June 5, 1951 F. G. VON HOORN 2,556,018

RENEWABLE ENCLOSED FUSE

Filed Feb. 19, 1946

Fig. 1.

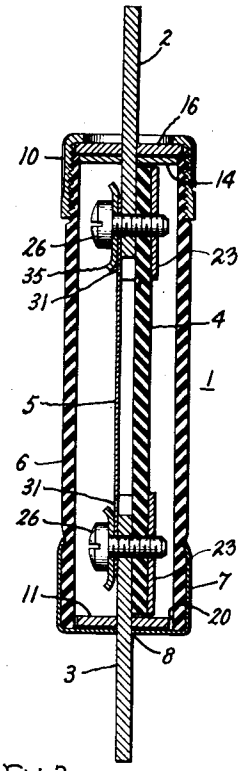


Fig. 2.

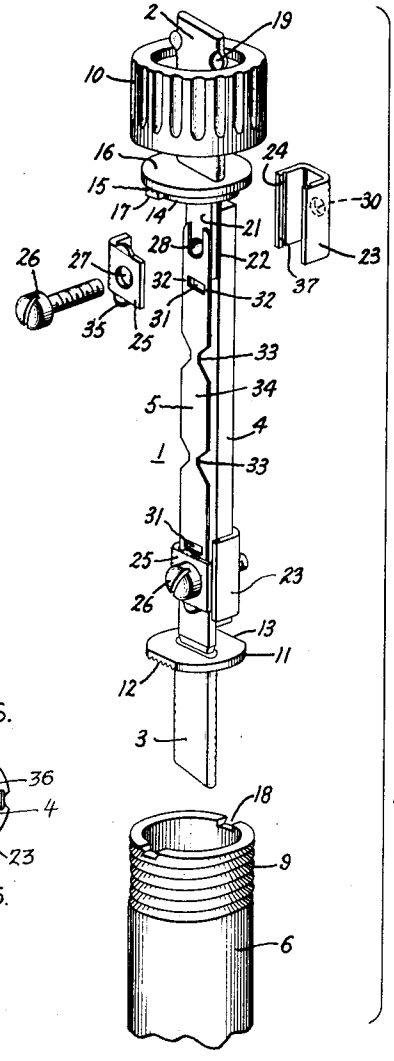


Fig. 3.

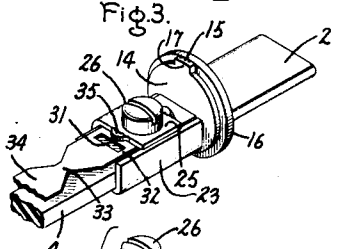


Fig. 4.

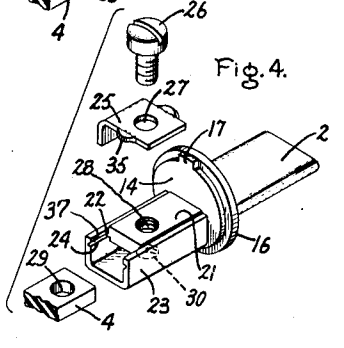


Fig. 6.

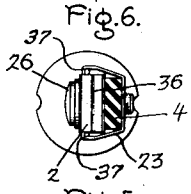
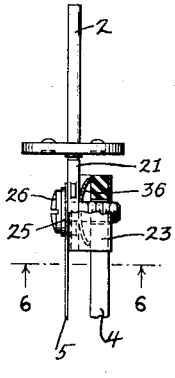


Fig. 5.



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RENEWABLE ENCLOSED FUSE

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Application February 19, 1946, Serial No. 648,764

9 Claims. (Cl. 200—131)

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My invention relates to electric fuses and more particularly to a fuse of the enclosed type in which provision is made for renewal of the fuse link.

One object of my invention is to provide a new and improved fuse construction incorporating means to secure a magnetic blowout of the fuse arc when the link ruptures.

Another object of my invention is to provide an enclosed fuse having means to secure a time delay in blowing of the fuse link and in which a magnetic flux is utilized to extinguish the arc when the link blows after a predetermined time delay.

Still another object of my invention is to provide an enclosed fuse so constructed as to permit quick and easy renewal of the fuse link.

A further object is to provide an enclosed fuse in which the parts are so arranged as to permit easy assembly during manufacture and which when assembled forms a rugged construction well suited for frequent renewal of the fuse link without damage to the parts.

In the accompanying drawing, Fig. 1 is a sectional view through a fuse constructed in accordance with my invention; Fig. 2 is a view showing the parts removed from the casing; Fig. 3 is a perspective view showing the arrangement of parts at one end of the fuse; Fig. 4 is a view showing certain of the parts in position for assembly; Fig. 5 is a sectional view of a modified construction, and Fig. 6 is a view of the modification taken along the line 6—6 of Fig. 5.

