Dec. 15, 1959 H. H. FAHNOE 2,917,605

FUSIBLE DEVICES

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Fig. 1.

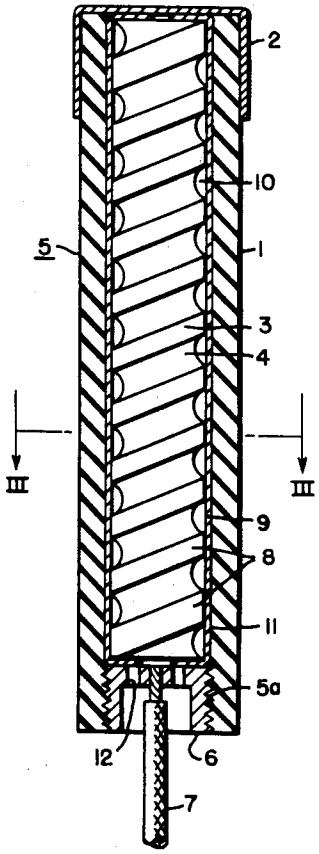


Fig. 2.

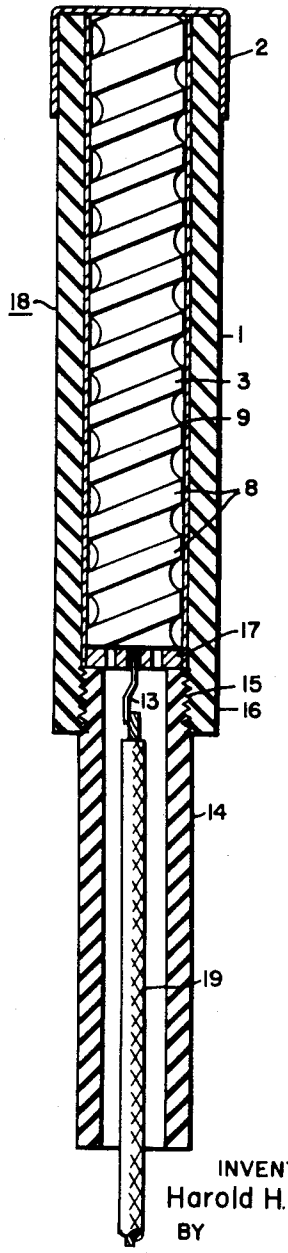
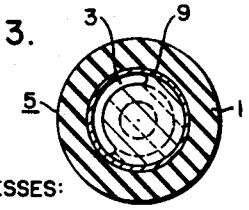


Fig. 3.



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FUSIBLE DEVICES

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Fig. 7.

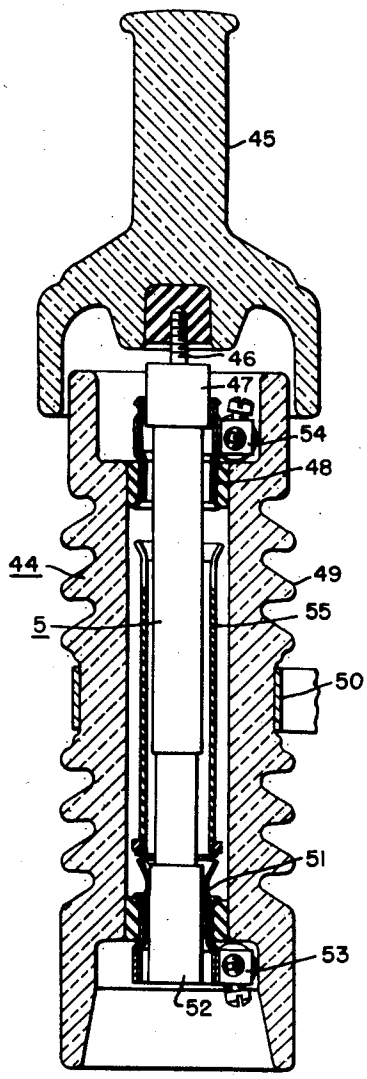


Fig. 4.

