Aug. 17, 1937. G. N. LEMMON 2,090,609

ELECTRICAL FUSE

Filed Nov. 13, 1933 2 Sheets-Sheet 1

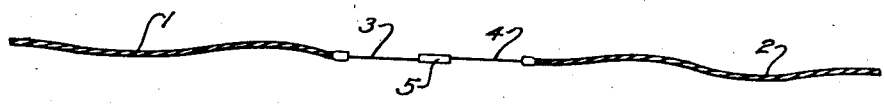


Fig. 1

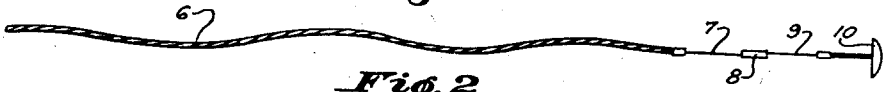


Fig. 2

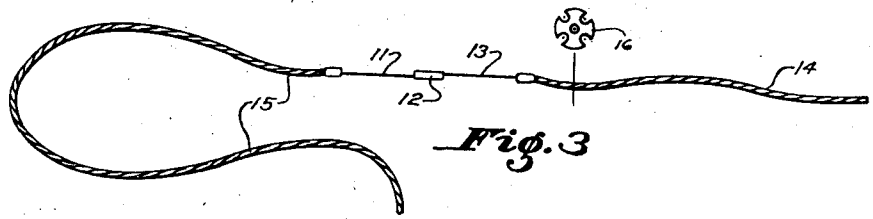


Fig. 3

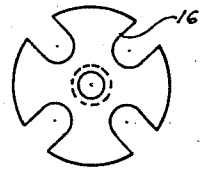


Fig. 4

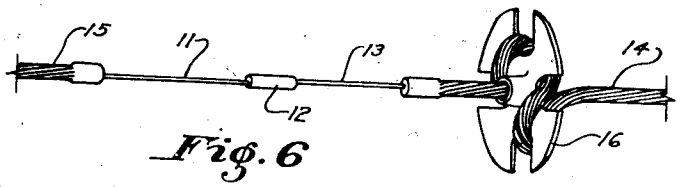


Fig. 6

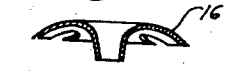


Fig. 5

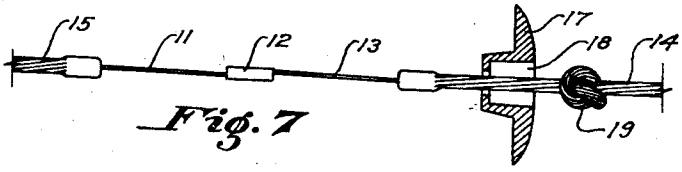


Fig. 7

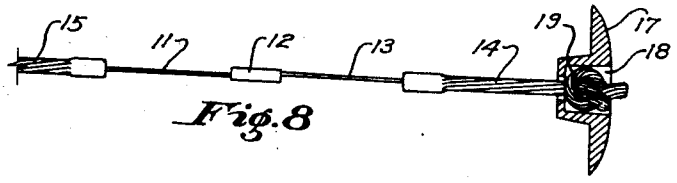


Fig. 8

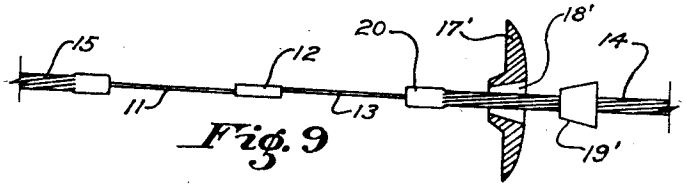


Fig. 9

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2 Sheets-Sheet 2

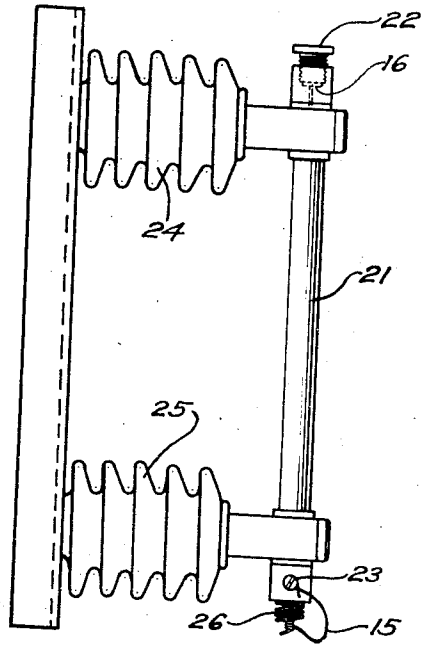


Fig. 10

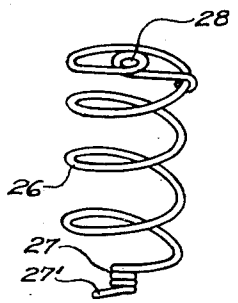


Fig. 12

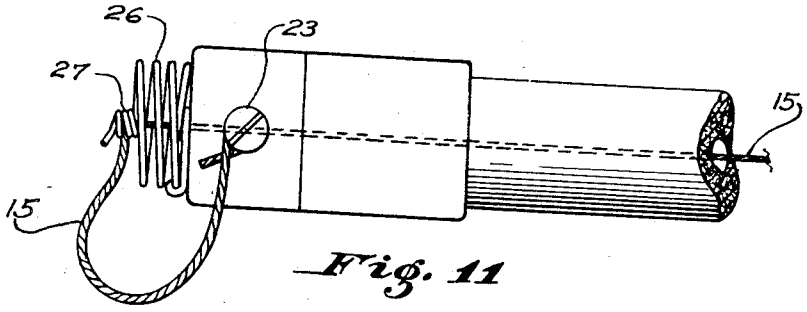


Fig. 11

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UNITED STATES PATENT OFFICE

2,090,609

ELECTRICAL FUSE

George N. Lemmon, Homewood, Ala., assignor to Southern States Equipment Company, Birmingham, Ala., a corporation of Alabama

Application November 13, 1933, Serial No. 697,865

9 Claims. (Cl. 200—135)

The purpose of my invention is to provide a fuse which is suitable for use in either one of the two types of fuse holders which are now in general use for the protection of equipment on high voltage lines.

One type of fuse-holder widely used is a tube of fibre or "bakelite" with metal fittings at each end of the tube, and having screws or wingnuts suitable for attaching the fuse to the said fittings. The fittings do not obstruct either end of the tube, and the fuse itself is so held inside the tube that the portion which is first fusible is near the center of the tube length.

Another type of fuse holder, which is also widely used, has one end of a similar tube closable by a screw plug, the other end of the tube being unobstructed. The proper fuse link for this type of holder has an enlarged portion called the button-head which can be slipped into a socket in one of the end fittings which later receives the screw plug. The screw plug, besides closing one free vent of the tube, acts to clamp the button-head into good electrical contact with the metal fitting at that end of the tube. For such a holder, the fuse should have a button-head attached to one end. Also it should have the part which is first fusible located near the button-head and it will thus necessarily follow that the other flexible end of the fuse must be longer than either end of the fuse first described.

