

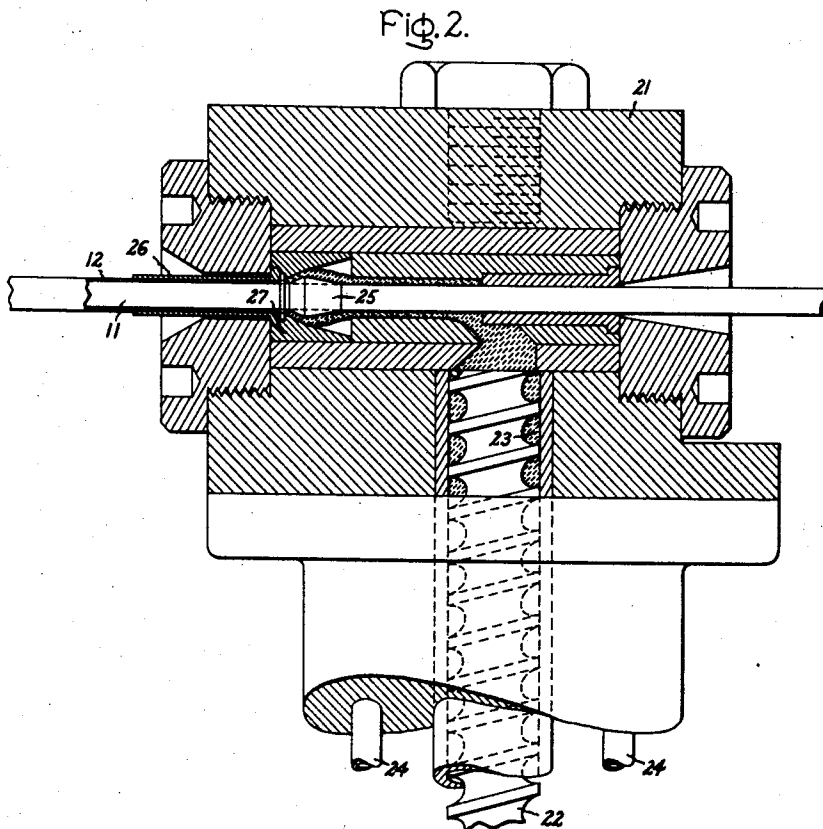
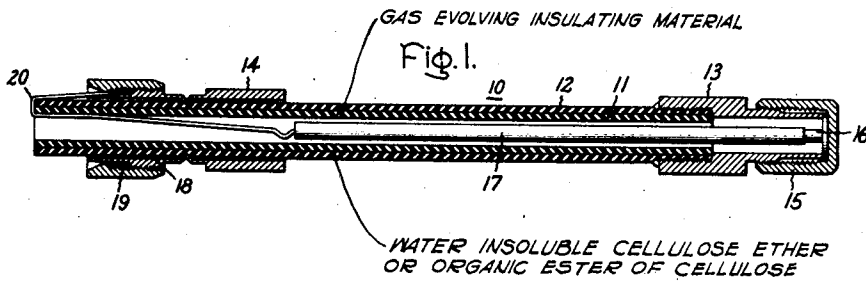
Aug. 3, 1943.

K. H. BENTON

2,325,935

ELECTRICAL PROTECTIVE DEVICE

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Inventor:
Kenneth H. Benton,
by *Harry E. Dunbar*
His Attorney.

UNITED STATES PATENT OFFICE

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ELECTRICAL PROTECTIVE DEVICE

Kenneth H. Benton, Pittsfield, Mass., assignor to
General Electric Company, a corporation of
New York

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9 Claims. (Cl. 200—127)

My invention relates to electrical protective devices and more particularly to electrical devices having terminals between which an arc is formed and a protective insulating structure is disposed adjacent to and in confining relationship with said arm. More specifically, my invention is an improvement on United States Letters Patent 2,157,815, granted May 9, 1935 and assigned to the same assignee as the present application.

