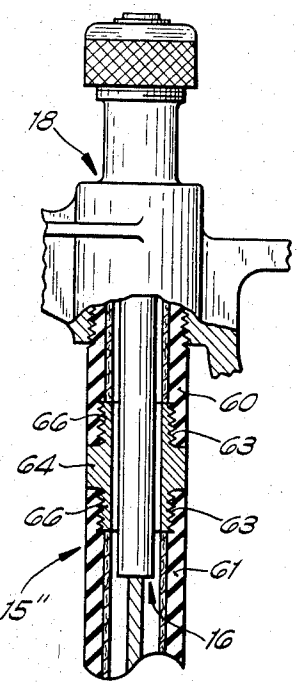


Fig. 4



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FUSE CUTOUT

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ABSTRACT OF THE DISCLOSURE

A fuse cutout comprising a fuse tube having a frangible cap at one end and being opened at its other end and a fusible element disposed within said tube wherein the fuse tube bore is composed of an arc extinguishing gas evolving material and a metallic insert as disposed within the bore and insulated from terminal means at the opposite ends of the fuse tube.

Background of the invention

This invention relates to fusible type circuit interrupters, and more particularly to a new and improved fuse cutout of the double-vented type.

One type of fuse cutout in common useage employs a fuse tube which is open at its lower end while its upper end is closed by a frangible cap. Such fuse tubes generally include an insulating portion which evolves arc extinguishing gases during a fault current interruption. When the fault current has a relatively low value, these gases are vented from the open lower end of the fuse tube while the upper end thereof remains closed to insure a sufficient pressure build-up to extinguish the arc. At higher fault current values, on the other hand, these arc extinguishing gases are evolved at a much higher rate than they can be vented from the lower end of the tube. The frangible cap, therefore, is constructed and arranged to rupture in response to such higher gas pressures and thereby to provide additional venting at the upper end of the tube.

When the frangible cap at the upper end of the fuse tube ruptures during the interruption of relatively high fault currents, the expelled gases have a tendency to drift or be blown downwardly around the fuse holder. This frequently triggers a flashover across the fuse tube. As a result, it was necessary to limit the fault current ratings of prior art double-vented fuse cutouts.

It is an object of the invention to provide a new and improved fuse cutout of the double-vented type.

Another object of the invention is to provide a double-vented fuse cutout having improved fault current interrupting capabilities.

A still further object of the invention is to provide a double-vented fuse cutout in which the flashover tendency during high fault current interruptions is substantially reduced.

Yet another object of the invention is to provide a double-vented fuse cutout which is more reliable during the interruption of relatively large fault currents.

Brief description of the drawings

FIG. 1 is a perspective view illustrating a fuse cutout incorporating the instant invention;

FIG. 2 is a sectional view of the preferred embodiment of the fuse tube illustrated in FIG. 1; and

FIGS. 3 and 4 are alternate embodiments of the instant invention.

Summary of the invention

In general terms, the invention comprises the combination of, a fuse tube at least partially composed of a gas evolving material and being open at one end, closure means disposed on the other end of the fuse tube and being constructed and arranged to rupture upon the occurrence of sufficient internal tube pressure, a fusible element disposed within the fuse tube and adapted to separate when subjected to a predetermined current, and conductive means disposed within the tube and intermediate the ends thereof and electrically insulated from terminal means adjacent the opposite ends of the tube.

Description of the preferred embodiments

Referring more specifically to FIG. 1, the fuse cutout according to the instant invention is designated by the general reference numeral **10** and is shown to include a fuseholder **11** which is adapted to bridge terminal assemblies **12** and **13** carried at the upper and lower ends, respectively, of an elongate insulator **14**.

The fuseholder **11** includes a fuse tube **15** for enclosing a fuse link **16** and first and second conductive terminal members **17** and **18** affixed to the lower and upper ends, respectively, of the fuse tube **15**. The terminal member **17** has a pair of laterally extending trunnions **20** which cooperatively engage a pair of hooklike hinge supports **21** integrally formed on the lower terminal **13**. The terminal member **18** has an integral contact portion **22** extending laterally of the fuse tube **15** and having a hooklike projection **23** at one end for latching engagement with a stationary contact assembly **24** carried by the upper terminal **12**. An eye **25** is also integrally formed on the terminal member **18** for manipulating the assembly **11**.

