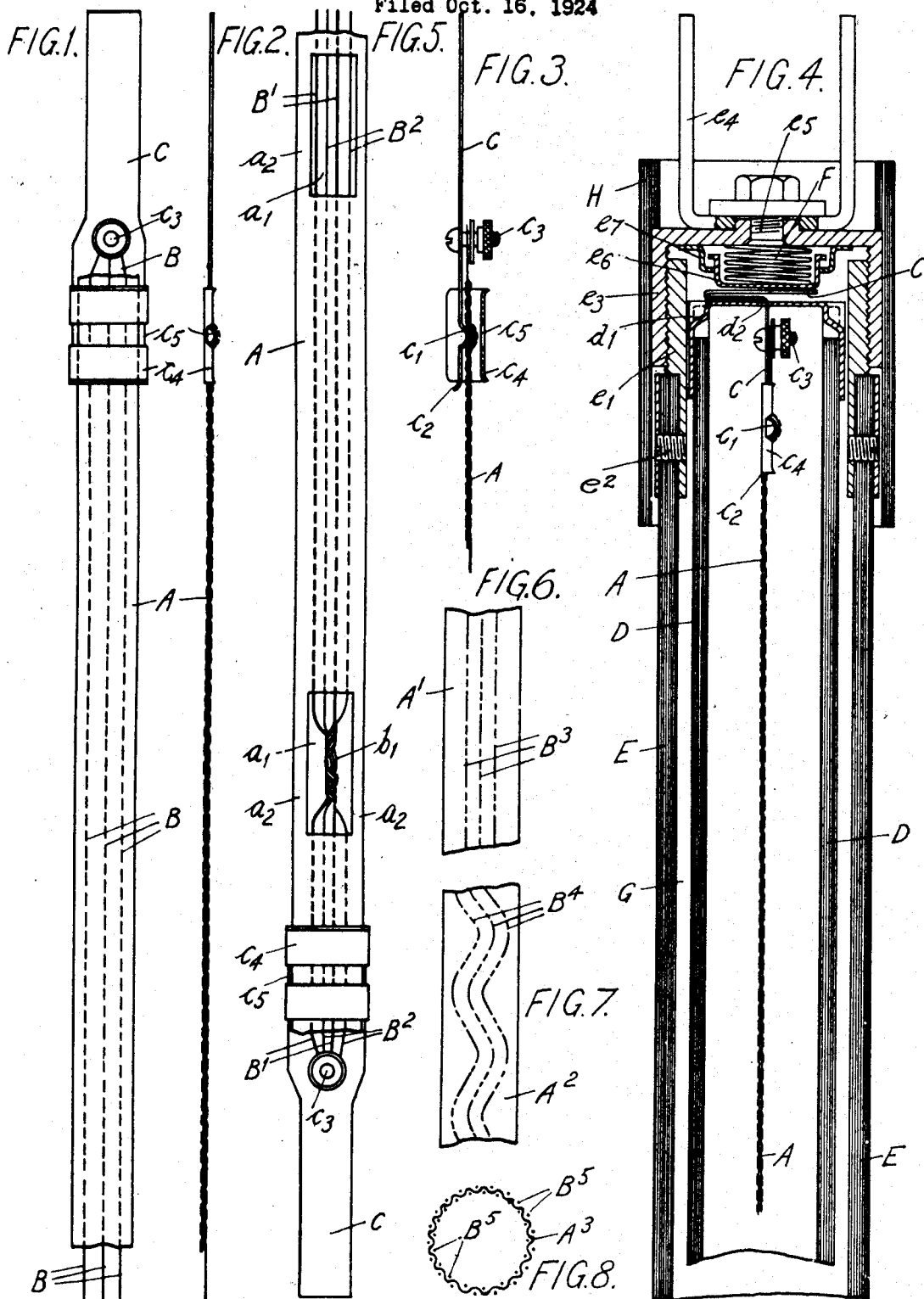


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ELECTRIC FUSE

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ELECTRIC FUSE.

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This invention relates to electric fuses and more particularly to fuses in which the diameter of the fuse wire is small as compared with its length; and the object is to provide improved means for supporting such fuse-wires, said means being specially adapted to support multiple fuse wires of fine gauge in such manner as to separate the individual lengths and to maintain them in parallel or other desired relationship. The invention is specially applicable to fuses for extra high-tension circuits in which the length between fuse terminals must be considerable, and where, for a given power to be transmitted at the high pressure, the magnitude of the current, and therefore the aggregate area of the fusible element is small.

