Dec. 16, 1958 G. A. BARRETT ET AL 2,864,916

BLADE TYPE CARTRIDGE FUSE

Filed April 2, 1958

Fig. 1.

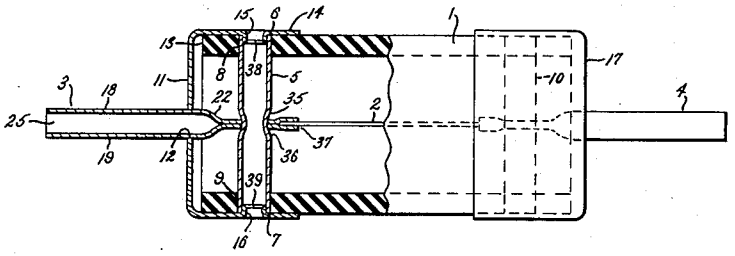


Fig. 2.

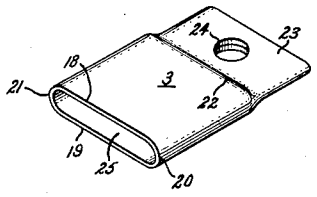


Fig. 3.

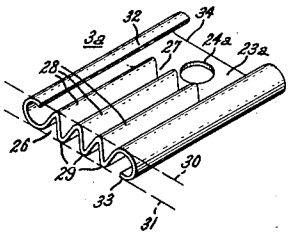
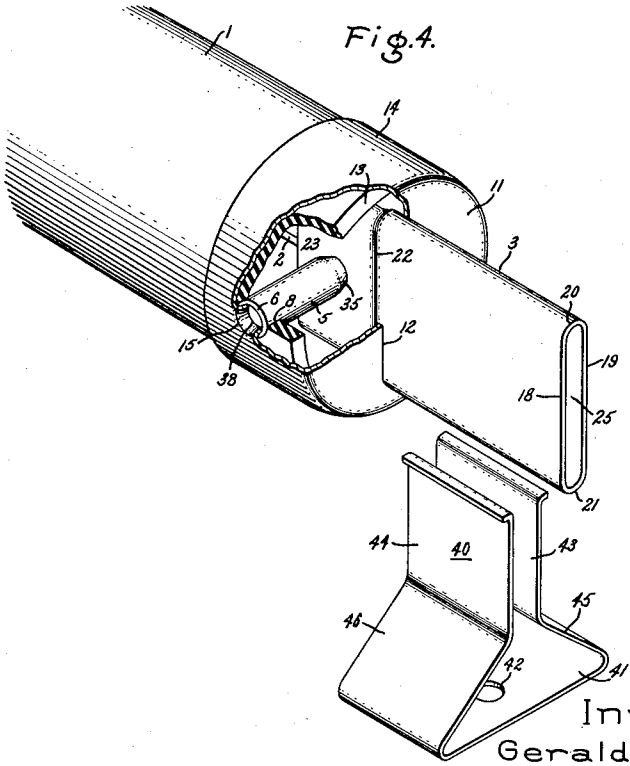


Fig. 4.



Inventors:
Gerald A. Barrett
Roy A. Patterson
by J. Wesley Vanbiver
Their Attorney.

United States Patent Office 2,864,916
Patented Dec. 16, 1958

2,864,916

BLADE TYPE CARTRIDGE FUSE

Gerald A. Barrett, Burlington, Ontario, and Roy A. Patterson, Thistletown, Ontario, Canada, assignors to Canadian General Electric Company, Limited, Toronto, Ontario, Canada, a corporation of Canada

Application April 2, 1958, Serial No. 725,927

Claims priority, application Canada July 23, 1957

7 Claims. (Cl. 200—132)

This invention relates to a cartridge fuse and more particularly to a contact structure therefor.

Circuit interrupting fuses of the general class to which this invention relates employ a tubular cartridge enclosing a fusible element connected to a blade type contact projecting from, and supported by, each end of the cartridge. It is well known to employ a solid strip of electrically conductive material, such as copper, for the contact. When the fuse is in an electrical circuit each of its contacts is received between a pair of fingers of a clip, the fingers being spring biased toward each other. Since these fuses are generally required to carry relatively high currents, considerable heat may be generated at the areas of engagement between the fuse contacts and the fingers of the clips. After an extended period of heating the engaging surfaces will oxidize, followed by an increase in resistance, and finally an increase in heating at the surfaces. Repeated heating and cooling will eventually relax the spring tension in the fingers of the clip thus further increasing the resistance between the fuse contact and the fingers.