As those skilled in the art will appreciate the fuseholder **11** has a tendency to pivot clockwise about hinge supports **21**, as viewed in FIG. 1, but this is normally prevented by the latching engagement between the contact projection **23** and the stationary contact assembly **24**. After the fuse link **16** has parted upon the occurrence of an overcurrent, however, the lower terminal assembly **13** is constructed and arranged to allow the fuseholder **11** to move downwardly to disengage the contact projection **22** from the stationary contact assembly **24**, thereby freeing the fuseholder **11** for pivotal movement in the counterclockwise direction from its position shown by full lines in FIG. 1.

The details of the fuse cutout assembly which have been heretofore described in general terms, form no part of the instant invention and, accordingly, will not be discussed in detail. For a more complete description of a fuse cutout construction of the general type hereinabove described, reference is made to U.S. Patent 2,702,842 which is assigned to the assignee of the instant invention.

The preferred embodiment of the fuse tube **15** is shown in greater detail in FIG. 2 to include a tubular outer insulating shell **26** and an inner lining **27** composed of an insulating material, such as vulcanized or horn fiber, which is capable of evolving arc extinguishing gases. The liner **27** defines a central bore **28** for receiving the fuse link **16** and extends for substanttially the entire length of the shell **26** except for a gap intermediate its ends which is occupied by a short sleeve **30** of conductive material, preferably a metallic.

The upper end of the shell **26** is externally threaded at **32** for being received in an internally threaded hole **33** formed in the lower end of the terminal member **18**. An integral neck portion **35** extends upwardly from the member **18** and has a bore **36** which is in registry with and forms a continuation of the bore **28**.

A frangible cap **38** is internally threaded at **39** for engaging the externally threaded upper extremity **40** of the neck portion **35** for closing the upper end of the bore **36**. The top of the cap **38** has an annular area **42** of reduced

thickness adjacent its outer periphery whereby the cap will rupture when the gas pressure within the fuse tube 15 exceeds a predetermined value.

The fuse link 16 is disposed generally coaxially within the bore 28 and includes the fusible element 45 disposed adjacent the upper end of the fuse tube 15. The lower end of the fusible element 45 is connected to a flexible conductive leader 46 which extends out of the open lower end 48 of the fuse tube 15 for being electrically connected to the lower terminal 17. A relatively heavy conductive member 49 extends from the fusible element 45 to a button member 50 disposed above the upper end of the neck portion 35 and whose outer diameter is greater than that of the bore 36. As a result, the button member 50 will be clamped between the upper end of the neck portion 35 and the cap 50 when the latter is screwed into position.

An auxiliary fuse tube 52, which may be composed of any suitable gas evolving insulating material, such as wax or resin impregnated fiber, is mounted at the underside of the button member 50 and extends downwardly therefrom for a substantial distance and in a coaxial relation to the fuse tube 15. The tube 52, which ruptures during a high fault current interruption, aids in the clearing of low current arcs.

It has been found that the position of the conductive sleeve 30 in the fuse tube 15 is relatively significant. More specifically, the sleeve 30 should be electrically isolated from the upper terminal member 18 and is preferably disposed above the lower end of the auxiliary tube 52 so as not to adversely effect the interruption of low amperage fault currents.

When fusible element 45 melts upon the occurrence of a relatively low magnitude overcurrent, the heat of the arc will cause the auxiliary tube 52 and the liner 27 to evolve arc quenching gases. During such relatively low magnitude fault currents, however, the pressure build-up within the tube 15 will be insfficient to rupture the cap 38 so that all of the gases will be vented downwardly through the lower open end 48 of the tube 15. Upon the occurrence of a relatively high magnitude fault current, however, the pressure build-up will be sufficiently rapid to rupture the cap 38 at its reduced section 42 and to discharge the cap 50 and the upper end of the fuse link 16 through the bore 36 of the neck portion 35.

It has been found that by the use of the conductive sleeve portion 30 in the gap formed between the portions of the liner 27 the interrupting capabilities of the fuse cutout 10 are substantially increased. For example, it has been found that in one commercial embodiment of the fuse cutout illustrated in FIG. 1 the interrupting reliability at 15 kv. was increased from 7,500 amps to 10,000 amps merely by the use of the conductive sleeve 30 and even though all other features of the fuse remained identical.

