May 3, 1932. J. B. GLOWACKI 1,857,097

REPLACEABLE FUSE ELEMENT

Filed Jan. 10, 1929 2 Sheets-Sheet 1

Fig. 1

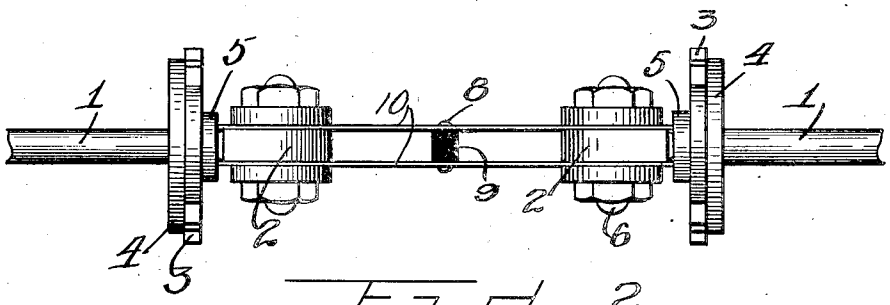


Fig. 2

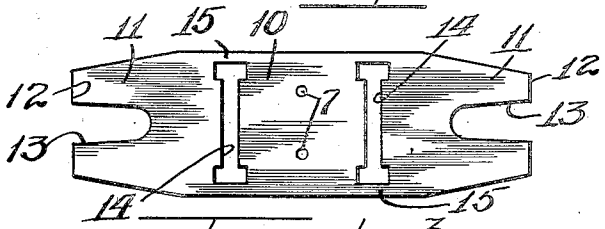


Fig. 3

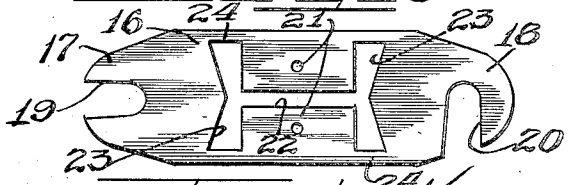


Fig. 4

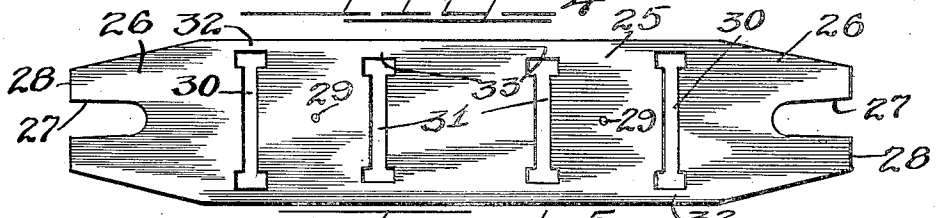
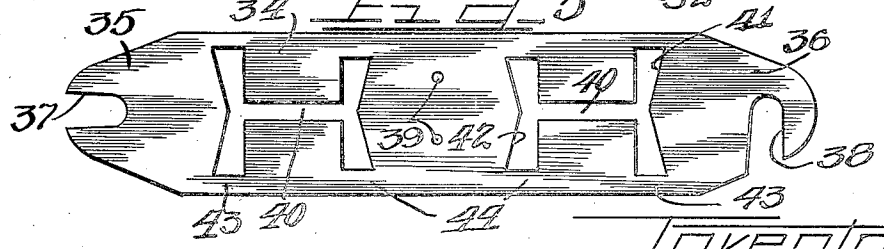