Hitherto, it has been general practice to design blade type fuse contacts large in mass in order to obtain satisfactory heat dissipating characteristics, and this mass was usually considerably greater than that necessary to carry the current flowing through the fusible element. As metals of good electrical and thermal conductivity, such as copper, are relatively expensive, massive fuse contacts add appreciably to the cost of a fuse. Accordingly, therefore, it is an object of this invention to provide a blade type contact structure for a cartridge fuse in which the quantity of metal used is reduced to the minimum required for mechanical strength and electrical conductivity.

It is another object of this invention to provide a ventilated blade type contact structure within which ambient air may freely circulate to dissipate heat from the contact.

A further object of this invention is to provide a blade type contact which will yield on being inserted between a pair of contact receiving fingers.

A still further object of this invention is to provide a novel means for securing a blade type contact to the cartridge of a fuse.

Briefly, this invention consists of a hollow blade type contact secured at one end thereof to the midpoint of a pin, the longitudinal axes of the contact and the pin being perpendicular or somewhere near perpendicular. The ends of said pin rest in a pair of diametrically disposed apertures in the wall of a fuse cartridge adjacent an end thereof so as to be more or less flush with the outer peripheral surface of the cartridge. A ferrule adapted to close the end of the cartridge has a flange overlying the end of the cartridge and the ends of the pin, the flange being indented in a manner to cooperate with the pin to maintain the pin and ferrule assembled to the cartridge. An aperture in the ferrule permits the contact to project through the ferrule from the end of the cartridge. Both ends of the fuse cartridge are provided with one of the aforementioned contact structures and they are joined by a fusible element.

The invention will be fully understood and its objects and advantages better appreciated by referring to the following detailed description taken in conjunction with the accompanying drawings, in which

Fig. 1 is a view of a cartridge fuse with one end of the cartridge and one contact structure in section;

Fig. 2 is a view in perspective of a hollow contact of tubular form;

Fig. 3 is a view in perspective of a hollow contact of corrugated form; and

Fig. 4 is a view in perspective of one end of a cartridge fuse with a portion of the cartridge and ferrule broken away to show the contact support means, and also a contact receiving clip.

Figure 1 illustrates a cartridge fuse having a tubular cartridge **1** enclosing a fusible element **2** connected between a pair of blade type contacts **3** and **4** projecting from the ends of the cartridge. Blade **3** is supported on a tubular pin **5** whose end **6** rests in an aperture **8** in the wall of cartridge **1** and whose end **7** rests in an aperture **9** in the wall of the cartridge, aperture **9** being disposed diametrically opposite aperture **8**. Pin **5** is of such a length that its ends **6** and **7** are substantially flush with the outer peripheral surface of cartridge **1**. Blade **4** is supported in a similar manner on a tubular pin **10** whose ends rest in a pair of diametrically disposed apertures in the wall of cartridge **1**.

A ferrule **11**, with an aperture **12** through which the contact **3** passes, closes off the open end **13** of cartridge **1**. The ferrule has an integral annular flange **14** which overlies end **13** of the cartridge and also ends **6** and **7** of pin **5**. Indentations **15** and **16** in flange **14** are deformed into the ends **6** and **7** respectively of tubular pin **5**. It is thus apparent that pin **5** supports blade **3** and the pin in turn is supported in apertures **8** and **9** in the wall of the cartridge, the whole being maintained in assembled relationship by means of ferrule **11**. Blade **4** and pin **10** are also maintained assembled to cartridge **1** in a similar manner by means of a ferrule **17**.

Blades **3** and **4** are identical. Blade **3** is illustrated in perspective in Figure 2 as comprising a contact formed from a length of electrically conductive tubing flattened along its length to provide a pair of parallel side walls **18** and **19** joined by curved edge walls **20** and **21**. One end of the flattened tube is pinched off at **22** to provide a flat portion **23** where the inner surfaces of side walls **18** and **19** touch. Flat portion **23** is apertured at **24** to permit the securing of contact **3** to pin **5** in a manner to be described later. By referring to Fig. 1 it will be seen that the end of contact **3** which projects from the end of cartridge **1** is hollow from the left hand tip thereof to region **22** where the pinch-off begins, flat portion **23** closing off the right hand end of the contact. This hollow is designated by the numeral **25** in Figures 1 and 2.

