

April 18, 1939.

C. L. MATTHEWS ET AL

2,154,688

FUSE

Filed Feb. 10, 1936

2 Sheets-Sheet 1

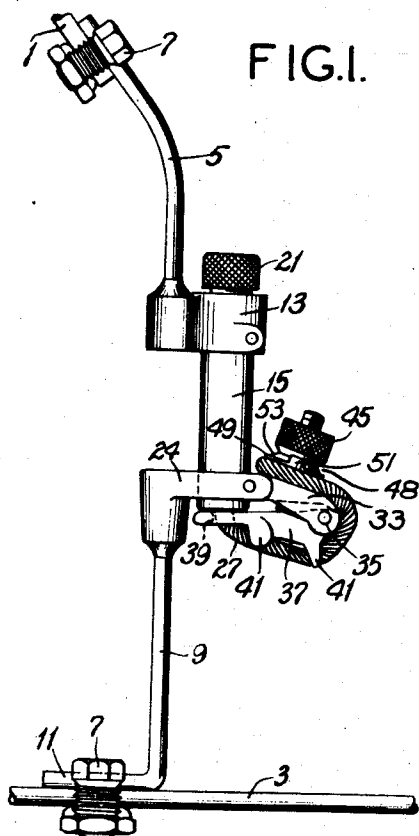


FIG. 1.

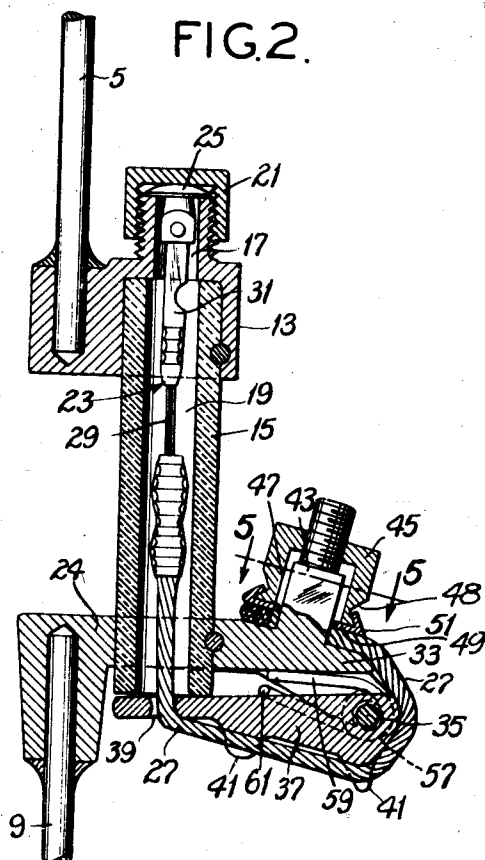


FIG. 2.

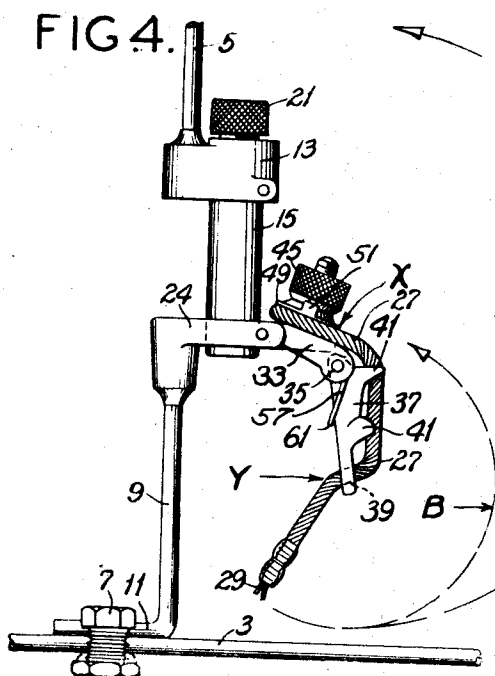


FIG. 4.