According to the invention the fuse wire or wires is or are supported between the fuse terminals or contacts by being woven into, threaded through, stitched in, or otherwise incorporated with or secured to a fabric having the necessary insulating properties, which fabric is preferably of pliable texture possessing sufficient tensile strength to permit its being stretched comparatively tightly between the fuse terminals, the fuse wires being so woven into or otherwise supported by the fabric that they are not stressed by such stretching of the fabric, but are maintained apart in parallel or other desired relationship. The fabric may be in the form of a strip or ribbon, say of silk or other suitable material, of width suitable for the fuse casing. The fuse wires are preferably multiple strands, which may be of any suitable fuse metal or be respectively composed of different fuse metals, arranged in parallel so as to divide the total current to be carried among the several separated fuse wires; the transverse spacing of the fuse wires is preferably such as to maintain for a given cross-sectional area of the fuse casing, the maximum distance between adjacent wires. The fuse wires (which for extra high tension work may be of silver) may, in standard sizes, be woven with the silk so as to run longitudinally and separately through the tape or ribbon; or the necessary number may be stitched or threaded in parallel lines to and fro alternately from one side to the other of the tape. The tape is cut to suitable lengths and opposite ends of the lengths fitted with contact plates to which the respective ends of the fuse wires are connected in any suitable manner so as to ensure good electrical contact between

them and the end plates, which latter are drilled or slotted or otherwise shaped so as to be adapted to make good electrical contact with the fuse terminals; the tape carrying the fuse wires is stretched to a sufficient degree to maintain it taut between the terminals, and thus keep it clear of the bore of the fuse container.

Replaceable fuses for terminals several feet apart may, according to the invention, be composed of multiple fuse wires of extremely fine gauge; there is no tendency for the wires to break under tension, the individual wires are prevented from twisting or curling and so making undesired contact with each other or with the fuse casing, and the act of re-fusing is very much simplified and is such as to ensure uniform results.

I find considerable advantage results from the use of multiple and separated fuse wires, and as these wires are woven or stitched into the fabric support a comparatively large number may be employed having an aggregate area which is relatively small.

Several tapes having multiple wires may be arranged in parallel; or the fabric may be woven in tubular form with the fuse wires equally spaced around the periphery.

The invention is particularly applicable to powder filled cartridge fuses of the type described in the specification to British Letters Patent No. 198,383, granted to me, and also to bi-metallic fuses as described in the specification to British Letters Patent No. 14,803 of 1911 granted to me. In applying the invention to bi-metallic fuses some of the strands would be of a metal such as copper or silver having a comparatively high fusing point, the other strands being of metal such as tin having a comparatively low fusing point. With such bi-metallic fuses I have found it desirable at certain points in the length of the fuse, to twist the strands composed of different metals together for a short length; this is done in the case of a supporting tape fabric by removing the central portions of the tape at the desired point or points, say by means of a caustic soda solution or a suitable acid solution, preferably so as to leave side connecting parts of the tape to take the tension.

The invention is illustrated, by way of example, in the accompanying drawings, in which:—

Figs. 1, 2 and 3 show the invention applied to an extra high tension fuse in which the

fusible element consists of strands of silver wire of fine gauge, woven or threaded into the silk tape.

Fig. 1 being an elevation,

Fig. 2 a side elevation, and

Fig. 3 a detail showing the mode of making the connection between the end of the tape and the end of the fusible metal to the contact block.

Fig. 4, which is an elevation in medial section, shows the mode in which the invention is applied to an enclosed cartridge fuse of the type described in the specification to Letters Patent No. 198,383 aforesaid;

Fig. 5 shows the invention applied to a multiple strand bi-metallic fuse; and

Figs. 6, 7 and 8 are fragmentary views showing modifications.