In place of the contact blade structure **3** shown in Figure 2 a contact **3***a*, such as that shown in Figure 3, may be used. The contact **3***a* illustrated in Figure 3 may be formed from a rectangular sheet of electrically conductive material by corrugating the sheet along its length from end **26** to region **27** adjacent the other end of the sheet. Crests **28** of the corrugations on one side of the contact **3***a* lie in a plane **30** while crests **29** on the other side of the contact lie in a plane **31** parallel to plane **30**. One edge of the corrugated sheet may be turned in as shown at **32** to lie in plane **30** while the opposite edge may be turned in as shown at **33** to lie in plane **31**. Although, in Figure 3, crests **28** and **29** of contact **3***a* are shown parallel to the long axis of the contact, or parallel

to the longitudinal axis of cartridge 1, it is to be understood that the direction which the corrugations run in relation to the contact is unimportant so long as their crests lie in planes 30 and 31. It is not necessary that the corrugations be parallel to one another. The flat end portion 23*a* of the sheet between region 27 and end 34, which has not been corrugated, is apertured at 24*a* to permit the securing of contact 3*a* to pin 5 in a manner to be described later.

The pin 5 is cut to a length about equal to the outer diameter of the cartridge from tubing having an outer diameter slightly less than the diameter of aperture 24 or 24*a*. To assemble contact 3 to the cartridge, aperture 24 in the contact is aligned with apertures 8 and 9 in the cartridge, and pin 5 is then inserted into these aligned apertures such that its ends 6 and 7 are substantially flush with the outer peripheral surface of the cartridge. Thereafter while holding contact 3 centrally positioned on pin 5, both ends of the pin are diametrically expanded down to the flat portion 23 on the contact. Expansion of tube 5 may be effected by well known means as by forcing an oversized mandrel into each end of the tube to form shoulders 35 and 36 on pin 5 between which the flat portion 23 of contact 3 is wedged thereby rigidly securing the pin to the contact. Assembly of contact 3*a* to pin 5 and to the cartridge may be carried out in a similar manner.

Fusible element 2 may be soldered to the contacts to provide a low resistance current path. When contacts such as 3 and 4 are used the ends of the element 2 may be sandwiched between the walls of the contact adjacent the aperture 24 as illustrated at 37 in Figure 1. The latter connection may be a pressure contact where the expanding of pin 5 provides the pressure through shoulders 35 and 36. For ease of assembly element 2 will usually be secured to the contacts before the contacts are secured to pins 5 and 10.

Figure 4 illustrates one type of spring clip 40 having a base 41 apertured at 42 so that it may be bolted to a support (not shown). Clip 40 has a pair of parallel contact receiving fingers 43 and 44 integrally united with base 41 through curved finger offsets 45 and 46 respectively. Clip 40 is formed from an electrically conductive resilient material in such a manner that base 41 cooperates with offsets 45 and 46 to bias fingers 43 and 44 toward each other. As edge 21 of contact 3 is inserted into clip 40, fingers 43 and 44 yield and thereby permit the outer surfaces of side walls 18 and 19 of the contact 3 to wipe along the inner surfaces of fingers 44 and 43 respectively thus providing a good electrical junction between the contact and the clip.

Since the contact 3 is made of a relatively thin walled material which may exhibit some resilience, and since the portion of contact 3 received within the fingers of clip 40 is hollow, the contact 3 will also yield on being inserted into the clip. In view of the fact that the contact, as well as the clip, is resilient it may be possible, under certain circumstances, to eliminate the back-up springs wihch are often provided to cooperate with the fingers of the clip to maintain adequate pressure between the contact and the clip.

The construction of contact 3*a* is also such that its corrugations will yield or flex on applying pressure to the sides of the contact perpendicular to planes 30 and 31, as by means of fingers 43 and 44 of clip 40. It is to be noted that crests 28 and 29 of the corrugations make line contact with the inner surfaces of fingers 43 and 44 respectively.