Fig. 5



Inventor
John B. Glowacki
Charles A. Wiley
Atty

May 3, 1932. J. B. GLOWACKI 1,857,097

REPLACEABLE FUSE ELEMENT

Filed Jan. 10, 1929 2 Sheets-Sheet 2

Fig. 6

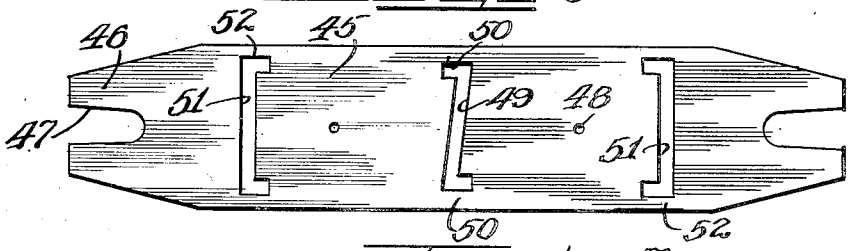


Fig. 7

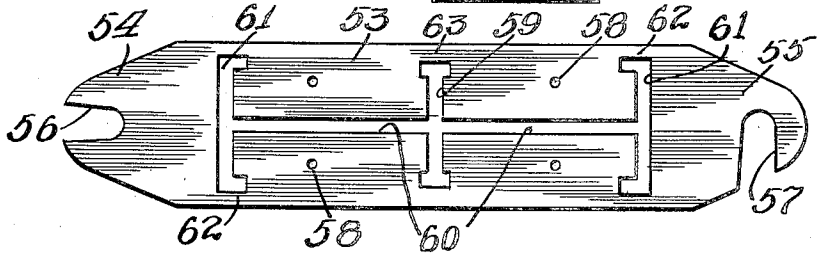


Fig. 8

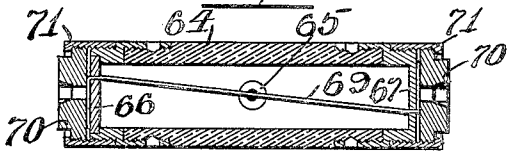


Fig. 9

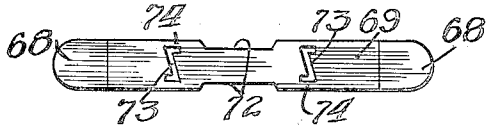
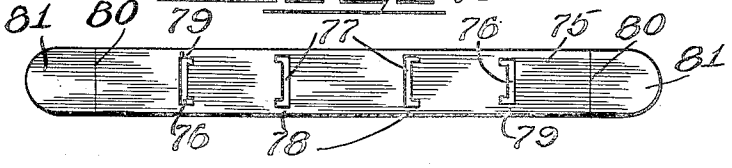


Fig. 10



Inventor
John B. Glowacki
Charles W. Kells
Atty.

By

Patented May 3, 1932 1,857,097

UNITED STATES PATENT OFFICE

JOHN B. GLOWACKI, OF CHICAGO, ILLINOIS

REPLACEABLE FUSE ELEMENT

Application filed January 10, 1929. Serial No. 331,498.

This invention relates to improved types of replaceable fuse elements adapted for use in fuses of the ferrule cartridge type and in fuses of the knife blade cartridge type, said fuse elements adapted to be interposed in electric circuits to prevent destructive action of the current due to overloading or short circuits.

It is an object of this invention to provide a replaceable fuse element constructed of a strip of metal having one or more irregular openings or slots provided therein with portions of the slots positioned parallel to the longitudinal edges of the fuse strip to afford fusing sections of a predetermined resistance whereby upon overloading or short circuiting of the fuse element, the fusing sections will blow, thereby creating a drop out portion adapted to interrupt the circuit.

It is also an object of this invention to provide an improved replaceable fuse element constructed of substantially a straight strip of material having irregular openings in the portion of greatest cross section affording fusing strips of uniform cross section parallel to the longitudinal edges of the element to afford a drop out section between the ends of the fuse element when the element is subjected to overloads or short circuits.

It is a further object of this invention to provide a replaceable fuse element wherein irregular slots or openings are provided either longitudinally or transversely of the element to afford parallel fusing strips of a predetermined resistance with the strips arranged in pairs of equal cross section or in pairs of different cross sections depending upon whether the element is intended for use in a small capacity fuse or in a high capacity fuse.

It is furthermore an object of this invention to provide a replaceable fuse element adapted for use in ferrule type cartridge fuses or in cartridge fuses of the knife blade type and having irregular slots arranged therein with the ends of the slots arranged in parallel relation to afford parallel melting strips of equal or different cross sections.

