Dec. 11, 1951 W. C. LINTON 2,577,899

CURRENT LIMITING FUSE

Filed Oct. 21, 1948

FIG. 1

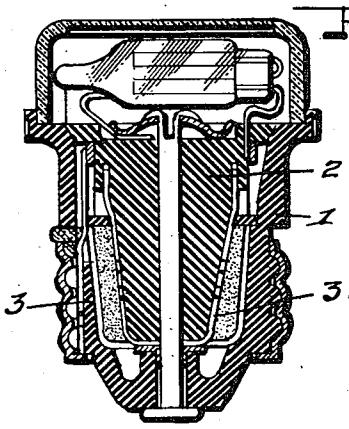


FIG. 2

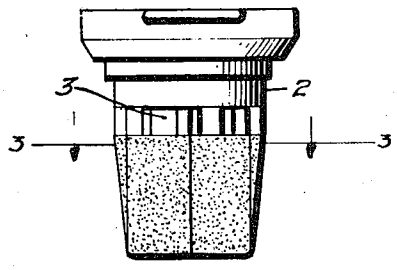


FIG. 3

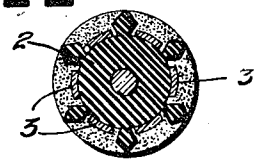
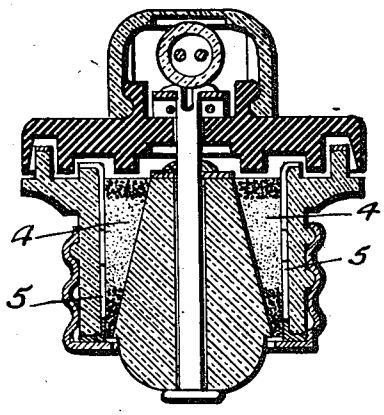


FIG. 4



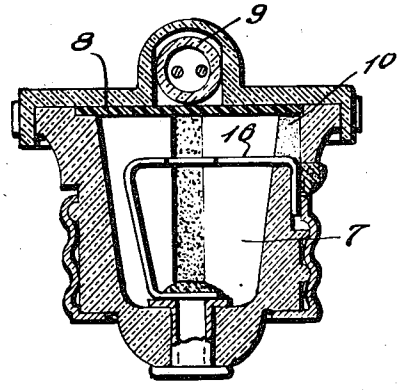
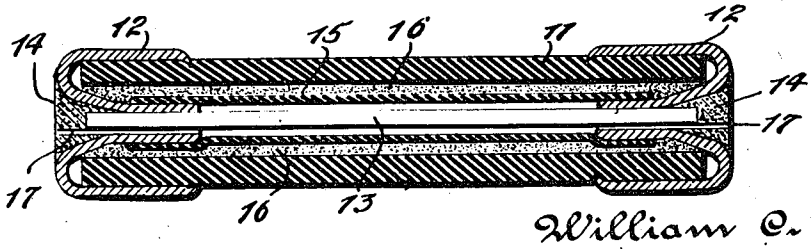


FIG. 6

FIG. 5



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CURRENT LIMITING FUSE

William C. Linton, Washington, D. C.

Application October 21, 1948, Serial No. 55,771

10 Claims. (Cl. 200—120)

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The present invention relates to arc quenching materials for use more particularly with all types of standard plug and cartridge enclosed electrical fuses and an object of the present invention is to provide a binder for conventional arc quenching materials now employed with electrical fuses whereby such materials may be retained about the fusible elements thereof and yet permit the gases generated by the blowing of the fusible elements to readily pass therethrough and escape therefrom.

Another equally important object of the present invention is to provide an elastic thermoplastic coating or covering having very difficult ignition and self arc extinguishing qualities for an enclosed fuse which upon subjection to currents of large magnitude, such as upon short circuit, the fusible element attains fusing temperature, whereupon arcing occurs and the metal vapors rapidly expand whereby most of the arc energy will be dissipated in the transfer of heat therethrough with practically negligible pressure within the fuse enclosure.

A still further object of the present invention is to provide an arc quenching composition for a plurality of fusible elements whereby should any one of the fusible elements become blown or ruptured due to a short circuit or overload the flame and molten metal emitted will be sufficiently subdued or quenched as to permit the remaining fusible elements to perform and yet permit the gases generated by any one or all of the fusible elements to readily escape therefrom.

Other objects of the invention will be in part obvious and in part pointed out hereinafter as the description continues.

In the accompanying drawings:

Fig. 1 is a vertical sectional view through a multiple plug type fuse illustrating one form of my arc quenching composition applied therein.

Fig. 2 is a side elevation of the rotatable fusible element holding member of said multiple plug type fuse with the arc quenching composition supported thereby and retained therein.

Fig. 3 is a horizontal section taken on the line 3—3 of Fig. 2 in the direction of the arrow points.

Fig. 4 is a vertical sectional view through another type of multiple plug fuse showing the application of my arc quenching composition thereto for retaining conventional arc quenching materials in place therein.