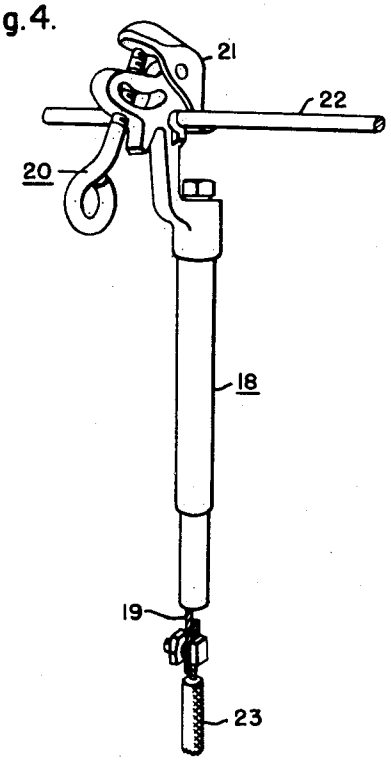
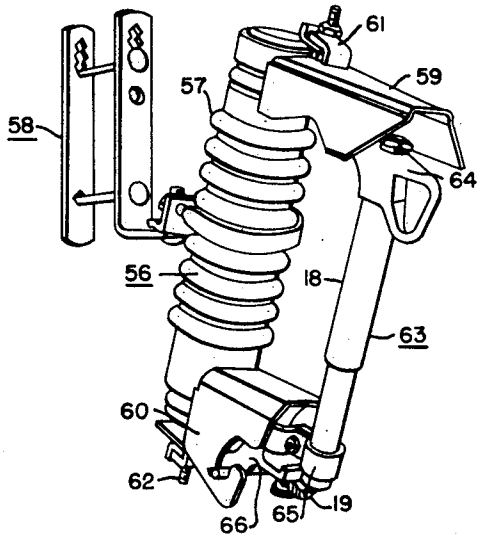


Fig. 8.



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FUSIBLE DEVICES

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Fig. 5.

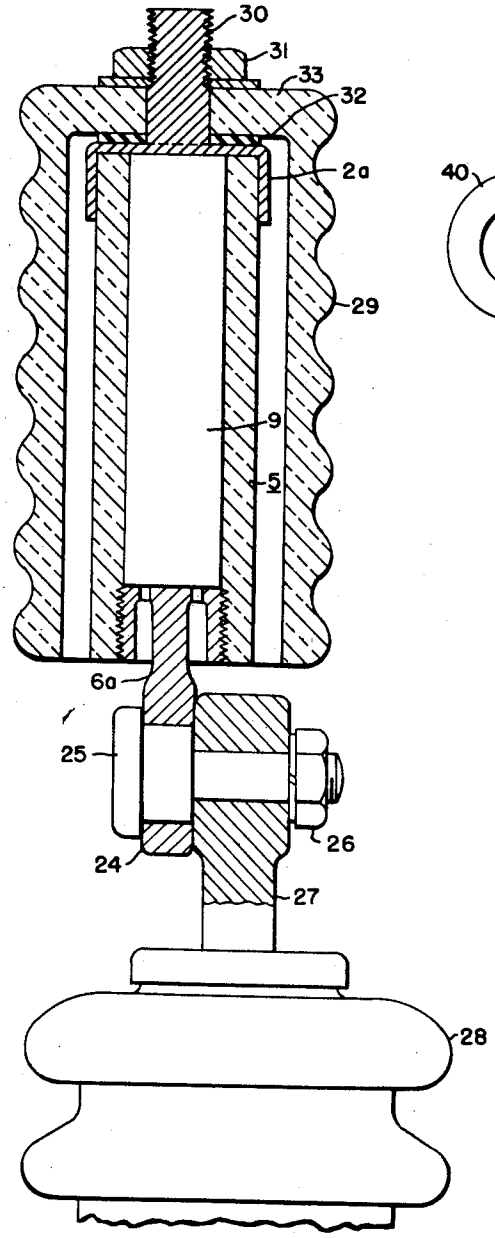


Fig. 6.