It is an important object of this invention to provide a replaceable fuse element wherein drop out sections are adapted to be created by arranging irregular openings in grouped relation to afford pairs of mounting strips of equal or unequal cross section parallel to the longitudinal edges of the fuse element.

Other and further important objects of this invention will be apparent from the disclosures in the specification and the accompanying drawings.

This invention (in a preferred form) is illustrated in the drawings and hereinafter more fully described.

On the drawings:

Figure 1 is a fragmentary side elevation of the knife blade terminal unit of a knife blade type cartridge fuse having mounted therein replaceable fuse elements embodying the principles of this invention.

Figure 2 is a plan view of an improved replaceable fuse element of a type adapted to be mounted on the knife blade terminal units illustrated in Figure 1.

Figure 3 is a plan view of a modified type of replaceable fuse element also adapted for use in cartridge fuses of the knife blade type.

Figure 4 is a plan view of another modified form of large capacity replaceable fuse element adapted for use in cartridge fuses of the knife blade type.

Figure 5 is another modified form of replaceable fuse element for use in cartridge fuses of the knife blade type.

Figure 6 illustrates another modified form of high capacity replaceable fuse element adapted for use in cartridge fuses of the knife blade type.

Figure 7 is a plan view of another modified form of high capacity replaceable fuse element adapted for use in cartridge fuses of the knife blade type.

Figure 8 is a longitudinal section taken through a ferrule type cartridge fuse having mounted therein an improved replaceable fuse element embodying the principles of this invention.

Figure 9 is a developed plan view of the replaceable fuse element illustrated in Figure 8 with said fuse element provided with notches to clear the inner end of a fuse in-

dicator mounted on the ferrule type cartridge fuse.

Figure 10 is a developed plan view of a modified form of higher capacity replaceable fuse element adapted for use in cartridge fuses of the ferrule type.

As shown on the drawings:

The reference numeral 1 indicates a pair of knife blade terminals of a cartridge fuse with said knife blade terminals having the inner ends thereof reduced in width to form tongues or projections 2. Mounted on each of the knife blade members 1 is a notched disk 3 and an outer metal disk 4. Secured on each knife blade 1 adjacent the inner surface of the notched disk 3 is a stop plate or block 5. Each of the knife blade tongues 2 is provided with an aperture for the reception of a retaining bolt 6 or other suitable means for securing a single or a multiple type replaceable fuse strip or element in place between the knife blade terminal units of the cartridge fuse. Figure 1 illustrates the use of a double or multiple type replaceable fuse unit, the two fuse elements of which are provided with suitable apertures 7 provided in the middle portion of the fuse elements for the reception of connecting pins or rivets 8 around which spacing sleeves 9 are engaged to hold the replaceable fuse elements separated and in substantially parallel relation with one another.

The improved replaceable fuse element adapted for use in the combination illustrated in Figure 1 comprises a strip of fusible metal embracing an intermediate or main body strip 10 having parallel longitudinal edges. The ends of the body strip 10 are shaped to form tapered end sections 11 the ends of which are squared at 12 to permit the same when engaged on knife blade terminal units to abut against the stop plates or blocks 5 to hold the replaceable fuse element in proper aligned position. Each end 11 of the replaceable fuse element is provided with a longitudinally directed notch 13 provided to permit the fuse element to be engaged around the bolts 6 of the knife blade units. The body section 10 of the replaceable fuse element illustrated in Figure 2 is provided with the apertures 7 when the fuse element is to be used in multiple as illustrated in Figure 1. It will of course be understood that when the fuse element is to be used singly, the apertures 7 may be omitted.

The body section 10 of the fuse element is also provided with a plurality of irregular slots or openings 14 of substantially I-shaped formation positioned in parallel relation transversely of the fuse element so that the ends of the irregular slots 14 are parallel to the longitudinal edges of the body portion 10 of the replaceable fuse element. This arrangement of the irregular openings 14 provides two pairs of parallel melting or fusing strips or sections 15 between the ends of the irregular slots 14 and the longitudinal edges of the body section 10. The fusing strips 15 are of equal length and cross section and are arranged to afford a predetermined resistance depending upon the capacity of the replaceable fuse element.