Since cartridge fuses of the type to which this invention relates usually carry relatively high currents, considerable heat may be generated between the fuse contacts and the contact receiving clips, particularly when the spring tension exerted by the fingers of a clip against a fuse contact relaxes due to age or repeated heating and cooling at the points of electrical contact. A fuse contact of the type shown in Figures 1 and 2 has a relatively

thin side wall of good heat conductivity whose inner surface of hollow 25 is exposed to the surrounding atmosphere. Air is therefore permitted to enter the open end of the hollow and circulate through it thus removing at least a portion of the heat generated in the contact.

As has been pointed out contact structure 3*a* (Figure 3) makes line contact with fingers 43 and 44 at points 28 and 29 respectively. The corrugations or furrows in contact 3*a* combine with the inner surfaces of fingers 43 and 44 to define a plurality of ducts along the length of the contact which are open to the surrounding atmosphere at tip 26 thereof. In place of the one hollow 25 in contact 3 contact 3*a* has a plurality of open ended hollows through which air may circulate to remove heat from the contact.

It is to be understood that the term "hollow" as applied to the contact structures of this invention includes the type of hollows provided by contact 3*a* when in place between the fingers of a contact receiving clip as well as the hollow 25 in contact 3. Ambient air may also be circulated through tubular pin 5 by perforating the bottom of indentations 15 and 16 as shown at 38 and 39 respectively in Figure 1. Since contact 3 or 3*a* is firmly secured to pin 5 some of the heat generated in the contact will be conducted to the pin and dissipated therefrom to the air circulating through the pin. Although circulation of air is permitted through pin 5 and in the hollow of contact 3 or 3*a* the pin, the ferrule and contact close off the end of cartridge 1 against any appreciable escape of arc gases generated within the fuse, the aperture 12 being just large enough to permit the contact to pass freely through it.

While preferred embodiments of the invention have been shown and described by way of illustration, many modifications will occur to those skilled in the art. Therefore it is contemplated that the claims concluding this specification shall cover all such modifications as fall within the true spirit and scope of the invention.

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

1. A cartridge fuse construction having a cartridge which includes at each end thereof a pair of oppositely disposed apertures in its wall; a pin disposed in said apertures; a ferrule closing off the end of said cartridge, said ferrule having a flange overlying the end of said cartridge and the ends of said pin and an indentation in said flange cooperating with an end of said pin to maintain said cartridge, pin and ferrule in assembled relationship; yieldable hollow blade type contact means secured at one end thereof to said pin and projecting through the ferrule from the end of said cartridge; and a fusible link inside said cartridge connected between said contact means at one end of the cartridge and contact means at the other end of the cartridge.

2. A cartridge fuse construction having a tubular cartridge which includes at each end thereof a pair of diametrically disposed apertures in the tube wall, a tubular pin disposed in said apertures with the ends of the pin substantially flush with the outer surface of the cartridge, a ferrule closing off the end of said cartridge, an annular flange on said ferrule overlying the end of said cartridge and the ends of said pin, indentations in said flange deformed into the hollow ends of said tubular pin to maintain said cartridge, pin and ferrule in assembled relationship, a yieldable hollow blade type contact secured at one end thereof to said pin and projecting through an aperture in the ferrule from the end of said cartridge, and a fusible link inside said cartridge connected between said contact at one end of the cartridge and a contact at the other end of the cartridge.

3. A cartridge fuse construction having a tubular cartridge which includes at each end thereof first and second diametrically disposed apertures in the tube wall, a tubular pin disposed in said first and second apertures with the ends of the pin flush with the outer peripheral

surface of the cartridge, a ferrule closing off the end of said cartridge, an annular flange on said ferrule overlying the end of said cartridge and the ends of said pin, indentations in said flange deformed into the hollow ends of said pin to maintain said cartridge, pin and ferrule in assembled relationship, a generally tubular contact having a pair of parallel side walls, the side walls at one end of said contact being flattened together to form a flat portion but the other end of said contact being open, a third aperture in said flat portion, said pin being disposed in said third aperture, outwardly expanded shoulders on said pin between which said flat portion is wedged to thereby support the contact on the pin, an aperture in said ferrule through which said contact projects from the end of the cartridge, and a fusible link inside said cartridge connected between said contact at one end of the cartridge and a contact at the other end of the cartridge.