Referring to the drawing, the fuse 1 is provided with spaced knife-blade terminals 2 and 3 interconnected by a rigid bar 4 of insulating material, such as impregnated sheet fiber or asbestos. A fuse link 5 extends between the terminals. The assembly is housed within a tubular casing 6 formed of any suitable insulating material such as a plastic impregnated fiber. One end of the casing is provided with a ferrule 7 having an opening 8 for accommodating the terminal 3. The other end of the casing is screw threaded, as indicated by numeral 9, for receiving a cap 10. By unscrewing the cap 10, the fuse mechanism may be removed as a unit from the casing to permit renewal of the fuse link.

In order properly to support the fuse mechanism within the casing, the terminal 3 is provided with a washer 11 staked thereon, the washer being provided with scorings 12 on the outer face thereof and flattened edges 13. As will appear presently, the washer is so formed to provide for venting of the fuse casing. Similarly, the other terminal 2 is provided with a washer 14 having a scored surface 15, the washer being staked to the terminal. In addition, the

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terminal 2 carries a cover plate 16 immediately adjacent the washer 14 and which cooperates with the cap 10 to form a closure for that end of the fuse. The washer 14 is provided with diametrically opposite projections 17 which rest in notches 18 in the end of casing 6 when the fuse mechanism is mounted in position. When the projections 17 nest in the notches 18, there is no danger of twisting the terminal 2 within the casing upon tightening down on cap 10. In order to prevent the cap 10 from falling off the terminal 2 during disassembly of the fuse, the terminal is provided with two punched ears 19 against which the cap rests.

In assembling the fuse mechanism within the casing, the terminal 3 is inserted through the opening 8 in ferrule 7 so that the washer 11 rests against the inner face of the ferrule. In this position of the fuse mechanism, the projections 17 rest in the notches 18 on the end of the fuse casing, with the washer 14 nested within the casing and the closure plate 16 resting on the threaded end of the casing. This position of the parts is shown by Fig. 1. The cap 10 is now threaded down on the casing to hold the mechanism firmly in position.

Proper venting of the fuse is secured at each end of the casing. At one end, the flattened edge 13 of the washer 11 and the scorings 12 form a passageway 20 for the hot gases generated upon blowing of the fuse link. The gases flow through the passageway and out through the opening 8 in the ferrule. The terminal 3 has a sufficiently loose fit in the ferrule 7 to permit this. At the other end, the gases vent around the edges of the washer 14 and then pass through a clearance channel formed by the threads on cap 10 and casing 6. The channel is formed by cutting off the tips of the threads, as is common practice in the fuse art. Gases also flow through the passageway formed by the scorings 15 and then out between the closure plate 16 and blade 2 through an opening similar to that provided at 8. The cap 10 is threaded down tightly by hand to hold the parts in assembled position, but due to manufacturing tolerances in the parts sufficiently small openings are formed to permit proper venting in the manner indicated.

The fuse mechanism thus far described may be easily and quickly removed from the casing simply by unthreading the cap 10. It comes out of the casing in a single piece so that there is no danger of any parts being lost. When removed from the casing, the blown fuse link may be easily replaced with a new one. Another advantage is that the end of the casing is then absolutely clear of parts so that frag-

ments of the blown fuse may be readily removed from the casing.

One important feature of my invention is the manner in which the terminals and insulating rod are assembled together. Referring to Figs. 3 and 4, it will be seen that the inner part of the terminal 2 comprises a flat strip of material 21, such as heavy sheet copper, and which is formed with projecting ribs 22 on its opposite sides. The ribs 22 form a guideway for a U-shaped slip 23. The arms of the U are formed with grooves 24 into which the ribs project to hold the parts together, the arms thereby embracing and clasping the edges of terminal 2. A clamp 25 overlies the terminal and is used to secure the fuse link in position. A screw 26 extends through opening 27 formed in the clamp and is threaded into tapped opening 28 in the terminal 2. It passes through a slightly undersized opening 29 in the insulating rod 4 and extends through a clearance hole 30 in the clip 23.