It will be noted that the body of the replaceable fuse element is substantially of equal width and cross section and is provided with the irregular slots or openings 14 which of course may be of any desired configuration other than the I-shape illustrated, provided that the slots afford fusing strips of sections 15 along the longitudinal edges of the body of the fuse element. This novel arrangement of a replaceable fuse element affords an element which may be easily and economically formed with the irregular slots or openings arranged to provide sets of oppositely positioned melting sections of a given or predetermined resistance whereby said fusing sections will melt on overloads or on short circuits, permitting the middle portion of the body section 10 to drop away and separate from the adjacent portions which remain connected to the knife blade units.

Figure 3 covers a modified form of renewable fuse element and comprises a strip or main body section of fusible metal 16 of uniform width and having integrally formed on the ends thereof tapered ends or mounting sections 17 and 18 with the end section 17 provided with a longitudinally positioned end notch 19 while the tapered end section 18 is provided with a transversely positioned notch 20. The intermediate or main body section of the replaceable fuse element 16 is provided with a pair of apertures 21 adapted for use in connecting two or more replaceable fuse elements in parallel assembled relation to provide a multiple fuse unit. If desired, the apertures 21 may be omitted when the fuse element is to be used singly. The main body sections 16 of the fuse element illustrated in Figure 3 is provided with an irregular or H-shaped slot or opening comprising a connecting slot or passage 22 disposed longitudinally in the center of the fuse element and connecting a pair of transverse slots 23, the ends of which are parallel and spaced from the longitudinal edges of the body section 16 of the fuse element to form melting or fuse strips 24 of a required length and cross section offering a predetermined resistance so that when the fuse element is subjected to an overload or to short circuits, said melting or fuse strips 24 will melt or blow thereby permitting the portion between the parallel slots 23 of the irregular opening to drop away and out of contact with the adjacent end sections of the fuse element which remain connected to the knife blade terminal units of the fuse.

Figure 4 illustrates another modified form

of replaceable fuse element of a higher capacity and embraces a fusible metal body section 25 of uniform width and having integrally formed on the ends thereof tapered end sections 26, each of which is provided with a central longitudinally directed notch 27 to facilitate mounting of the fuse elements. The ends of the tapered end sections 26 are squared at 28 to permit the replaceable fuse element to be held in proper aligned position abutting against stop blocks 5 of the knife blade terminal units of the kind illustrated in Figure 1. When the replaceable fuse element is to be used in multiple, the body section 25 is provided with apertures 29 for the reception of pins or rivets used to connect parallel fuse elements. The main body section 25 of the fuse element is provided with transversely arranged irregular slots or openings 30 and 31, the ends of which are parallel to the longitudinal edges of the body section 25 and afford pairs of parallel melting or fusing strips 32 and 33, with the fusing strips 33 being of greater cross section than the cross section of the fusing strips 32. The fusing strips 32 and 33 are formed of different cross section to provide different resistances by having the two irregular slots or openings 31 shorter than the two outer irregular slots 30. When the replaceable fuse element illustrated in Figure 4 is subjected to an overload, the melting sections 33 will blow or melt thereby permitting the middle portion of the body section 25 to drop out from between the portions of the body section between the slots 30 and 31. When the fuse element is subjected to a short circuit all of the fusing strips 32 and 33 will blow or melt thereby permitting three drop out sections to fall from between the end sections 26 to interrupt the circuit.

Figure 5 illustrates another modified form of replaceable fuse element embracing a body or intermediate section 34 of uniform width having the ends thereof tapered to provide end sections 35 and 36. The end section 35 is provided with a longitudinal center notch 37 while the end section 36 is provided with a transverse notch 38. Apertures 39 are provided in the middle portion of the body section 34 for the reception of rivets or pins when the element is to be used in multiple. The main body portion 34 of the fuse element is provided with a plurality of H-shaped irregular openings on opposite sides of the apertures 39 and each comprising a longitudinally positioned middle or connecting slot 40 connecting a pair of transverse slots or openings 41 and 42 with the transverse slot 42 shorter than the transverse slot 41. The two transverse slots have the ends thereof parallel to the longitudinal edges of the body section 34 thereby providing two pairs of melting or fusing strips 43 and 44 of different cross sections and of different resistances thereby permitting the larger fusing or melting strips 44 to fuse on overloads permitting the middle portion of the body section 34 to drop out. On short circuits both the small and large melting sections 43 and 44 will blow thereby permitting a plurality of sections to drop out from between the end sections 35 and 36 to insure positive breaking of the circuit.