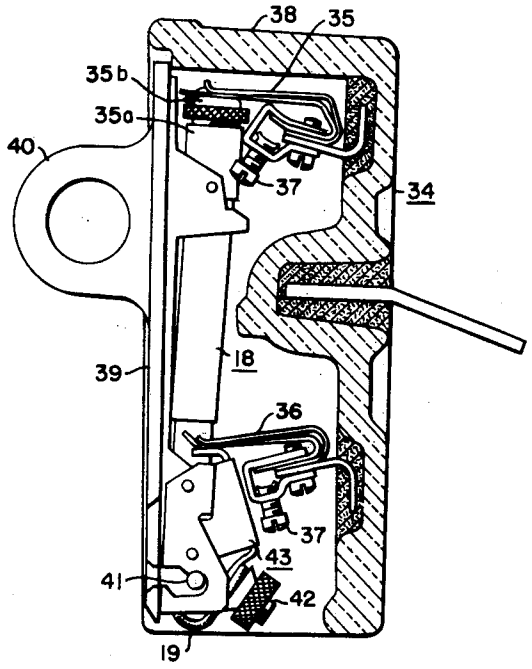
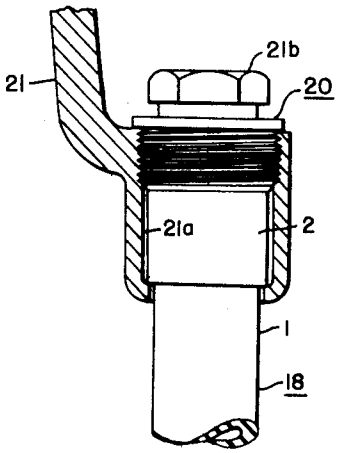


Fig. 4A.



United States Patent Office 2,917,605
Patented Dec. 15, 1959

2,917,605

FUSIBLE DEVICES

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Application April 26, 1956, Serial No. 580,864

18 Claims. (Cl. 200—114)

This invention relates to fusible devices in general, and more particularly, to improved interrupting structures and arc-extinguishing arrangements therefor.

A general object of the invention is to provide an improved fusible device which will be economical to manufacture and will be highly effective in operation.

A more specific object of the invention is to provide an improved fusible device which is inherently current limiting in its action, that is, limiting the short circuit currents passing through the fusible device to a fraction of that available on the circuit at the point of application of the fusible device.

Still a further object of the present invention is to provide an improved fusible device of the gas-evolving type in which a filler, or core member, is utilized interiorly within an enclosing tubular structure, said core or filler member having a generally helical, or spiral, groove upon its surface with a foil member interposed between the core or filler member and the surrounding tubular structure.

Still a further object of the invention is to provide a basic fuse-unit design which may be used by itself alone, or in combination with a series fusible element in a wide variety of different fusible and disconnecting structures. Thus, by merely changing the external supporting arrangement or clamping structure, it is possible to use the same basic fuse-unit design in a wide variety of different fusible structures adaptable for a wide variety of applications.

A further object of the invention is to provide a current-limiting fuse unit which may be substituted for a universal type of fuse link in a wide variety of fusible devices.

Still a further object of the invention is to associate a series fuse element with a current-limiting fuse unit and substitute such a combination for a universal type of fuse link in fusible structures of the type employing toggle mechanisms for opening.

Further objects and advantages will readily become apparent upon reading the following specification, taken in conjunction with the drawings, in which:

Fig. 1 illustrates a longitudinal vertical sectional view through the basic fuse-unit design of the invention, the fuse unit being illustrated in its unfused condition;

Fig. 2 is a longitudinal vertical sectional view through a modification of the invention, which incorporates the basic fuse-unit design of Fig. 1, but which, in addition, employs a serially disposed fusible element;

Fig. 3 is a plan view in section taken substantially along the line III—III of Fig. 1;

Fig. 4 illustrates a suspension type of cutout which again employs the basic fuse-unit design in combination with a series fusible element of the type shown in Fig. 2, the several parts being shown in their unfused condition;

Fig. 4A is a fragmentary, enlarged sectional view of the upper end of the cutout of Fig. 4;

Fig. 5 illustrates partially in section, and partially in elevation, an application of the basic fuse-unit design as

adapted for a stud connection directly to the bushing of a transformer or capacitor;

Fig. 6 illustrates a vertical sectional view through an enclosed fuse cutout with various parts in side elevation, which again employs the basic fuse-unit design in a widely used commercial form;

Fig. 7 illustrates a vertical sectional view through an enclosed bayonet-type cutout and switching device, which utilizes the basic fuse-unit design, and

Fig. 8 illustrates in perspective, an open fuse cutout again employing the basic fuse-unit design, with the several parts shown in their unfused, in-toggle position.

Referring to the drawings, and more particularly to Fig. 1 thereof, there is illustrated a fuse cutout particularly adapted for voltages in the class from 2,500 to 15,000 volts, and suitable for a continuous current rating of, say from 1 ampere to approximately 100 amperes. Although there have been indicated certain ratings, as set out above, it is to be clearly understood that certain features of the invention may readily be adapted to fuse cutouts of higher or lower voltages and that have different current ratings by suitable modifications of the dimensions and materials, as will be apparent to one skilled in the art upon reading the following description.