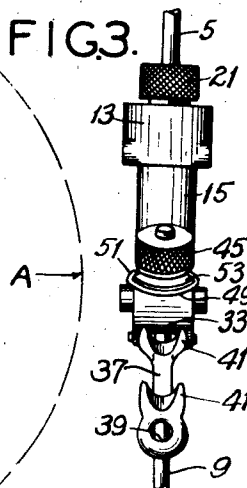
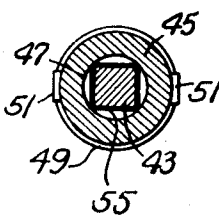


FIG. 3.

FIG. 5.



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FIG. 6.

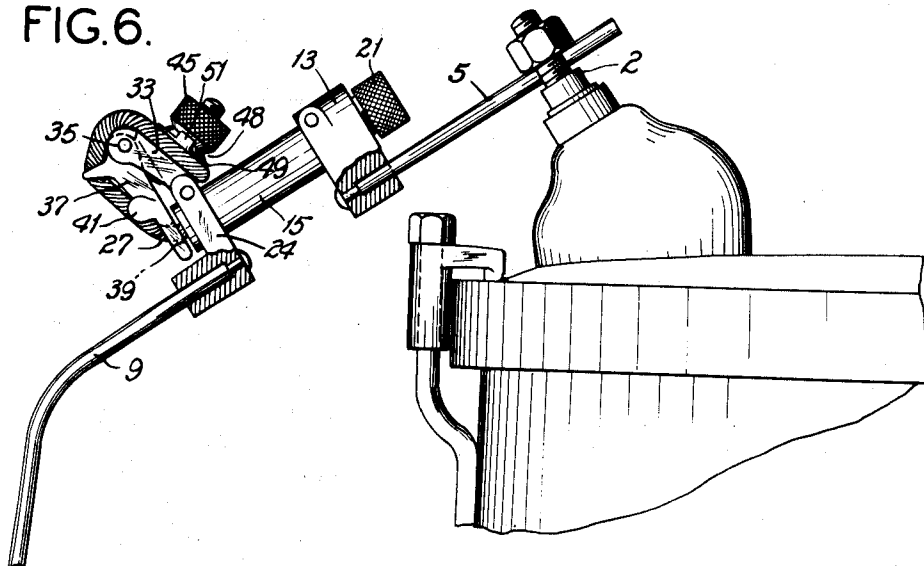
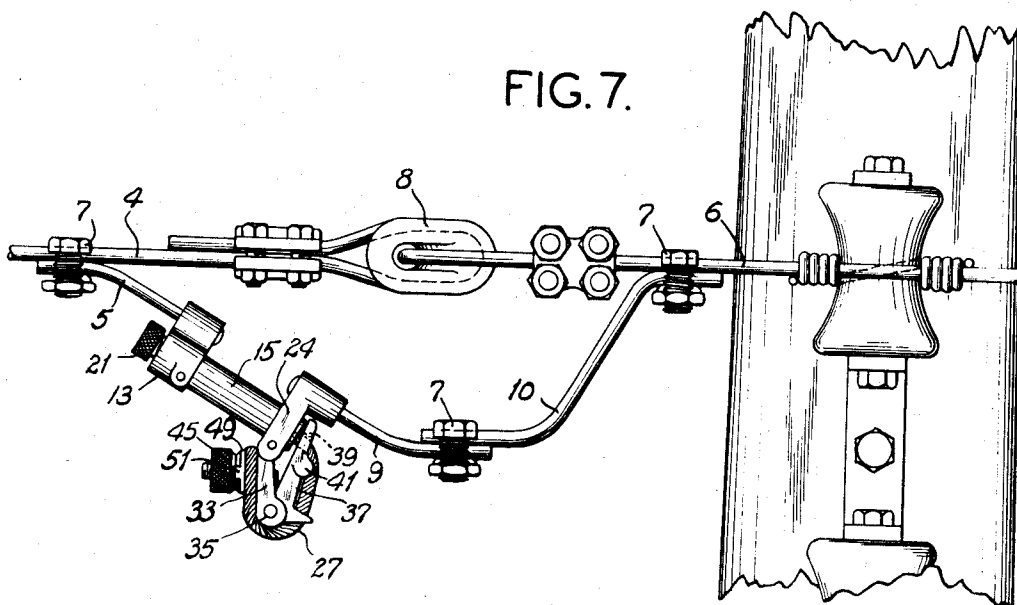


FIG. 7.



