A. L. EUSTICE.

CARTRIDGE FUSE.

APPLICATION FILED JULY 23, 1914.

1,180,767.

Patented Apr. 25, 1916.

Fig. 1

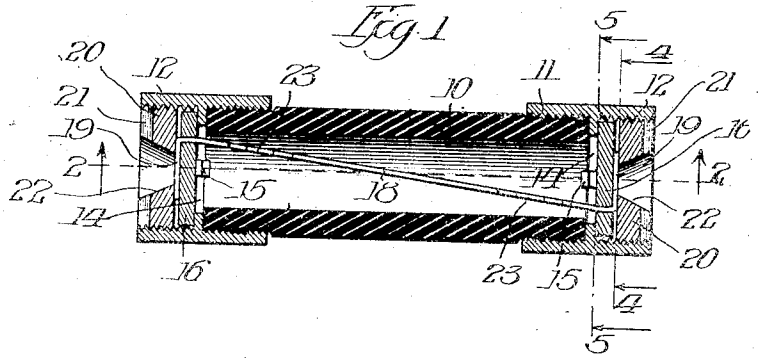



Fig. 2

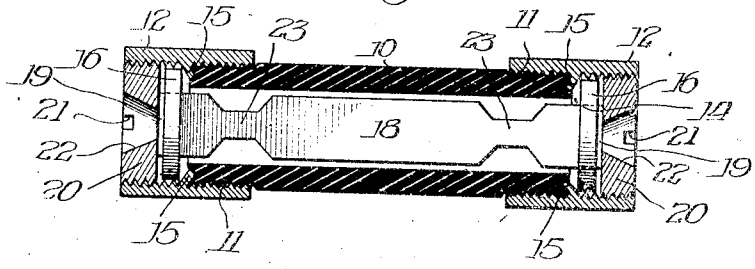



Fig. 3

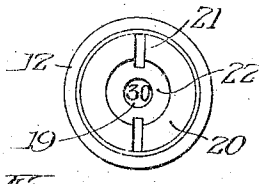



Fig. 4

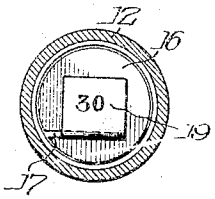



Fig. 5

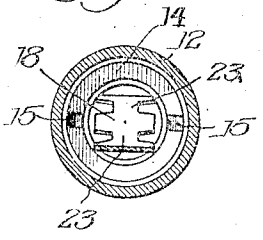



Fig. 7

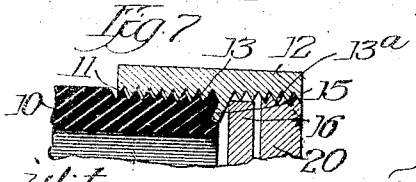
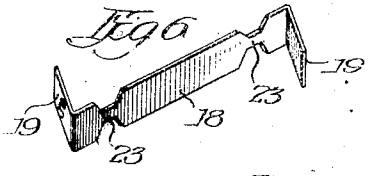



Fig. 6




Witnesses

Inventor.

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# UNITED STATES PATENT OFFICE.

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## CARTRIDGE-FUSE.

1,180,767. Specification of Letters Patent. Patented Apr. 25, 1916.

Application filed July 23, 1914. Serial No. 852,557.

*To all whom it may concern:*

Be it known that I, ALFRED L. EUSTICE, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Cartridge-Fuses, of which the following is a specification.

My invention relates to cartridge fuses, and refers particularly (although not exclusively) to renewable cartridge fuses of the ferrule type.

I am aware that renewable ferrule type fuses are well known, as shown, for example, in the following United States patents: No. 861,965, issued to C. Gehrke July 30, 1907; No. 961,716, issued to A. F. Daum June 14, 1910; No. 1,022,834, issued to S. F. Estell April 9, 1912; No. 1,092,498, issued to E. B. Mallory April 7, 1914. All of these patents show electrical safety fuses in which the fusible element may be renewed on removal of retaining members located at the ends of the casing. The results obtained in fuses such as are shown in the patents above mentioned have not proved entirely satisfactory, either on account of the complicated construction of the fuse or on account of the fact that after the various parts of the fuse are assembled they become loosened by shrinkage of the casing (ordinarily made of fiber) or other similar cause. Still another defect of these fuses has been that their construction was such that their rating did not prove to be accurate when subjected to overload conditions, and they were apt to vent fire when subjected to violent short-circuit conditions.

It is the object of my invention to construct a fuse which is cheap and simple to manufacture, which is efficient when blown under either overload or short-circuit conditions, and the parts of which will remain in tight contact with each other irrespective of any shrinkage which might occur in connection with the insulating fiber casing.

My improved fuse is so designed that it is unnecessary to employ a non-conducting filling material of asbestos, lime, or the like. The parts are so constructed that on blowing of the fuse under short-circuit the gases formed are restricted in their escape from the fuse casing, with the result that the operation of the fuse is noiseless while at the same time the venting of fire is effectually prevented. I preferably construct the fusible link with two or more restricted portions of less cross-sectional area than the balance of the link so that on blowing the fuse the portion of the link between these restricted portions drops out of the link, thereby reducing the volatilization of metal to a minimum.

These and other advantages of my invention will be more readily understood by reference to the accompanying drawings, in which—

Figure 1 is a longitudinal section through my improved fuse; Fig. 2 is a section taken on the line 2—2 of Fig. 1; Fig. 3 is an end elevation of the fuse shown in Figs. 1 and 2; Fig. 4 is a transverse section taken on the line 4—4 of Fig. 1; Fig. 5 is a transverse section taken on the line 5—5 of Fig. 1; Fig. 6 is a perspective of the fusible link; and Fig. 7 is an enlarged fragmentary longitudinal section through the end of the casing and a portion of the ferrule showing the clearance between the threaded portions of these elements.