The novel features of the new fuse design, as set out hereinafter, enables it to be used on extremely high-capacity systems because the fuse is inherently current limiting in its action, that is, it limits the short-circuit currents passing through the fuse to a fraction of that available on the circuit at the point of application of the fuse.

The basic fuse-unit design, as set out in Figs. 1 and 3, employs an outer insulating fuse tube, or casing **1**, which for certain ratings, as more fully described hereinafter, will preferably be of a gas-evolving material, such as fibre or boric acid, or similar materials of such type well known to those skilled in the art. The tubular casing **1** has an upper fuse terminal ferrule **2**, which may be fixedly secured in any suitable manner to the upper end of the casing **1**.

Disposed interiorly within the cylindrical insulating casing **1** is a plug, or filler member **3** having a spiral or helical groove **4** on its outer surface. As more fully described hereinafter, for certain applications the core or plug **3** will be formed from a suitable gas-evolving material such as fibre or boric acid, or similar materials, but yet for other applications, it may be made from a suitable non-gas-evolving material, such as porcelain or soapstone.

Threadedly secured, as at *5a*, to the lower end of the tubular insulating casing **1** is a perforated vent plug **6** constituting another fuse terminal, to which may be secured, as by soldering, a flexible conducting cable **7**, the latter leading to any apparatus which it is desired to protect.

Interposed between the inner surface of the casing **1** and the lands, or raised portions **8** of the spirally grooved core **3** is a fusible element **9**, preferably in the form of a thin silver, copper or aluminum foil. This foil is placed in the space between the filler **3** and the insulating tube **1**, as shown in Fig. 1. The combined thickness and width and material of this foil member **9** determines the continuous current rating of the fusible device. The clearance between the lands, or raised portions **8** of the spirally grooved insulating filler **3** and the inner bore of the outer insulating tube **1** is very close. Melting or vaporizing of this foil fusible element **9** due to excessive current establishes an arc between the filler **3** and the outer fibre tube **1** extending from the upper metal ferrule **2** to the lower conducting terminal plug **6**. The close clearance between the filler **3** and the tube **1** constitutes a very severe mechanical restriction of the arc

so formed by the fusion of the metallic fuse element 9. This highly restricted and relatively short electric arc is then provided with an alternate much longer and less restricted path through the spiral groove 4 in the filler element 3. This longer less restricted path maintains the high arc resistance equivalent to that initially present. This continued high arc resistance enables the device to limit the current flowing through the device to a relatively small value. Interruption of the current flowing through this groove 4 is accomplished by deionizing action of the gas blast, which is liberated from the walls of the insulating tube 1 or the filler 3. This gas flows axially through the arc, which is present in the groove 4 on the filler support 3. The interruption of the arc is quickly and effectively accomplished because of the high pressure within the passage 10, provided between the helically grooved filler 3 and the internal bore 11 of the tubular casing 1. Also, considerable turbulence is created by the rapid flow of the gas through the spiral groove 4 and out through the apertures 12 provided in the perforated vent plug 6 at the bottom of the unit.

For low current ratings, such as 5, 10 and 15 amperes, which might be used with small distribution transformers, individual capacitors, and the like, the material used in the insulating tube 1 and in the filler 3 may be fibre, boric acid, or some other suitable gas-evolving material, which evolves gas upon contact with an arc. Gas-evolving materials would be selected in this case in order to insure that there would be a sufficient deionizing gas blast to effectively interrupt all values of current. On higher current ratings of the fuse, because of the higher let-through current permitted by the larger fusible element, less gas evolution may be desirable. In this latter case, the filler 3 could be of some non-gas-evolving material, such as porcelain or soapstone. Likewise, the other insulating tube 1 could be made of some insulating material, such as glass melamine.

Referring to Fig. 2 of the drawings, there is shown a modification of the basic fuse-unit provided with a series fuse 13, which would act very similar to a universal fuse link in a fibre tube. As set out in Fig. 2, an additional fibre tube 14 may be threadedly connected, as at 15, to the lower end 16 of the casing 1, with the series fuse element 13 secured, as by soldering, to an apertured vent plug 17.