When both types of fuse-holders are in use on the same electrical system, it is most desirable that the trouble-men be required to carry with them only one type of fuse link, but that that type of link shall be suitable for use in either type of fuse holder.

On many high voltage distribution systems there are fuse holders now in use which impose no mechanical strain upon the fuse link, and there are also other fuse holders with movable latch-members which do impose in normal use a mechanical strain upon the fuse link so that when the link ruptures, the mechanical strain separates the ruptured ends and thereby widens the gap in the circuit. This latter method of operation is preferred by many users of fuse-holders, and I therefore provide also an attachable spring for use with such fuse-holders as do not in themselves impose any strain on the fuse link.

One object of my invention is to provide a fuse link of ample length which may be used with either type of the fuse holders above described and to which fuse link a separate attachable head may be connected when the fuse link is to be used in a holder requiring such a button-head. Other objects and advantages of my invention will appear as it is described in connection with the accompanying drawings.

Referring to the drawings Fig. 1 shows the type of fuse link required for the holder having both ends unobstructed. Fig. 2 shows the type of fuse link which is suitable for fuse holders which have one end closed and which have the first-fusible portion located close to the button-head. The link of Fig. 1 can not be used in the holder for the link of Fig. 2 nor vice versa. Fig. 3 shows one form of my improved fuse link invention which can be used in either of the above-mentioned types of fuseholder. Figs. 4 and 5 show in plan and in cross section full size views of the attachable button head which is part of my fuse link invention. Fig. 6 is a full size view of part of my fuse link invention with the button-head of Figs. 4 and 5 attached. Fig. 7 is a cross sectional view of another modification of button-head being attached to a fuse link; and Fig. 8 is a view similar to Fig. 7 but with the fuse link and button-head secured together. Fig. 9 illustrates a further modification of the button-head and means for attaching it to the fuse link.