Referring first to Figs. 1 to 3:—

A is a tape of non-conducting material preferably a woven fabric, say of silk, which is found to give excellent results. B are the strands of fusible metal; in the case illustrated, and for the sake of clearness only three such strands are shown, the number of strands employed would of course vary with the duty of the fuse; in the case of a fuse for extra high tension circuits a single strand only of fine gauge silver wire may be employed. The strands may be threaded or stitched into the tape, preferably however, they are incorporated with the tape in the act of weaving by substituting for certain of the ordinary warp threads, wires of a suitable metal of appropriate gauge.

At each end the tape is fitted with contact plates C the connection of the plate to the tape and the fuse wires being preferably made as follows:—

The plate C is transversely indented as at c^1 , the end being turned over as at c^2 , and a suitable terminal c^3 is fitted; a clip c^4 having a narrow transverse slot c^5 is fitted to the plate C with the tape interposed, the indented part c^1 protruding through the slots c^5 and serving to grip the tape securely in position. The fuse wires B beyond the tape are connected to the terminal c^3 . A contact plate such as C is of course fitted at each end of the tape.

The end plate C is attached in any convenient way to the respective fixed fuse terminals.

In the case of a cartridge fuse the preferred construction is shown in Fig. 4. In this figure, D is an inner tubular casing of non-conducting material, in which the tape A and fuse wires B are located, and the ends of which are closed by caps d^1 each having a narrow slot d^2 through which the respective contact plate passes; the container D is packed with a refractory powder, say marble dust or the like, employed with this type of fuse. The container is enclosed in an outer casing to the respective ends of which screwed ferrules e^1 are attached by pins or

screws e^2 ; and the ends of the container E are closed by screwed caps e^3 screwing on to the said ferrules, to which caps any suitable form of contact blades e^4 are fitted by means of bolts e^5 . At each end the contact plate C after passing through the slot d^2 is bent as shown so as to lie between the cap d^1 and the face of a hollow plunger e^6 . The plunger e^6 is guided by a flange e^7 attached to the screwed cap e^3 , and a spring F, interposed between the plunger e^6 and the cap e^3 exerts the axial pressure necessary to ensure the desired contact. The metallic portions are shielded by insulating sleeves H fitted to the ends of the casing E which make suitable joint with corresponding insulating sleeves on the fixed fuse contacts, thereby enclosing all live parts. Between the inner container D and the casing E, an expansion chamber G is formed which communicates with the interior of the container D in the manner described in the specification to my said Patent No. 198,383, and the action of the fuse is as described in the said specification. In the drawing only one end of the cartridge is shown but the other end is constructed in exactly similar manner.

In Fig. 5, four metallic strands forming the fuse are shown; the strands B^1 being of a metal of comparatively low fusing point, say tin, and the strands B^2 being of a metal of comparatively high fusing point say silver or copper, the strands being woven or stitched or threaded in the tape as described. It is desirable in a bi-metallic fuse that the strands should be twisted together at one or more positions in the length of the fuse, and in order to accomplish this, portions of the fabric are removed as at a^1 , say by means of a solution of caustic soda or acid, or in any other suitable way, so as to leave connecting edge portions a^2 , to relieve the fuse wires of tension stresses. Within the spaces a^1 so formed the bi-metallic wires may be twisted together as shown at b^1 . In this construction it is found that the wires usually fuse at the points b^1 ; at the upper end of Fig. 5 the strands are shown in position bared before being twisted.

In Fig. 6 the fuse wires B^3 are shown as being stitched in position in a tape A' woven in the usual way. In some cases the fuse wires B^4 may be arranged in the tape A^2 as shown in Fig. 7, in zig-zag or wave-like form so that the tape may be stretched with suitable force without subjecting the wires to tension.

Where a large number of fuse wires of fine gauge are required they may be woven as shown at B^5 , Fig. 8 in a tape A^3 of tubular configuration.

In the case of fuses for circuits of exceptionally high tension, a cartridge type of fuse as shown in Fig. 4 of several feet in length may be employed, the mode of carrying the fine fuse wire or wires in a tape having con-

necting plates attached to the end thereof rendering it possible to wire a cartridge of this length with ease and certainty.

The details on construction may be varied to suit different types of fuses.