My improved fuse is provided with the casing 10, of fiber or other suitable insulating material, the ends of the casing 10 having thereon the threads 11. A ferrule 12 is applied to each end of the casing 10 and has threaded engagement therewith, a slight clearance 13 being provided between the threads 11 of the casing 10 and the threads of the ferrule 12. Each ferrule 12 is provided with an inwardly extending retaining flange 14, which engages the end of the casing 10 after the ferrule 12 has been screwed into position. To prevent rotation of the ferrule 12 in either direction with respect to the casing 10, the lugs 15 are forced from the metal of the retaining flanges 14 into the fiber at the ends of the casing 10, this operation being performed by any suitable tool after the ferrule 12 has been screwed into position. A permanent connection between the casing 10 and the ferrules 12 is thus provided. At each end of the fuse a washer 16 having the slot 17 is located just outside of

the retaining flange 14 and engages the latter. The fusible link 18 passes through the slot 17 and has its end 19 bent over the outer surface of the washer 16. As clearly shown in Figs. 3, 4 and 6, the bent-over end 19 of the link 18 is preferably stamped with a number indicating the capacity of the fuse in amperes. The washers 16 do not have threaded engagement with the ferrules 12 but are freely movable in the outer threaded portions of these ferrules so that they may be quickly applied to or removed from their positions in engagement with the flanges 14.

At each end of the fuse is a plug 20 which has threaded engagement with the inner surface of the outer end of the ferrule 12. As clearly shown in Fig. 7, there is a slight clearance $13^a$ between the threads of the plugs 20 and the threads of the outer portions of the ferrules 12. The plug 20 is provided with a slot 21 which may be engaged by a screw driver or other suitable tool so that the plug may readily be screwed home. The plug also preferably has an aperture 22 through its central portion through which the number on the over-turned end 19 of the fuse link may be readily visible. When screwed into position the plug 20 engages the over-turned end 19 of the fuse link and forces it into tight contact with the washer 16. This washer at the same time is forced into tight engagement with the retaining flange 14. The ferrules 12, the washers 16, and the plugs 20 are preferably made of a readily conducting metal, such as brass or copper, and it will be evident that by the construction just described these parts are maintained in engagement with each other and with the over-turned end of the fusible link by a metal-to-metal contact, and if shrinkage of the casing 10 occurs the engagement of the ferrules 12 with the washers 16, the ends 19 of the link 18, and the plugs 20 is not affected. In this way good electrical contact is always maintained between these parts, and unsatisfactory performance of a fuse on account of loose contacts is effectively avoided.

The fusible link 18 is preferably flat and provided with the restricted portions 23. On blowing of the fuse the latter melts at these restricted portions, causing the section of link between the restricted portions 23 to drop out of the link, thereby avoiding volatilization of a large amount of the metal of which the link is composed. After the fuse is blown a new link 18 may readily be placed in position by first removing the plugs 20 and then removing the washers 16. One end of the new link is then bent, passed through the slot 17 of a washer 16, and the washer is placed in position in engagement with the retaining flange 14, thereby causing the link to extend through the casing 10. The plug 20 is then screwed into position, thereby anchoring one end of the fuse link. The washer 16 at the opposite end of the fuse is now placed in position and the end of the link 18 after being passed through the slot 17 is bent over the outer surface of the washer 16. The plug 20 is then screwed into position and the fuse is ready for use. When the fuse is blown it will be apparent that there is no opportunity for escape of the gases which are generated except through the clearance spaces 13 and $13^a$ between the threads 11 of the casing and the threads of the inner ends of the ferrules 12 and between the threads of the plugs 20 and the threads of the outer ends of the ferrules 12, respectively. I have found by experience that the clearance spaces $13^a$ are more efficient than the clearance spaces 13, as the former are between metal parts and are less liable to distortion. Inasmuch as the gases are thus restricted in their passage to the exterior the device acts according to the same principle as the well-known Maxim silencer or an automobile muffler, thereby preventing the noise of an explosion and preventing the venting of fire.

It will be apparent to those skilled in the art that many changes may be made in the detailed construction of the various parts which I have described without departing from the spirit or scope of my invention.

What I claim is:

1. In a cartridge fuse, the combination of a cylindrical casing, ferrules at the ends of said casing, each of said ferrules having engagement with the corresponding end of said casing, retaining means on the inner periphery of each of said ferrules, means for preventing rotation of said ferrules with respect to said casing, a washer freely insertible in the outer end of each of said ferrules and engaging said retaining means, a link passing through said casing and having its ends bent over the outer surfaces of said washers, and a plug in the outer end of each ferrule, said plugs engaging the bent-over ends of said link and forcing said washers into tight engagement with said retaining means.

2. In a cartridge fuse, the combination of a casing, a ferrule at each end of said casing and having threaded engagement therewith, a retaining flange formed on the inner periphery of each of said ferrules, said retaining flange engaging an end of said casing, lugs formed in said retaining flange and passing into the body of said casing, whereby relative rotation of said ferrule and said casing is prevented, an apertured washer freely insertible in the outer end of said ferrule and engaging said retaining flange, a link passing through said casing and the apertures in said washers and having its

ends bent over the outer surfaces of said washers, and a plug in the outer end of each ferrule and having threaded engagement therewith, said plugs engaging the bent-over ends of said link and forcing said washers into tight engagement with said retaining flange.

In witness whereof, I hereunto subscribe my name this 11th day of July, A. D., 1914.

ALFRED L. EUSTICE.

Witnesses:
JAMES A. SHULTS,
W. E. REQUISA.