In assembling the insulating bar on the terminal, the clip 23 is held in a fixture and bar 4 placed inside the clip. The blade 21 is then slipped into position with the ribs 22 seated in grooves 24. The fuse link 5 and clamp 25 are then assembled on blade 21. Screw 26 is threaded through the parts to hold them in assembled relationship. The construction is one which is easily and quickly assembled. It requires only a single fastening screw. In order to prevent loosening of the screw, the hole 29 in the fiber bar is punched slightly smaller than the outside diameter of the screw. This means that when the screw is threaded into position, it cuts threads in the fiber bar which frictionally grip the screw and give a locking action. However, the screw may be easily unthreaded to release clamp 25 when replacing the fuse link. When renewing the fuse link, it is not necessary to disassemble the parts because only the clamp 25 need be lifted slightly to permit insertion of a new link. Since the fiber bar 4 is clamped in position by the terminal 2 and clip 23 for a substantial distance along its length, the assembly gives an exceptionally rigid construction. This means that the two terminals are held securely in alignment so that no stress is placed upon the fuse link.

The fuse link 5 is so designed for use in conjunction with the terminals 2 and 3 as to give a time delay action of the fuse. To this end, the link is provided with a slot 31 adjacent each end which forms blow points 32 on opposite side edges of the link. When the fuse link is assembled on the terminals, the blow points 32 are located immediately adjacent the end of clamp 25 and are close to the mass of material formed by the strip 21 of the terminal. On substantial overloads for short periods of time, the heat generated in the blow points 32 will be absorbed and dissipated by the large mass of metal formed by the terminal strip 21. Since this is formed of copper, it comprises a good heat conducting material. The clip 23 and clamp 25 also assist in conducting away the heat. This means that on high overloads of short duration, a time delay action is secured so that the fuse will not rupture when excessive surges occur in the line for relatively short periods of time, for example, as when starting a motor.

In order to facilitate blowing of the link on very heavy overloads, it is provided with spaced blow points 33 in addition to the blow points 32. When the fuse is subjected to such overloads, it will blow at the point 33. This means that the middle section 34 will drop out forming a large gap in the link to extinguish the arc.

Under certain conditions of light overload for prolonged periods of time, the link will blow in the center section 34. The reason for this is that the heat generated in the link at both blow points 32 and 33 will be absorbed and dissipated along the opposite ends of the links to the heat absorbing masses formed by the terminals 2 and 3. On short circuit, the link will blow at both the blow points 32 and 33.

In order to prevent damage to the terminal strips 21 upon rupture of the link at the blow points 32, the clamp 25 is provided with an arcing tip 35 which extends upwardly away from the end face of the terminal strip 21. Any arcing between the link and the terminal construction takes place between the link and this arcing tip rather than between the link and the end face of the terminal strip 21. This arrangement prevents pitting and burning of the terminal strip 21. The arcing tips 35 are formed at both ends of the clamp 25 so that in the event that one of the arcing tips becomes unduly burned or pitted, the clamp may be reversed in position to utilize the arcing tip at its other end. It should be noted that the insulating bar 4 is formed of fire and arc resistant material such as an impregnated asbestos fiber which is capable of withstanding the high temperatures existing in the arc when the fuse blows.

Another important feature of my invention is the provision of a magnetic blowout construction which aids in extinguishing the arc upon blowing of the fuse link. To this end, the U-shaped clip 23 is made of any suitable magnetizable material, such as sheet steel. As shown in Fig. 3, the side arms of the U are extended along the length of the bar 4 beyond the end of the terminal strip 21 a distance such that they overlie the blow points 32. When high currents flow through the terminal construction, including the clip 23, upon rupture of the blow points 32, a magnetic flux is set up between the arms of the U-shaped clip 23. This flux crosses the path of the arc and has a tendency to draw it toward the fiber insulating bar 4 to break the arc and extinguish it. This increases the speed with which the arc is interrupted. Moreover, the action of the magnetic blowout helps to prevent damage to the end face of the terminal strip 21. In this way, the magnetic flux helps protect the terminal the same as the arcing tip 35.

After the fuse blows, the link may be easily replaced by unthreading the cap 10 and removing the knifeblade terminals and insulating bar. A single turn on the screws 26 will loosen the clamps 25 sufficiently to permit removal of the link fragments and insertion of a new link. The link is provided with slotted ends of a conventional form to permit easy insertion of the link and to position the link properly on the terminals.

Figs. 5 and 6 illustrate a modification of the construction in which a blade spring 36 is inserted between the insulating bar 4 and the terminal blade 21. The spring is provided with an opening, not shown, for receiving the screw 26. It acts as a spacer to provide wider separation of the bar 4 and the fuse link so that when the fuse link expands on heating, it does not engage the bar and alter calibration of the fuse. In addition, the spring 36 is sufficiently strong to keep the assembly snug and tight without requiring close manufacturing tolerances of the parts.