Circuit-interrupting devices, such as circuit breakers, fuses, and the like, quite often employ an arc-confining structure composed of or surfaced with a gas-evolving insulating material, that is, a material which, under the influence of the heat of the arc, emits gases or vapors to aid, at least in part, in extinguishing the arc. Numerous organic or inorganic gas-evolving insulating materials have been suggested for use with electric circuit interrupters but most of these have certain disadvantages, such as a tendency to become conducting because of carbonization when subjected to the heat of an arc. Vulcanized fiber has long been accepted as a very efficient gas-evolving insulating material for use with circuit-interrupting devices since it is not affected in the disadvantageous manner indicated above by the heat of an arc as are the other organic or inorganic materials referred to above. Such vulcanized fiber or fibrous organic material has good mechanical strength together with the inherent ability to give off large quantities of water vapor when exposed to the heat of an arc. However, when used for the casing of expulsion tubes, fuses, or the like which are exposed to the weather, fiber absorbs water to such an extent that, unless a tube or casing formed of such a material be protectively covered with a moisture resistant composition, the tube swells, warps, and soon becomes useless. Also, the high degree of water absorption of organic fibrous material tends to increase its rate of deterioration and the progressive formation of a conducting and finally a carbonized path ("tracking") across the outer surface of the fuse tube. This tracking occurs, of course, only when voltage is maintained across the tube surface, such as is the case after an expulsion fuse has blown.

To improve the weathering of fiber and also to lend mechanical support against warping, it has been the general practice to cover a fiber fuse tube, for example, with cloth or paper covered or filled with a resin, generally of the phenolic type. The use of fiber fuse tubes covered with a phenolic covering, involving a cloth or paper base,

necessitates an expensive process involving several steps, and the resulting covering of such heat-curable resins is often very brittle and consequently has a low impact strength.

One object of my invention is to provide a new and improved electric protective device.

It is another object of my invention to provide an arc-confining structure for electric circuit interrupters in which a fibrous organic material is surfaces with a thermo-plastic cellulose derivative of the ether or ester group.

Further objects and advantages of my invention will become apparent as the following description proceeds and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of my invention, reference may be had to the accompanying drawing in which Fig. 1 is a sectional view of an electric protective device embodying my invention, and Fig. 2 portrays one method of constructing the fuse tube embodied in the protective device illustrated in Fig. 1.

Although my invention is applicable to circuit interrupters in general employing gas-evolving insulating materials for arc-extinguishing purposes, I have chosen to illustrate my invention specifically in Fig. 1 as applied to a fused protective device including an expulsion tube surrounding a renewable fuse link. The fuse holder of the expulsion tube of Fig. 1 is illustrated as comprising a tubular casing, generally indicated at 10 including an inner tube or liner 11 constructed of a gas-evolving insulating material, preferably a fibrous organic material such as vulcanized fiber or the like. Surrounding the inner tube or liner 11 is a weatherproof surfacing material 12 which lends strength to the inner tube 11. Such surfacing material which should be of substantial thickness such that it may be machined without cutting through said thickness is preferably composed of an extrudable or moldable composition of a particular class of compounds which I have found to be eminently suitable for this purpose. These compounds are water-resistant or water-insoluble cellulose derivatives selected from the class consisting of cellulose ethers and organic esters of cellulose, as, for instance, ethyl cellulose, benzyl cellulose, cellulose acetate, cellulose propionate, cellulose butyrate, cellulose aceto-butyrate, etc. The tubular casing or holder 10 is provided with contacts 13 and 14 which are mounted on either end thereof for connecting the

fuse unit in the circuit, by mounting in a suitable fuse support or otherwise. A cap 15 which closes one end of the casing 10 is threaded on to the contact 13, providing a clamped electrical contact with the button head end 16 of the fuse link 17. Other suitable clamping means 18 and 19 are provided for similarly clamping the lower terminal 20 of the fuse link 17 to the contact 14.

By constructing the expulsion fuse tube or casing 10 in the manner indicated, the cellulose derivatives, which are thermoplastic, may be extruded on the fiber tube or molded thereon in a single operation as contrasted with the much more complicated and expensive process required in prior arrangements where a cloth or paper-covered fiber tube had the cloth or paper impregnated with a phenolic resin compound.

In Fig. 2 I have illustrated an apparatus for covering the fiber liner 11 of Fig. 1 with an extruded coating of the thermoplastic cellulose derivative. Referring to Fig. 2, the extrusion apparatus may comprise an electrically heated head 21 and a material feed screw 22 which supplies the thermoplastic material indicated at 23 to the forming dies of the extrusion apparatus. Suitable heating tubes 24 may be provided for maintaining the thermoplastic material at the proper temperature during the extrusion process. The fiber tube 11 is passed through the extrusion apparatus and the material 23 is forced around the tube 11. A suitable centering guide 25, forming die 26, and forming dieholder 27, mounted on the extrusion apparatus, cause the material 23 to be extruded around fiber tube 11 to produce the fuse tube 10 indicated in Fig. 1 by a single operation.

Although I have illustrated in Fig. 2 an extrusion apparatus for coating the fiber tubes with the thermoplastic cellulose derivative, it should be understood that this thermoplastic substance might also be molded around the fiber tube.