Fig. 5 is a vertical sectional view through a non-renewable plug type fuse having a single fusible element enclosed in the explosive chamber thereof and the latter being closed with a

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thermoplastic sheet or disc of arc quenching material, and

Fig. 6 is a sectional view through a standard cartridge type enclosed fuse having another form of the present invention applied thereto.

All types of standard plug and cartridge enclosed fuses preferably employ an arc quenching material which are usually in powdered or granular form. Such arc quenching materials generally consist of sulphite or carbonate or both, but due to their loose granular or powdered form it has been found somewhat difficult to retain the same in proper position about fusible elements of standard enclosed fuses. Therefore, I provide a binder or enclosure for such arc quenching materials which will retain the latter in proper position within an enclosed fuse and yet permit the gases generated by the blowing of the fuse to readily pass through the same and escape therefrom.

The binder or coating for such arc quenching materials is thermoplastic, elastic, having very difficult ignition qualities, self extinguishing qualities and has a very high dielectric strength; and I now find the material best suitable for such a coating or binders to be vinylidene chloride resins. The vinylidene chloride resin employed is a synthetic resin sold under the trade names of "Geon" and "Saran." This material is said to resist heat up to 160–200° F., distortion under heat of 150–180° F. and a higher softening range than related thermoplastics, a very high dielectric strength; and its burning rate being practically nil. This material is sold to the trade in granular resin form as well as in sheets and extruded tubings. The granular resin form of this material will partly dissolve in many hydrocarbon solvents and when mixed with arc quenching materials of granular form, will hold the same together in a single mass and yet due to the granular form of these arc quenching materials, the mass so formed is sufficiently porous as to permit gases under pressure to readily pass therethrough and emit therefrom.

In Fig. 1 of the drawings I have disclosed a lamp type indicating multiple enclosed plug fuse forming a part of my Patent No. 2,206,785 dated July 2, 1940, in which the enclosed casing 1 has mounted for rotation therein a rotator with a plurality of vertical extending grooves formed in the outer periphery thereof in which are retained the fusible elements 3. The grooves are each filled with an arc quenching composition embodying the present invention so as to cover those portions of the fusible links which become blown or ruptured

due to an overload or short circuit occurring in the electrical circuit whereby when any one of the fusible links or elements become blown or ruptured the arc quenching composition covering the same will subdue any flame caused by the blowing of the fuse without in any manner interfering with the successive operation of the remaining fusible elements. This composition preferably consists of kaolin in its white powdery form and a binder of vinylidene chloride resin. The vinylidene chloride resin is first sufficiently dissolved in benzine and while in its liquid state is mixed with the kaolin until a plastic mass is formed and then this mass or paste is filled within the recesses and over the fuse links 3. As the benzine evaporates a hard mass is formed and the resin therein causes the same to adhere to the rotator 2 yet due to the granular form of the kaolin, this mass is sufficiently porous as to permit any gases generated by the blowing of the fuse to readily pass therethrough and escape through the provided vents in the casing 1 of the multiple fuse.

In Fig. 4 of the drawings I have illustrated another type of multiple enclosed plug fuse having explosion chambers 4 vertically positioned within the casing thereof. The opposite ends of these explosion chambers 4 are opened and a fuse link 5 extends through each explosion chamber 4 and the open ends thereof. Each explosion chamber 4 is filled with arc quenching materials. Whereas, a paste or composition may be employed for filling each explosion chamber 4 and this composition could be the same as that shown in Fig. 1 of the drawings, I preferably employ an arc quenching composition at the open ends of the explosion chambers and retain therebetween the arc quenching materials in loose or free granular form. After dissolving the vinylidene chloride resin, I either prepare a paste by mixing kaolin therewith and inject the same in the lower end of each explosion chamber 4, or first fill the lower end of each explosion chamber 4 with a small amount of kaolin in granular form and then mix the same with the liquid vinylidene chloride so as to form a paste which will close the lower ends of each explosion chamber 4. Upon this paste I then fill within each explosion chamber 4 kaolin in free granular form and upon the top thereof I place a paste of kaolin and vinylidene chloride or merely inject vinylidene chloride in liquid form upon the top of the kaolin filled within each explosion chamber 4. The free particles of kaolin are now securely retained within each explosion chamber 4 and yet any gases generated by the blowing of the fusible elements 5 can readily pass through the arc quenching materials within the explosion chamber 4 and be vented therefrom.

In Fig. 5 of the drawings I have illustrated a non-renewable plug type fuse having enclosed therein a single fusible element 16 extending through the explosion chamber 7 thereof. This explosion chamber is closed by means of a sheet or disc 8 formed entirely from vinylidene chloride resins. In order to retain the disc 8 within the fuse, I may apply heat to its marginal edges or squirt a small amount of benzine around its marginal edges so that the marginal edges of this disc will adhere itself to the fuse casing. As the fusible element or link 16 blows, the gases generated will pass from the explosion chamber 7 through its provided vented outlet and yet the disc 8 will seal the glass bulb of the lamp indicator 9 against such gases and prevent the flame or arc emitted from the fusible element from damaging the lamp indicator. At times it may be desirable to fill the explosion chamber with arc quenching materials in loose granular form and in such latter cases a paste 10 of kaolin and vinylidene chloride is placed in the vent opening of the fuse which paste together with the disc 8 seals the arc quenching powders therein.