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

1. In an electric fuse, spaced knife blade terminal strips, U-shaped clips carried by said strips, the arms of the U and side walls of the strips being provided with cooperating groove and ridge means whereby said clips may be slidably mounted in position on said strips to form a space between the strips and clips, an elongated bar of insulating material having its ends resting in the said spaces to support the terminal strips on the bar, a fuse link extending between said terminal strips, clamps overlying the ends of the links, and separate screw means extending through the clamps, clips and terminal strips to fasten these parts in position on the insulating bar.

2. An electric fuse comprising, in combination, an elongated bar of insulating material, spaced apart knife blade terminal strips connected to opposite ends of the bar, a fuse link connected between the terminal strips, said link being provided with blow points located adjacent the ends of the terminal strips, and a metallic U-shaped member located at each terminal strip, the arms of the U extending near a corresponding blow point to generate a magnetic flux to extinguish the arcs at the blow points upon rupture of the fuse.

3. An electric fuse comprising, in combination, spaced knife blade terminal strips, a metallic U-shaped clip carried by each of said strips, an elongated bar of insulating material having its ends clamped between the U-shaped clips and the terminal strips, a fuse link connected between the terminal strips, said link being provided with blow points located adjacent the ends of the terminal strips, the arms of the U-shaped clips extending beyond the ends of the terminal strips to points near a corresponding blow point so that upon rupture of the fuse, a magnetic flux is generated between the clip arms to extinguish the arcs at the blow points, and a casing enclosing the fuse link and parts of the terminal strips.

4. An electric fuse comprising, in combination, an elongated bar of insulating material, spaced apart knife blade terminal strips connected to opposite ends of the bar, a fuse link connected between the terminal strips, a casing enclosing the fuse link and parts of the knife blade terminal strips, said fuse link being provided with blow points located adjacent the ends of the terminal strips, and a clamping member carried by each of said terminal strips for securing the fuse link in position, each of said clamping members being provided with an arcing tip extending beyond the end of the corresponding terminal strip to receive the arc formed upon rupture of the fuse at the blow points.

5. An electric fuse comprising, in combination, a bar of insulating material, spaced apart knife blade terminal strips mounted on opposite ends of the bar, U-shaped clip members carried by the terminal strips and extending around the ends of the bar, a fuse link connected between the terminal strips, a clamping member carried by each of said terminal strips for securing the fuse link in position, each of said clamping members being provided with an arcing tip extending beyond the end of the corresponding terminal strip to receive any arc formed upon rupture of the fuse link, screw means fastening the clamps, clips and terminal strips to opposite ends of the insulating bar and a casing enclosing the fuse link, the insulating bar and portions of the knife blade terminal strips.

6. A fuse comprising, in combination, a bar of insulating material, spaced apart knife blade terminal strips mounted on opposite ends of the bar, U-shaped clip members carried by the terminal strips and extending around the ends of the bar, a fuse link connected between the terminal strips, said fuse link being provided with blow points located adjacent the ends of the terminal strips, a clamping member carried by each of said terminal strips for securing the fuse link in position, each of said clamping members being provided with an arcing tip extending beyond the end of the corresponding terminal strip to receive any arc formed upon rupture of the fuse at the blow points, the arms of the U-shaped clip members extending beyond the ends of the terminal strips near the corresponding blow points in the fuse link, thereby to provide a magnetic flux to extinguish the arc at the blow points.

7. A renewable electric fuse comprising, in combination, an elongated bar of insulating material having a pair of opposed faces, a conducting terminal strip member overlying a portion of the bar at each end thereof to be engageable with one of said faces, a U-shaped clip member overlying the opposite face of each of said bar portions to have the clip base substantially parallel thereto while the clip arms extend toward said terminal strip, means comprising a projection on one of said members interlocking said strip and said clip to prevent separation of said member by transverse movement between them without limiting relative longitudinal movement therebetween, a fuse link extending between the terminal strips, and screw means engageable with said terminal strip and extending through registering bores in said bar and said clip for securing said link to said strip and for locking said bar, said strip and said clip against relative longitudinal movement thereby effecting a sturdy assembled relationship.

8. A claim in accordance with claim 7 in which said means interlocking said clip and said strip comprises a projection on each of the arms of said U-shaped clip, a complementary recess on each side of said terminal strip whereby said U-shaped clip and said terminal strip are interlocked to prevent transverse movement in one direction, and a compression spring member interpositioned between said terminal strip and said insulating bar to limit transverse movement of said clip and said bar in the opposite direction.

9. A claim in accordance with claim 7 wherein said U-shaped clip and said terminal strip have complementary projections preventing relative transverse movement in one direction and wherein a resilient compression member is positioned between said terminal strip and said insulating bar to limit relative transverse motion in the other direction.

FRED G. VON HOORN.

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