Fig. 10 shows in reduced scale a fuse-holder of the stationary-tube type in which my new link is being used; Fig. 11 is a fragmentary view, in larger scale, of the lower end of the tube and the link-tensioning spring; and Fig. 12 is a view of the link-tensioning spring member by itself.

The fuse link shown in Fig. 1 is made up of two pieces of flexible copper conductor **1**, **2** to which are soldered two smaller conductors **3**, **4** and these in turn are soldered together by the joint **5**. This is a well known type of fuse link and when heated by a moderate overload the separation first occurs either at the joint **5** or at one or both of the small conductors **3** and **4**. The explosive action of the resultant arc expels the remains of the flexible conductors **1** and **2** leaving the circuit open through the tube. In case of very excessive overload, conductors **1** and **2**, may be volatilized along with **3**, **4** and **5**.

Referring to Figure 2 wherein the fuse link is for use in a holder which has one end closed it will be noted that the flexible conductor **6** is longer than either of those in Figure 1 in order that the fusible portion **7**, **8**, **9** may be located close to the button-head **10**. When this fuse link ruptures the flexible conductor **6** is expelled from the end of the tube away from the end in which the button-head is clamped.

Referring to Figure 3 showing my improved

fuse link, the fusible portion 11, 12 and 13 is the same as in Figures 1 and 2 but the flexible end-conductor is as long as conductor 2 in Figure 1, while the flexible end-conductor 15 is as long as conductor 6 of Figure 2.

When my improved link is to replace a link like that of Figure 1 the end of conductor 15 is cut off or wound up out of the way. When my improved link is to replace a link like that of Figure 2 the button-head 16 is attached by the method shown in Figure 6, which is by passing the button-head over the free end of conductor 14 and twisting the conductor in and out of the slot in the button-head 16. Then the surplus length of conductor 14 is cut off forming a fuse link assembly which is adapted for substitution in place of the link shown in Figure 2.

A modification of the button-head is shown in Figs. 7 and 8. The attachable button 17, which is shown in cross section, is made of a suitable size metal disc with a counter-sunk passage 18, which is larger on one side than the other. When it is desired to attach the button, the flexible conductor 14 is threaded through the passage or hole and a knot 19 is tied in it as shown in Fig. 7. The surplus end of 14 is then cut off and the knot is pulled down into the counter-sink as shown in Fig. 8. The proportions are preferably such that the knot 19 fits snugly into the counter-sink 18, thereby making good contact and also holding the button-head 17 and knot 19 together.

The contour of the button-head 17 can be varied to suit any special requirements desired, and the knot can be placed close to the small fusible conductor 13, or at any other position on the conductor 14 which is found desirable.

A further modification is shown in Fig. 9 in which the central passage comprises a tapered hole 18', and instead of a knot there is provided a tapered enlargement 19' which fits into the hole 18'. The enlargement 19' may be of solder moulded into and around the conductor 14. It may be an enlargement of the soldered joint 20, or it may be formed in any other suitable manner. It is small enough to not interfere with the use of the fuse as shown in Fig. 1, and yet the button 17' can be readily slipped over 15, 11, 12 and 13 and can be seated solidly in contact with 19', when it is desired to have a button-head fuse.

To make my fuse still more useful and effective I also provide a means to accelerate its circuit-opening action. Fig. 10 shows an insulating tube 21 within which is one of my improved fuse links, with the attached button-head 16 held by the screw plug 22, while the other end of the conductor 15 projects from the lower end of the tube holder and is secured to the terminal by the screw 23. Suitable insulators 24, 25 support the device. A wire spring 26 is held in a compressed position by the intact fuse as shown in Figs. 10 and 11, the conductor 15 passing through the guide hole 28 and the close coil 27. The last serves as a clamp when the conductor is forced between two adjacent turns of the coil 27, as shown in Fig. 11. The projecting end 27' makes it easy to twist the conductor between two coils.

There is sufficient slack in the part of 15 which is outside of the spring to allow the spring to pull apart the ends of 11 and 13 as soon as the solder of the joint 12 has melted, thereby accomplishing a result similar to that produced when external latch members on other devices pull the conductor partly out of the tube holder.

The guide 28 holds one end of the spring 26 in proper position on the end of the tube, and the coil 27 at the other end gives a quick means for clamping the conductor 15 at any place that is desired.

Since the button-head and the spring can either be omitted or can be attached at any place that is desired on the end conductors, my fuse link with these accessories is easily adjusted for use with either type of fuse holder above described, and for various lengths of tubes also. There are numerous other modifications of details which can be made and I do not limit myself to the arrangements here shown.