The two fuses are connected serially, with the lower fuse 13 in the fibre tube 14 being so calibrated that it will blow prior to the current-limiting element 9 in all cases. Thus, in the event of extremely low values of overcurrent, or fault current, sufficient to blow the entire fuse unit 18, the series fuse element 13 alone in the fibre tube 14 will operate, or fuse. The resulting expulsion action will remove the connecting cable 19 from the tube 14, thereby providing a means for operating an indicator, or operating a dropout or indicating type of fuse assembly, as more fully described hereinafter. In the case of high-fault currents, both the current-limiting basic unit incorporating the fusible foil 9, and the series fuse element 13 would operate.

Although Fig. 2 shows only one form of indicator, that is causing the ejection of the cable 19, other forms will be readily apparent to those skilled in the art. For example, instead of having the cable 19 extend beyond the lower portion of the fuse tube 14, a metal ferrule, not shown, could be attached to the lower end of the fuse tube 14 and the internal cable member 19 attached to a compression spring. This compression spring would separate the series fuse element 13, when it operated under fault conditions, and could project an indicating target member below the bottom of the fuse tube to indicate that the fuse had operated.

Fig. 4 shows a possible application of the fusible assembly 18 of Fig. 2 as applied to a suspension-type cutout. As shown, the suspension-type cutout 20 includes a hot-line clamp 21 which may be clamped to a transmission line 22, associated with a fuse-unit assembly 18 of the type illustrated in Fig. 2 of the drawings. Thus, the basic current-limiting unit 18 with the series fuse element 13 is connected by the cable connection 19 to a connector 23 extending to a suitable load. The fuse assembly 18 is attached directly to the line conductor 22 by means of the hot-line clamp attached to top of the fuse assembly.

As shown in Fig. 4A, the assembly 18 may be threaded through an opening 21*a* of the clamp 21. A threaded clamping plug 21*b* holds the assembly 18 fixedly in position, and makes a good electrical connection with the fuse terminal ferrule 2. When the fuse operates, regardless of the current magnitude, the dropout lead 19 is ejected from the lower portion of the fuse assembly 18, thereby clearly indicating to the lineman that the fuse has blown. In this way, the restored voltage is removed from the fuse link and no extra precautions are necessary to prevent breakdown of the fuse tube due to the restored voltage.

Another form of the invention is shown in Fig. 5 of the drawings. Here, the basic unit 5 of Fig. 1 is provided with a modified type of perforated vent plug 6*a*, which has an extension 24 suitable for clamping by a bolt 25 and nut 26 to a connector 27, which forms part of a transformer or capacitor bushing 28. Preferably, a porcelain weather-housing 29 encloses the basic fuse unit 5, being clamped to the top of a modified ferrule 2*a* having an upper terminal stud portion 30. A suitable line connection may be made to the stud portion 30 by a clamping nut 31. Preferably, a gasket 32 is utilized, being interposed between the end 33 of the porcelain enclosure 29 and the modified ferrule 2*a*.

In Fig. 6 of the drawings, there is shown an application of the basic fuse assembly 18 employed in an enclosed fuse cutout 34 of a type more fully described in Rawlins U.S. Patent 2,359,153, issued September 26, 1944. Generally, such an enclosed fuse cutout employs a pair of spaced contacts 35, 36 which are connected by clamps 37 to suitable line connectors, not shown, which extend laterally through the side wall of the porcelain housing 38. The fuse unit 18 is secured to a cutout door 39 having a handle portion 40. It may be threaded through a hollow contact 35*a* in a manner similar to that of Fig. 4*a*. A threaded contact plug, or removable fuse terminal 35*b* is preferably employed, which is similar to the plug 21*b* of Fig. 4A. The cutout door 39 is pivotally mounted upon inwardly extending pivot pins 41 disposed at the lower end of the housing 38 as well-known.

As well known by those skilled in the art, to break the circuit extending between the contacts 35, 36, it is merely necessary to manually grasp the handle 40, and to pull the cutout door 39 outwardly and around its pivotal connection at 41 to open the circuit. However, for automatic protection, the cable 19 of the fuse unit 18 is secured to a clamp 42 forming a part of a toggle mechanism 43, as set out in the aforesaid Rawlins patent. Upon fusing of the basic unit 18, the fuse cable 19 is freed. The toggle mechanism 43 then functions in a manner as set out in the aforesaid Rawlins patent, and the cutout door 39 swings in a counterclockwise direction about the pivotal point 41 to effect withdrawal of the fuse unit 18 from between the contacts 35, 36, thereby providing an isolating gap. The illustration in Fig. 6 is not intended to disclose the details of the mechanism of the enclosed fuse cutout 34, reference for such details being disclosed in the aforesaid Rawlins patent. Fig. 6 merely indicates a possible application of the fuse unit 18 in enclosed fuse cutouts, which heretofore have employed a universal fuse link extending down through an expulsion fuse tube attached to the cutout door 39. Following operation of the fuse unit 18 in the enclosed cutout of Fig. 6, the complete unit is replaced with a

new unit 18, which may be secured to the cutout door 39 in the above-described manner.