Figure 6 illustrates another modified form of replaceable fuse element constructed of fusible metal and comprising a main body section 45 of uniform width having integrally formed on the ends thereof tapered end sections 46 provided with longitudinally disposed end notches 47. Small apertures 48 are provided in the body section 45 for the reception of rivets or pins when the fuse elements are to be used in multiple. Provided in the middle portion of the body section 45 is a transverse irregular or Z-shaped slot or opening 49, the end portions of which project in opposite directions and are spaced and parallel to the longitudinal edges of the body section 45 to afford primary melting or fusing strips 50. Provided in the body section 45 near the end sections 46 are transversely positioned channel or U-shaped transversely disposed irregular slots or openings 51, the ends of which are parallel to one another and to the longitudinal edges of the body section 45 to provide secondary melting or fusing sections 52 which are smaller in cross section than the melting or fusing sections 50. When the fuse element is subjected to overloads, the primary melting sections 50 will melt or blow creating a gap in the middle portion of the body section 45. When the fuse element is subjected to a short circuit, both the primary and the secondary melting sections 50 and 52 will melt or blow permitting a plurality of drop out sections to fall out to insure positive breaking of the circuit.

Figure 7 illustrates another modified form of renewable fuse element comprising a strip of fusible metal consisting of a body section 53 of uniform width having integrally formed on the ends thereof tapered end sections 54 and 55 provided with notches 56 and 57 respectively. The body section 53 is provided with a plurality of small apertures 58, two diagonally positioned apertures adapted to be provided with rivets or pins when the fuse elements are used in multiple. When the fuse element is used singly, the apertures 58 may be omitted.

The body section 53 is provided with an irregular slot or opening comprising a transversely positioned middle or intermediate irregular slot or I-shaped opening 59 connected by longitudinally positioned connecting slots 60 to a pair of transversely disposed irregular end slots or openings 61 of U-shape or channel shape formation. The transverse

irregular slots 61 are longer than the middle transverse slot 59 and have the ends thereof positioned adjacent and parallel to the longitudinal edges of the body section 53 to afford secondary fusing or melting sections 62 while the ends of the middle irregular slot 59 are also disposed parallel to the longitudinal edges of the body section 53 and afford primary melting sections or strips 63 which are of greater cross section than the cross section of the melting sections 62. On an overload to the fuse element, the primary melting sections 63 will blow creating a gap in the body section 53. When the fuse element is subjected to a short circuit, both the primary and secondary melting strips 63 and 62 will blow to insure positive breaking of the circuit and falling out of the drop out sections.

Figure 8 illustrates a longitudinal section of a cartridge fuse of the ferrule type comprising a cylindrical body 64 having radially engaged in the wall thereof a fuse indicator 65. The body section 64 is provided with slotted thimble plates 66 and 67 through which the end sections 68 of a metal fuse strip 69 are adapted to be projected and bent over to form a Z-shaped element. Retaining heads 70 are engaged against the ends 68 of the fuse element and are secured in place by internally threaded locking rings 71 or the like. The body portion of the replaceable fuse element 69 is provided with a pair of oppositely positioned notches 72 whereby the inner end of the fuse indicator 65 is adapted to be properly cleared when the replaceable fuse element is mounted in position within the ferrule type cartridge fuse. Provided in each end portion of the fuse element 69 near the notches 72 is a transversely positioned irregular slot or opening 73 having the end portions of said slot positioned parallel to the longitudinal edges of the body section 69 to afford melting or fusing strips 74 which are adapted to melt or fuse when the fuse element is subjected to overloads or to short circuits thereby permitting the middle portion of the body section 69 to drop out to insure proper breaking of the circuit.