I claim:

1. In an expulsion tube type of circuit breaker having an insulating tube and terminals adjacent each end of the tube with one terminal formed to have a metallic button-head maintained in contact with it, an electric fuse link comprising a flexible conductor having a fusible portion within said tube, a manually attachable metallic button-head of circular form having a central aperture through which the conductor passes and having at least one recess for the reception of a looped portion of the conductor whereby to hold said conductor and button-head together in contact with said one terminal.

2. In an expulsion tube type of circuit breaker having an insulating tube and terminals adjacent each end of the tube with one terminal formed to have a metallic button-head maintained in contact with it, an electric fuse link comprising a stranded flexible conductor, a fusible element electrically connected to said conductor, a button-head of circular form having a central aperture through which the conductor passes, said conductor being restrained in its movement through said button-head by looping said conductor, said button head and looped portion being held in contact with said one terminal.

3. In an expulsion tube type of circuit breaker having an insulating tube and terminals adjacent each end of the tube with one terminal formed to have a circular metallic member held in contact therewith, an electric fuse link comprising a flexible conductor, a fusible element electrically connected thereto, a circular metallic member having a central aperture therein through which the conductor passes, said aperture being of greater diameter at one side of said member than at the other side, and means increasing the transverse dimensions of the conductor at a desired point on the conductor at the side of the member adjacent said greater diameter, said means being adapted to be seated in said aperture to hold the conductor in engagement with said member, and said circular metallic member and said means being held in contact with said one terminal.

4. In an expulsion tube type of circuit breaker having an insulating tube and terminals adjacent each end of the tube with one terminal formed to have a circular metallic member held in contact therewith, an electric fuse link comprising a flexible conductor, a fusible element electrically connected thereto, a circular metallic member having a central aperture therein through which the conductor passes, said member having a well substantially coaxial with said aperture, and means increasing the transverse dimensions of the conductor at a desired point, said means being adapted to be drawn into and seated in said well to hold the conductor in en-

gagement with said member, and said circular metallic member and said means being held in contact with said one terminal.

5. In an expulsion tube type of circuit breaker having an insulating tube and terminals on each end of the tube with one terminal formed to receive a circular metallic member, an electric fuse link comprising a flexible conductor, a fusible element electrically connected thereto, a circular metallic member having a central aperture therein through which the conductor passes, said member having a well substantially coaxial with said aperture, said well being adapted to receive a knot formed in said conductor whereby passage of said conductor through said aperture is restrained, and said circular metallic member and said knot being receivable within said one terminal.

6. In an expulsion tube type of circuit breaker having an insulating tube and terminals on each end of the tube with one terminal formed to receive a circular metallic member, an electric fuse link comprising a flexible conductor, a fusible element electrically connected thereto, a circular metallic member having a central aperture therein through which the conductor passes, said aperture being of greater diameter at one side of said member than at the other side, and a member having a transverse dimension greater than the least transverse dimension of said aperture, said last named member being secured upon said conductor and received in said aperture, whereby passage of said conductor through said aperture is restrained, said last named member and said circular member being receivable in said one terminal.

7. In an expulsion tube type of circuit breaker having an insulating tube and terminals on each end of the tube with one terminal formed to receive a circular metallic member, an electric fuse link comprising a flexible conductor, a fusible element electrically connected thereto, a circular metallic member having a central tapering aperture through which the conductor passes, and a tapering member secured on said conductor and received in said aperture whereby passage of said conductor through said aperture is restrained, said circular member and said tapering member being receivable within said one terminal.

8. In combination in an expulsion circuit breaker, an insulating tube open to the atmosphere at one end and with a metallic terminal adjacent the other end adapted to have a metallic button head maintained in contact with it, a fuse link comprising a flexible conductor having a fusible portion within said tube, a manually attachable metallic button head in contact with said terminal and having a central aperture through which the conductor passes, said aperture being of greater diameter at one side of said button head than at the other side, and means increasing the transverse dimensions of the conductor, said means being adapted to be seated in the said aperture to hold the conductor in engagement with said button head.

9. In combination in an expulsion circuit breaker, an insulating tube open to the atmosphere at one end and with a metallic terminal adjacent the other end adapted to have a metallic button head maintained in contact with it, a fuse link comprising a flexible conductor having a fusible portion within said tube, a manually attachable metallic button head in contact with said terminal and having a central aperture through which the conductor passes, and means increasing the transverse dimensions of the conductor and adapted to hold the conductor in engagement with the said button head.

GEORGE N. LEMMON.