While the exact reason for this improved interrupting capability is not fully understood, it is believed that the use of the metallic sleeve in this manner results in a modification of the flow pattern of the gases which are expelled from the upper end of the neck portion 35. As a result, there is a substantial reduction in that portion of the gas which billows downwardly and would normally tend to cause flashover of the tube 15. For this reason the fuse cutout 10, according to the instant invention, has a substantially reduced tendency to flashover at higher fault current values, and accordingly its reliability at high currents is substantially increased.

FIG. 3 is an alternate embodiment of the instant invention which illustrates that the conductive insert member need not comprise an uninterrupted surface. Here, the insert comprises a conductive, helically wound spring member 54 which is embedded into the internal surface 55 of the unitary fuse tube 15'.

FIG. 4 is yet another embodiment of the invention which illustrates that the conductive insert member need not be isolated from the external surface of the fuse tube. Here, the fuse tube 15'' is divided into upper and lower sections 60 and 61, respectively, whose adjacent portions are internally threaded at 63. The conductive insert member 64 has an outside diameter equal to that of the fuse tube 15'' and externally threaded axial extension 66 of reduced diameter for engaging the threaded portions 63 of the tube sections 60 and 61.

While it has been known heretofore to use conductive insert members in single-vented fuse cutouts, this was for the purpose of reducing damaging recoil forces during high fault current interruptions. For example, such a single vented fuse cutout is shown in U.S. Patent 3,102,178, which is assigned to the assignee of the instant invention. However, in the instant invention, the conductive inserts are for an entirely different and unrelated purpose inasmuch as there are little or no recoil forces in a double-vented fuse cutout such as that illustrated in the drawings.

While the fuse tube 15, according to the instant invention, has been illustrated and described with respect to one particular type of fuse cutout, those skilled in the art will appreciate that it has application to other types of fuse cutouts as well. In addition, while only a few embodiments of the invention have been shown and described, other modifications will become apparent to those skilled in the art once the invention is known. Accordingly, it is not intended that the invention be limited to the specifically disclosed embodiments, but only by the scope of the appended claims.

I claim:

1. In a circuit interrupting device, the combination of, a hollow, open ended fuse tube at least partially composed of gas evolving material, terminal means mounted adjacent the opposite ends of said tube, a frangible cap mounted on one end of the fuse tube and being constructed and arranged to rupture upon the occurrence of a sufficient pressure within said tube, the other end of said tube being open, a fuse link extending longitudinally within said tube and out the open end thereof, said fuse link including a fusible element constructed and arranged to separate when subjected to a predetermined current, said fuse tube being disposed with said frangible cap elevated relative to the open end of said tube, a conductive insert member disposed within said tube and intermediate the ends thereof and electrically insulated from said terminal means, and an auxiliary tube disposed coaxially within said fuse tube and around said fuse link, said auxiliary tube being disposed adjacent said cap and being shorter than said fuse tube, said insert member being disposed entirely intermediate the ends of said auxiliary tube.

2. The circuit interrupter set forth in claim 1 and including first and second terminal means affixed to the opposite ends of said fuse tube, said fusible element being connected to said terminals, said conductive insert member being electrically insulated from said terminal means by said fuse tube.

3. The circuit interrupter set forth in claim 1 wherein said fuse tube has an axial bore, said gas evolving material defining a substantial area of said bore, said conductive insert member comprising an insert member disposed in said bore.

4. The circuit interrupter set forth in claim 3 wherein said conductive insert member comprises a metallic sleeve affixed intermediate the ends of said bore and surrounding said fusible element.

5. The circuit interrupting device set forth in claim 4 and including insulating means for supporting said interrupting device, hinge means disposed adjacent the lower end of said insulating means and first contact means disposed adjacent the upper end thereof, second contact means in circuit with fusible element and disposed on the upper end of said fuse tube for engaging said first contact means, said hinge means being constructed and arranged to disengage said first and second contact means

and to rotate the upper end of said fuse tube away from the upper end of said insulating means when said fusible element separates.

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