Figure 10 illustrates a developed plan view of a modified form of replaceable fuse element adapted for use in cartridge fuses of the ferrule type and embraces a body section of uniform width with said body section 75 provided with a plurality of transversely positioned irregular slots or openings 76 and 77 with the slots 77 being longer than the slots 76 and having the ends thereof positioned parallel to the longitudinal edges of the body strip 75 to afford primary fusing strips 78. The irregular slots 76 are shorter than the irregular slots 77 and have the ends thereof positioned parallel to the longitudinal edges of the body section 75 to provide a plurality of secondary melting or fuse strips 79 which are of a greater cross section than the primary fuse strips 78. The end portions of the fuse element are provided with transverse creases or grooves 80 permitting the rounded end sections 81 of the fuse element to be bent over in opposite directions to permit mounting of a fuse element within a ferrule type cartridge fuse. When a fuse element of the class illustrated in Figure 10 is subjected to an overload, the primary melting strips 78 are adapted to melt to permit the portion of the fuse element between the irregular slots 77 to drop out. When the fuse element is subjected to a short circuit, both the primary and secondary melting sections 78 and 79 are adapted to blow thereby permitting a plurality of drop out sections to fall out to insure positive breaking of the circuit.

It will be noted that a plurality of different types of renewable fuse elements have been illustrated and described in which the elements are of substantially the same width except for the tapered end sections and are provided with irregular slots or openings of various shapes permitting melting or fusing strips to be formed in the main body of the fuse elements parallel to the longitudinal edges of the elements whereby when the elements are subjected to overloads or short circuits, a positive breaking of the circuit is insured due to the blowing of the primary or the primary and secondary fusing strips to permit sections of the fuse elements to drop out to insure a gap between the end portions of the fuse elements which are secured to the terminal heads or units of the cartridge fuses in which the fuse element may be mounted. The provision of irregular slots or openings in a fuse element permits the fuse element to be constructed of substantially a uniform width thereby providing a strong element which may be readily manufactured at economical cost and which furthermore permits the element to be provided with the required melting or fusing strips of the same or different cross sections and resistances to insure positive dropping out of the intermediate section or sections of the fuse element when said element is subjected to overloads or to short circuits. The various fuse elements illustrated and described may be used singly or in multiple as illustrated in Figure 1 and it will also be noted that the elements may be adapted for use in cartridge fuses of the knife blade type or in cartridge fuses of the ferrule type. No apertured reduced sections are therefore necessary in this type of replaceable fuse element thereby obviating the use of weak sections included in many types of earlier fuse elements. The provision of irregular slots or openings in the fuse elements of uniform width affords an improved means for providing the necessary melting or fuse strips which are required to afford drop out sections when the elements

are subjected to overloads and short circuits.

While tapered square ended and round ended end sections are illustrated and described in connection with the various types of replaceable fuse elements, it will, of course, be understood that any desired or required type of end portions may be formed on the improved renewable fuse elements so long as the body portions of the element are provided with the irregular slots or openings required to afford primary and secondary melting or fusing strips hereinbefore described.

It will, of course, be understood that many changes may be made and numerous details of construction may be varied through a wide range without departing from the principles of this invention and, it is, therefore, not purposed limiting the patent granted hereon otherwise than necessitated by the scope of the appended claims.

I claim as my invention:

1. A replaceable fuse element comprising a fusible metal strip having an irregular opening therein forming aligned melting sections of different resistances.

2. A replaceable fuse element comprising a fusible metal strip having the ends thereof formed to permit the strip to be mounted in position in a cartridge type fuse, said fusible metal strip having irregular slots of different lengths formed therein with the ends of said slots wider than the main portion of the slots and positioned parallel to the longitudinal edges of the fusible metal strip to form melting sections of different resistances.

3. A fuse element comprising a fusible metal strip having transverse slots of different lengths therein to form aligned melting sections of different resistances.

In testimony whereof I have hereunto subscribed my name at Chicago, Cook County, Illinois.

JOHN B. GLOWACKI.