It should be understood that suitable plasticizers may be used with the above-mentioned coating materials in order to impart the desired degree of extrudability.

I have discovered that the thermoplastic surfacing material, referred to above, machines very satisfactorily so that threads may be cut therein as indicated in Fig. 1, or any other suitable operation may be performed thereon. Furthermore, such fiber tubes covered with one of the above referred to cellulose derivatives have great impact strength to withstand the explosive action upon blowing of the fuse. Also, this material provides a greater resistance to carbonization than material used heretofore. I have also discovered that, by using the thermoplastic material set forth above in the manner indicated, a very simple means for identifying fuse tubes for different purposes or of different ratings is obtained since various colored dies may be added to the thermoplastic cellulose derivative material.

It is to be understood that this invention is not limited to the specific structures described and illustrated and the invention may be utilized with any type of circuit interrupter or fuse structure having as an essential element an insulating member disposed adjacent to and in confining relationship with an arc formed when the circuit is opened. The term "arc-confining structure" and similar terminology as used herein and in the appended claims includes within its means any structure disposed adjacent an arc

whether such structure is in the form of a tube or spaced apart plates or walls.

It should be understood that my invention is not limited to specific details of construction and arrangements thereof herein illustrated and changes and modifications may occur to one skilled in the art without departing from the spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. An arc-confining structure comprising gas-evolving insulating material having the outer portion thereof surfaced with a coating of a cellulose derivative selected from the class consisting of water-resistant cellulose ethers and organic esters of cellulose, said coating having a substantial thickness such that it may be machined without cutting through said thickness.

2. An arc-confining structure comprising fibrous organic material having the outer portion thereof surfaced with a coating of a cellulose derivative selected from the class consisting of water-resistant cellulose ethers and organic esters of cellulose, said coating having a substantial thickness such that it may be machined without cutting through said thickness.

3. An electric device having terminals between which an arc is formed and an insulating structure disposed adjacent to and in confining relationship with said arc, said insulating structure comprising fibrous organic material having the outer portion thereof surfaced with a coating of substantial thickness such that it may be machined without cutting through said thickness formed of a cellulose derivative selected from the class consisting of water-resistant cellulose ethers and organic esters of cellulose.

4. An electric circuit interrupter comprising means for opening the circuit so as to form an arc and an insulating structure disposed adjacent to and in confining relationship with said arc, said insulating structure having an outer surface comprising a coating of substantial thickness such that it may be machined without cutting through said thickness formed of a cellulose derivative selected from the class consisting of water-insoluble cellulose ethers and organic esters of cellulose.

5. An expulsion fuse including an arc-confining structure formed of a fibrous organic material coated on the outside with a material comprising a coating of substantial thickness such that it may be machined without cutting through said thickness formed of a cellulose derivative selected from the class consisting of water-insoluble cellulose ethers and organic esters of cellulose.

6. An electric device having terminals between which an arc is formed and an insulating structure disposed adjacent to and in confining relationship with said arc, said insulating structure having the outer surface thereof covered with a coating of substantial thickness such that it may be machined without cutting through said thickness formed of cellulose acetobutyrate.

7. An electric device having terminals between which an arc is formed and an insulating structure disposed adjacent to and in confining relationship with said arc, said insulating structure having an outlet surface comprising a coating formed of cellulose acetate of substantial thickness such that it may be machined without cutting through said thickness.

8. An electric device having terminals between which an arc is formed and an insulating struc-

ture disposed adjacent to and in confining relationship with said arc, said insulating structure having an outlet surface of ethyl cellulose comprising a coating of substantial thickness such that it may be machined without cutting through said thickness. 5

9. An edectric device having terminals between which an arc is formed and an insulating structure disposed adjacent to and in confining

relationship with said arc, said insulating structure comprising a fibrous organic material covered with an outer coating of substantial thickness such that it may be machined without cutting through said thickness comprising an extruded cellulose derivative selected from the class consisting of water-insoluble cellulose ethers and organic esters of cellulose.

KENNETH H. BENTON.

CERTIFICATE OF CORRECTION.

Patent No. 2,325,935.

August 3, 1943.

KENNETH H. BENTON.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, first column, line 6, for "arm" read --arc--; and second column, line 10, for "surfaces" read --surfaced--; page 2, first column, line 75, for "means" read --meaning--; and second column, line 70, and page 3, first column, line 3, for "outlet" read --outer--; line 7, for "edectric" read --electric--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 12th day of October, A. D. 1943.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.

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