Fig. 7 shows another application of the basic fuse unit 5 as applied to a so-called bayonet-type cutout and switching device 44. Here, a handle 45 is secured by a cemented stud 46 to the basic fuse unit 5, which has an upper contact 47. This contact may constitute an integral part of the ferrule 2 of Fig. 1. The contact 47 engages a tulip-type contact 48 disposed and cemented into place at the upper end of a tubular enclosure 49. The tubular enclosure 49, which is preferably formed of a suitable weatherproof material, may be clamped into position in the usual manner by a clamping collar 50.

Cemented into place in the lower end of the casing 49 is a second tulip-type contact 51, which makes engagement with a second contact 52 associated with the lower end of the basic fuse unit 5. This contact 52 may constitute an integral portion of the vented plug 6 of Fig. 1. Clamping connections 53, 54 may be made between suitable line connectors and the tulip stationary contacts 48, 51.

To effect a manual switching operation, one merely grasps the handle 45 and pulls it upwardly, as viewed in Fig. 7, withdrawing the fuse unit 5 upwardly out of the surrounding casing 49. When the cutout 44 is carrying load current, this will establish an arc between the contacts 51, 52 within a gas-evolving fibre tube 55. The evolution of the gas within the fibre tube 55 will extinguish the arc drawn between the contacts 51, 52, and the opening motion continues until the fuse unit 5 is completely withdrawn out of the weatherproof casing 49.

To effect contact closure, the reverse operation takes place, namely one inserts the fuse unit 5 and the contacts 47, 52 associated therewith into contacting engagement with the stationary contacts 48, 51 to complete the circuit.

During automatic operation, the fuse unit 5 will fuse and the current limiting action of the fusible foil 9 will take place, as described heretofore in connection with Fig. 1, and the circuit will be broken. It is then necessary to remove the fuse unit 5 by withdrawing the handle 45 upwardly away from the casing 49 so that a new unit 5 may be secured to the stud portion 46 associated with the handle 45. The handle assembly may then be replaced within the casing 49 in the same manner as heretofore described during the closing of a manual switching operation.

Fig. 8 discloses still a further possible application of the fuse unit 18, set out in Fig. 2, as applied to an open fuse cutout. Reference may be had to United States Patent 2,734,964, issued February 14, 1956 to Andrew W. Edwards and William J. Paxton, and assigned to the assignee of the instant application. Generally, the fuse structure 56 includes a supporting porcelain 57, secured into a fixed position by a clamping assembly 58, as well known by those skilled in the art. Clamped to the opposite ends of the porcelain support 57 is a pair of contact assemblies 59, 60, to which line connections may be made, as at 61 and 62. The fuse holder 63 will include the fuse unit 18 with contact assemblies 64, 65, as set out in the above Edwards and Paxton patent. Fig. 4A may be referred to in connection with the manner of securing the assembly 18 to the upper contact assembly 64. A toggle mechanism 66 is associated with the lower contact assembly 65 and is maintained in an intoggle position by the fuse cable 19. Details of the contact structure and the toggle mechanism may be obtained by a reading of the aforesaid Edwards and Paxton patent. For an understanding of the present invention, it is merely necessary to know that the fuse unit 18 is substituted for the conventional universal fuse link and associated expulsion fuse tube, so that when the fuse unit 18 blows, the cable 19 will be freed and will permit the toggle mechanism 66 to break, thereby resulting in the opening dropout action of the fuse holder 63.

From the foregoing description, it will be apparent that there is provided an improved basic fuse unit 5, as set out in Fig. 1, which may be used alone or in conjunction with a serially related fusible element 13 of the type set out in Fig. 2. Either the fuse unit 5, or the assembly of the fuse unit 5 with the series fuse 13, constituting an assembly 18, may be employed in a wide variety of different operating structures.