In Fig. 6 of the drawings, I have illustrated a standard cartridge type enclosed fuse of the midget or smallest size, but the invention may be applied as equally well to all larger sized cartridge fuses. This cartridge type fuse comprises a fiber tube 11 having its opposite ends closed by means of the ferrule contacts 12 and the fusible element 13 consisting of a single strand of wire having its opposite ends connected to the ferrules 12 by means of solder 14. The fusible element 13 is enclosed by an extruded tube 15 formed from vinylidene chloride and surrounding this tube 15 is a filler 16 consisting of a sulphate or carbonate or both in granular form. The opposite ends of the fuse are provided with conventional vent openings 17. As the fuse link softens due to an overload or a short circuit the tube 15 will initially retain the same in its original form until it is finally blown or ruptured. During the initial softening period of this link the gases so generated will readily pass from the opposite ends of the tube 15 and escape through the vent openings 17. This tube being formed of resilient material will act as a bellows and due to the pressure of the filler 16 thereupon, the gases will be forced from this enclosure without damaging the fibre casing. However, any arcing or flashing that may occur will be subdued by the tube 15, but should any part of the latter become disintegrated the granular arc quenching filler 16 will pass through the tube 15 into contact with the fusible element for further quenching or subduing any arc or flame that may occur due to the blowing of the fuse.

Whereas, I preferably employ kaolin other arc quenching materials such as sand, borax, rock wool or asbestos may be substituted therefor. Halogenated compounds such as monochlorobenzene, dichlorobenzene and trichlorobenzene or ketones, such as mesityl oxide, isophorone and acetonyl acetone, may be substituted for benzene should it be necessary to completely dissolve the vinylidene chloride resin in preparing the binder for the other arc quenching materials.

This application contains subject matter disclosed in my abandoned application Serial No. 29,572, filed May 27, 1948.

I claim:

1. An enclosed fuse comprising a casing having a fusible element, a granular arc quenching material within said casing and extending over said fusible element and a thermoplastic binder for said arc quenching material consisting of vinylidene chloride.

2. An enclosed fuse comprising a casing having a fusible element arranged therein, granular arc quenching materials encasing said fusible element, a sheet retaining said granular arc quenching materials within the fuse casing and said sheet consisting of vinylidene chloride.

3. An enclosed fuse comprising a casing, a fusible element arranged within said casing, a tube surrounding said fusible element and said tube consisting of vinylidene chloride.

4. An enclosed fuse comprising in combination a casing having an explosion chamber therein and a vent opening leading from the explosion chamber, contact terminals, a fusible element ar-

ranged within the explosion chamber and connected to said contact terminals, an arc quenching material, and means for retaining said arc quenching material in the explosion chamber of said casing consisting of vinylidene chloride.

5. A fuse of the current limiting type, comprising a casing having spaced terminals, a fusible element extending in said casing and connected between said terminals, a principal arc-quenching filler arranged within said casing, a substance having different characteristics from that of said principal arc-quenching filler arranged within said casing and said substance consisting essentially of vinylidene chloride.

6. A fuse of the current limiting type, comprising a casing having spaced terminals, an elongated fusible element extending in said casing and connected between the terminals thereof, a coating consisting essentially of vinylidene chloride surrounding said elongated fusible element and a granular arc-quenching material arranged between said coating and casing.

7. An enclosed cartridge type fuse comprising a tubular casing, spaced terminals, a fusible element extending in said casing and connected between said terminals, a tube consisting essentially of vinylidene chloride surrounding said fusible element and granular arc-quenching materials arranged within said casing and surrounding said tube.

8. An enclosed cartridge type fuse comprising a tubular casing, contact terminals secured to the opposed ends of said casing, a fuse link extending in said casing and connected to said contact terminals, an enclosure consisting essentially of vinylidene chloride surrounding said fuse link and

said contact terminals having vent openings therein communicating with said enclosure.

9. An enclosed cartridge type fuse comprising in combination a casing, contact terminals secured to the opposed ends of said casing, an elongated fusible element extending within said casing and connected to said contact terminals, a tube consisting essentially of vinylidene chloride surrounding said fusible element, a tubular extension formed with each of said contact terminals, and said tube being connected to and supported by said tubular extensions.

10. An enclosed cartridge type fuse comprising in combination a casing, contact terminals secured to the opposed ends of said casing, an elongated fusible element extending within said casing and connected to said contact terminals, a tubular extension formed with each contact terminal, a tube consisting essentially of vinylidene chloride enclosing said fusible element and attached to and supported by said tubular extensions, said contact terminals having vent openings therein communicating with said tube and granular arc-quenching materials arranged within said casing and extending about said tube.

WILLIAM C. LINTON.

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The following references are of record in the file of this patent:

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