Having now fully described my invention, I declare that what I claim, and desire to secure by Letters Patent is:—

1. In an electric fuse in combination;—
a tape composed of woven weft threads and warp threads of flexible insulating material; multiple fuse wires extending longitudinally from end to end of the tape and being secured to the tape at frequent intervals in such manner that the flexible wires are supported by the tape clear of the edges of the tape and with sufficient slackness to ensure that when the ends of the tape are pulled apart the tension to resist such pull is taken by the insulating warp threads of the tape, without subjecting the multiple fuse wires to tension, some of the said fuse wires being composed of a metal of comparatively high conductivity and comparatively high fusing point and some of them composed of a metal of comparatively low melting point; a contact plate at each end of the flexible tape attached to the said tape and making contact with the several fuse wires; substantially as described.

2. In an electric fuse in combination;—
a tape composed of woven weft threads and warp threads of flexible woven insulating material; multiple fuse wires woven with the tape by being substituted for some of the warp threads of the tape, said fuse wires being located clear of the edges of the tape and being woven with sufficient slackness to ensure that when the ends of the tape are pulled apart the tension to resist such pull is taken by the insulating warp threads of the tape without subjecting the multiple fuse wires to tension, some of the said fuse wires being composed of a metal of comparatively high conductivity and comparatively high fusing point, and some of them composed of a metal of comparatively low melting point; a contact plate at each end of the flexible tape attached to the said tape and making contact with the several fuse wires; substantially as described.

3. In an electric fuse in combination;—
a tape of flexible woven insulating material; multiple fuse wires woven with the tape by being substituted for certain of the warp threads of the tape, the process of weaving being conducted so as to leave the metallic warp threads slack so that they are not subjected to tension when the tape is stretched; some of the said fuse wires being composed of metal of comparatively high conductivity and comparatively high fusing point, and some of them composed of a metal of comparatively low melting point; a contact plate at each end of the flexible tape attached to the

said tape and making contact with the several fuse wires; substantially as described.

4. In an electric fuse in combination;—
a tape of flexible insulating material; multiple fuse wires extending longitudinally from end to end of the tape and being secured to the tape at frequent intervals in such manner that they are maintained clear of the edges of the tape, some of the said wires being composed of a metal of comparatively high conductivity and comparatively high fusing point and some of them composed of a metal of comparatively low melting point; a contact plate at each end of the flexible tape attached to the said tape and making contact with the several fuse wires; and gaps formed by removing portions of the central part of the tape; the bi-metallic fuse wires at the said gaps being twisted together; substantially as described.

5. In an electric fuse in combination;—
a tape of flexible insulating material; multiple fuse wires extending longitudinally from end to end of the tape and being secured to the tape at frequent intervals in such manner that the flexible wires are supported by the tape throughout their length, some of the said fuse wires being composed of a metal of comparatively high conductivity and high fusing point, and some of them composed of a metal of comparatively low melting point; a contact plate at each end of the fuse tape; said contact plate at one end being transversely indented; and a clip for each contact plate adapted to surround the indented end of the contact plate and the end of the flexible tape and fuse wires; said clip having at one side a slot which aligns with the said indentation, the slotted side and the opposite side of the clip being adapted to be pressed together so as to force the said indentation with the tape and fuse wires extending over it into the said slot, so that the said tape and fuse wires are gripped between the indentation and the edges of the slot; each said contact plate carrying a terminal screw to which the bi-metallic fuse wires are attached; substantially as described.

6. In an electric fuse in combination;—
a tape of flexible insulating material; multiple fuse wires extending longitudinally from end to end of the tape and being secured to the tape at frequent intervals in such manner that they are maintained clear of the edges of the tape, some of the said fuse wires being composed of a metal of comparatively high conductivity and comparatively high fusing point, and some composed of a metal of comparatively low melting point; a contact plate at each end of the fuse tape; said contact plate at one end being transversely indented; a clip for each contact plate adapted to surround the indented end of the contact plate and the end of the flexible tape and fuse wires; said clip having at one side a slot which

aligns with the said indentation, the slotted side and opposite side of the clip being adapted to be pressed together so as to force the said indentation with the tape and fuse wires extending over it into the said slot so that the said tape and fuse wires are gripped between the indentation and the edges of the slot; each said contact plate carrying a terminal

screw to which the bi-metallic fuse wires are attached; and gaps formed by removing portions of the the central part of the tape, the bi-metallic fuse wires at the said gaps being twisted together; substantially as described. 10

In witness whereof I set my hand.

VERNON HOPE.