4. A cartridge fuse construction having a tubular cartridge which includes at each end thereof first and second diametrically disposed apertures in the wall of said cartridge, a tubular pin disposed in said first and second apertures with the ends of the pin flush with the outer peripheral surface of the cartridge, a ferrule closing off the end of said cartridge, an annular flange on said ferrule overlying the end of said cartridge and the ends of said pin, indentations in said flange deformed into the hollow ends of said pin to maintain said cartridge, pin and ferrule in assembled relationship, a corrugated contact having the crests of the corrugations on one side thereof in a first plane and the crests on the other side of the contact in a second plane parallel to the first plane, a flat end on said corrugated contact, a third aperture in said flat end, said pin being disposed in said third aperture, outwardly expanded shoulders on said pin between which said flat end is wedged to thereby support the contact on the pin, an aperture in said ferrule through which said contact projects from the end of the cartridge, and a fusible link inside said cartridge connected between said contact at one end of the cartridge and a contact at the other end of the cartridge.

5. A cartridge fuse construction having a tubular cartridge which includes at each end thereof a pair of diametrically disposed apertures in the tube wall, a tubular pin disposed in said apertures with the ends of the pin substantially flush with the outer surface of the cartridge, a ferrule closing off the end of said cartridge, an annular flange on said ferrule overlying the end of said cartridge and the ends of said pin, indentations in said flange deformed into the hollow ends of said tubular pin to maintain said cartridge, pin and ferrule in assembled relationship, the bottoms of said indentations being apertured to provide an open passage through the flanges of the ferrule into said tubular pin, a yieldable hollow blade type contact secured at one end thereof to said pin and projecting through an aperture in the ferrule from the end of said cartridge, and a fusible link inside said cartridge connected between said contact at one end of the cartridge and a contact at the other end of the cartridge.

6. A cartridge fuse construction having a tubular cartridge which includes at each end thereof first and second diametrically disposed apertures in the tube wall, a tubular pin disposed in said first and second apertures with the ends of the pin flush with the outer peripheral surface of the cartridge, a ferrule closing off the end of said cartridge, an annular flange on said ferrule overlying the end of said cartridge and the ends of said pin, indentations in said flange deformed into the hollow ends of said pin to maintain said cartridge, pin and ferrule in assembled relationship, a generally tubular contact having a pair of relatively thin side walls disposed in spaced-apart parallel planes and yieldable in a direction generally perpendicular to said planes, the side walls at one end of said contact being flattened together to form a flat portion but the other end of said contact being open, a third aperture in said flat portion, said pin being disposed in said third aperture and being diametrically expanded along its length from each side of said flat portion thereby rigidly to secure the contact to the pin, an aperture in said ferrule through which said contact projects from the end of the cartridge, and a fusible link inside said cartridge connected between said contact at one end of the cartridge and a contact at the other end of the cartridge.

7. A cartridge fuse construction having a tubular cartridge which includes at each end thereof first and second diametrically disposed apertures in the wall of said cartridge, a tubular pin disposed in said first and second apertures with the ends of the pin flush with the outer peripheral surface of the cartridge, a ferrule closing off the end of said cartridge, an annular flange on said ferrule overlying the end of said cartridge and the ends of said pin, indentations in said flange deformed into the hollow ends of said pin to maintain said cartridge, pin and ferrule in assembled relationship, an elongated corrugated contact having the crests of the corrugations on one side thereof in a first plane and the crests on the other side of the contact in a second plane parallel to the first plane, the corrugations being arranged so that their crests run parallel to the longitudinal axis of the contact, a flat end on said corrugated contact, a third aperture in said flat end, said pin being disposed in said third aperture, outwardly expanded shoulders on said pin between which said flat end is wedged to thereby support the contact on the pin, an aperture in said ferrule through which said contact projects from the end of the cartridge, and a fusible link inside said cartridge connected between said contact at one end of the cartridge and a contact at the other end of the cartridge.

References Cited in the file of this patent

UNITED STATES PATENTS

1,107,861	Stout	Aug. 18, 1914
1,237,211	Leveen	Aug. 14, 1917
2,255,926	Muller-Hillebrand et al.	Sept. 16, 1941