Although the fuse structure set out in Figs. 4–8 are of widely different external form, yet all employ the same basic fuse unit 5 or the basic fuse unit 5 in conjunction with a serially related fusible element 13 constituting an assembly 18, as illustrated in Fig. 2. In all the structures, the current limiting action of the basic fuse unit 5 is present so as to limit the current passing through the fuse device to a small fraction of the short-circuit current available on the circuit at the point of application of the fusible device. Thus, it is possible by use of this invention to use a current-limiting fuse element in the same types of fuses where universal fuse links had been used before.

Although there have been shown and described specific structures, it is to be clearly understood that the same were merely for the purpose of illustration, and that changes and modifications may readily be made therein by those skilled in the art, without departing from the spirit and scope of the invention.

I claim as my invention:

1. A fuse device including a tubular insulating casing, an interiorly disposed filler member having a helical groove on the outer surface thereof, a fusible foil disposed in the space between the filler member and the tubular casing, and said fusible foil having a cylinderical configuration and substantially completely enveloping the helically grooved filler member.

2. The combination in a fusible device of a cylindrical insulating casing, a helically grooved cylindrical insulating filler member disposed interiorly of the casing and having a relatively close fit therewithin, a fusible foil in the narrow space between the casing and the helically grooved filler member, and said fusible foil having a cylindrical shape and substantially covering said filler member.

3. A fuse device including a tubular insulating casing having a pair of spaced fuse terminals associated therewith, a cylindrical fusible foil disposed interiorly of the casing and electrically connected to the fuse terminals, a helically grooved filler member disposed within the cylindrically-shaped fusible foil, and the cylindrically-shaped fusible foil fusing upon the passage of excess current therethrough.

4. The combination in a fusible device of a tubular insulating casing having a pair of spaced fuse terminals associated therewith, an interiorly disposed helically grooved filler member, a fusible foil disposed between the filler member and the tubular casing and electrically connected to the spaced fuse terminals, and said fusible foil having a cylindrical configuration and substantially completely enveloping the helically grooved filler member.

5. A fusible device including a tubular insulating tube, a fuse terminal closing one end of the tube, an apertured vent plug associated with the other end of the tube and constituting a second fuse terminal, a fusible foil disposed interiorly of the tube and electrically connected to the fuse terminals, a helically grooved filler member disposed interiorly of the tube, and said fusible foil having a cylindrical configuration and substantially enveloping the helically-grooved filler member.

6. The combination in a fusible device of an insulating tube, a pair of spaced fuse terminals, an interiorly disposed helically grooved insulating filler, a fusible foil between the filler and the tube and electrically connected

to the fuse terminals, and said fusible foil having a cylindrical shape and substantially enclosing said helically grooved filler.

7. The combination in a fusible device of a cylindrical insulating casing, a cylindrical insulating filler member disposed interiorly of the casing, a fusible foil in the space between the casing and the filler member, said fusible foil being a cylindrically-shaped wrapping about said cylindrical insulating filler member, and a series fusible element connected in series with the fusible foil.

8. A fuse device including a tubular insulating casing having a pair of spaced fuse terminals associated therewith, a cylindrical fusible foil disposed interiorly of the casing and electrically connected to the fuse terminals, a grooved filler member disposed within the cylindrically-shaped fusible foil, the cylindrically-shaped fusible foil fusing upon the passage of excess current therethrough, and a series fusible element connected in series with the fusible foil.

9. The combination in a fusible device of an insulating tube closed at one end, an interiorly disposed helically grooved filler member, a fuse terminal associated with the closed end of the tube, an apertured conducting plug associated with the other end of the fuse tube, a fusible foil disposed between the tube and the filler member and electrically connected to the fuse terminal and the plug, said fusible foil having a cylindrical configuration and substantially enclosing said helically grooved filler member, a series fusible element electrically connected to the plug at one end, and a conducting cable electrically connected to the other end of the series fusible element.

10. An open fuse cutout including a rotatable fuse holder, an insulator supporting a pair of terminals electrically bridged by the fuse holder in the closed position of the cutout, the fuse holder including a helically grooved filler member and a surrounding at least partially cylindrically-shaped fusible foil, said fuse holder also including a tubular insulating casing closely surrounding said helically grooved filler member and said at least partially cylindrically-shaped fusible foil, and a series fusible element in series with said foil.

11. A current-limiting fusible device including an insulating cylindrical casing, a pair of terminals disposed at opposite ends of the insulating cylindrical casing, an interiorly disposed insulating filler member having a close fit interiorly of said cylindrical casing, said filler member having upon its outer surface a continuous groove extending between the terminals and of greater length than the axial length between said terminals, and a fusible foil disposed in the narrow space between the interiorly disposed filler member and the outer cylindrical casing at least partially out of said groove and electrically connected to the terminals.

12. A current-limiting fusible device including an insulating cylindrical casing, a pair of terminals disposed at opposite ends of the insulating cylindrical casing, an interiorly disposed insulating filler member having a close fit interiorly of said cylindrical casing, said filler member having upon its outer surface a continuous groove extending between the terminals and of greater length than the axial length between said terminals, and a fusible foil disposed in the narrow space between the interiorly disposed filler member and the outer cylindrical casing at least partially out of said groove and electrically connected to the terminals, and a series fusible element connected to one of said terminals and having fusing characteristics such that it will fuse at all currents which will effect fusing of said foil.

13. A current-limiting fusible device including an insulating cylindrical casing, a pair of terminals disposed at opposite ends of the insulating cylindrical casing, an interiorly disposed insulating filler member having a close fit interiorly of said cylindrical casing, said filler member having upon its outer surface a continuous groove extending between the terminals and of greater length than the axial length between said terminals, and a fusible foil disposed in the narrow space between the interiorly disposed filler member and the outer cylindrical casing a least partially out of said groove and electrically connected to the terminals, and a series fusible element including a tensioned fuse cable connected to one of said terminals and having fusing characteristics such that it will fuse at all currents which will effect fusing of said foil.

14. A fuse device including a tubular insulating casing having a pair of spaced fuse terminals associated therewith, an interiorly disposed filler member having a helical groove on the outer surface thereof, a fusible foil disposed in the space between the filler member and the tubular casing and electrically connected to the fuse terminals, said fusible foil having a cylindrical configuration and substantially completely enveloping the helically grooved filler member, and a hot-line clamp associated with one fuse terminal.

15. A fusible device including a tubular insulating tube, a fuse terminal closing one end of the tube, an apertured vent plug associated with the other end of the tube and constituting a second fuse terminal, a fusible foil disposed interiorly of the tube and electrically connected to the fuse terminals, a helically grooved filler member disposed interiorly of the tube, said fusible foil having a cylindrical configuration and substantially completely enveloping the helically grooved filler member, and the apertured vent plug having an extension suitable for clamping purposes.

16. An enclosed fuse cutout having a pair of spaced contacts, a cutout door having a fuse unit with associated contacts for opening and closing the circuit between the said spaced contacts, the fuse unit including a cylindrical insulating casing, a helically grooved cylindrical insulating filler member disposed interiorly of the casing and having a relatively close fit therewithin, a fusible foil in the narrow space between the casing and the helically grooved filler member, and said fusible foil having a cylindrical shape and substantially covering said filler member.

17. An enclosed bayonet-type cutout and switching device including a casing having contact terminals associated with the opposite ends thereof, a removable handle and fuse tube assembly for electrically interconnecting the contact terminals, the fuse tube assembly including a cylindrical insulating casing, a helically grooved cylindrical insulating filler member disposed interiorly of the casing and having a relatively close fit therewithin, a fusible foil in the narrow space between the casing and the helically grooved filler member, and said fusible foil having a cylindrical shape and substantially covering said filler member.

18. A current-limiting, drop-out type, fusible device including a pair of spaced contact assemblies, a fuse holder for electrically bridging said spaced contact assemblies, the fuse holder including a current-limiting fuse unit having a fuse terminal disposed adjacent one end thereof, said fuse terminal being engageable and disengageable with one of said spaced contact assemblies, said current-limiting fuse unit having a definite continuous current rating and being capable of producing an arc voltage high enough in value and with sufficient rapidity to prevent the rise of current interrupted above a predetermined value, a series fusible element having one end thereof electrically connected to the other end of said current-limiting fuse unit, said series fusible element having the characteristic of fusing in the event of extremely low values of fault current which are not sufficient to effect fusing of said current-limiting fuse unit, a toggle mechanism for causing drop-out operation of the fusible device upon a fusing operation thereof, a fuse cable electrically connected to the other end of the series fusible element and maintaining the toggle mechanism in the

in-toggle position under tension, and the fusing of the series fusible element causing a freeing of the fuse cable to effect thereby a breaking of the toggle mechanism and a drop-out operation.

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