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UNITED STATES PATENT OFFICE

2,154,688

FUSE

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Application February 10, 1936, Serial No. 63,098

7 Claims. (Cl. 200—117)

This invention relates to fuses, and with regard to certain more specific features, to fuses having means for separating the fuse ends upon blowing.

Among the several objects of the invention may be noted the provision of a simple and economical form of fuse cutout which is adapted to be connected between a transformer secondary or the like and adjacent apparatus without a special mount or enclosure; the provision of a device of the class described, which despite its lack of mounting or covering, is positively safe and reliable in opening the circuit, without the possibility of an accidental non-fused reclosure of the circuit through the burned fuse link; the provision of a fuse cutout which may be universally used in connection with various apparatus; and the provision of a device of the class described having a fuse-link terminal which prevents undesirable destructive action on the link when making a fastening. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, features of construction, and arrangements of parts which will be exemplified in the structures hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which is illustrated one of various possible embodiments of the invention,

Fig. 1 is a side elevation showing one application of the device;

Fig. 2 is an enlarged vertical section of one form of the invention;

Fig. 3 is a fragmentary right-side elevation of Fig. 1 but showing a fuse pulling device in open position and without a fuse link therein;

Fig. 4 is a view similar to Fig. 1 showing the apparatus in blown condition;

Fig. 5 is a cross section taken on line 5—5 of Fig. 2;

Fig. 6 is a side elevation, parts being broken away, and showing an alternative form and application of the invention; and,

Fig. 7 is a side elevation showing another application.

Similar reference characters indicate corresponding parts throughout the several views of the drawings.

Referring now more particularly to Fig. 1, there is shown at numeral 1, for example, a secondary outlet tap of a transformer which it is desired, through a fuse, to electrically connect with a

wire such as shown at 3. It is to be understood that the invention may be applied directly to the secondary transformer studs where taps are not used and to other connections than secondary taps or studs of transformers, and that it has general utility in the electrical field, both for high and low voltages. For instance, in Fig. 6, the device is shown attached to a transformer stud 2, and in Fig. 7 it is shown electrically connecting line wire sections 4 and 6 which are mechanically joined by the strain insulator 8. In this case an insert wire 10 may be used. As will be clear from the following specification, the device will accommodate various fuse links adaptable for primary and secondary applications. Other applications may be thought of with the above as examples.

At numerals 5 and 9 are shown deformable conducting terminals composed of material such as heavy bendable (but in the drawings non-flexible) copper wires, which are initially made straight and so delivered to the user. The user then bends and/or cuts off portions of these terminals 5 and 9 to suit his needs, and, as illustrated in the drawings, they have been bent to suitable positions. Thus an electrical connection may be made by means of a connector 7 of known type, to any size of conductor wire which is within the range of the connectors 7. As shown in Fig. 6, bending may not be necessary.

It is to be understood that the wires 5 and/or 9 may be flexible and that the term "deformable" is meant to be generic to the terms "flexible" and "bendable".

Between the terminals 5 and 9 is located the cutout per se, but it is to be understood that it and the terminals 5 and 9 form a unit when delivered to the customer, with the wires 5 and 9 preferably, though not necessarily straight and solid, but as above forecast they may be flexible wires.

In the form of the invention shown in Fig. 1, the upper terminal 5 forms a rigid extension from an upper terminal socket 13 within which is held the upper end of an insulating, expulsion tube 15. The terminal socket 13 has an upper inlet 17 which is in alignment with the opening 19 of the insulating tube 15. The element 13 is threaded about said opening 17 to accommodate a cap 21 which may be removed to permit insertion of a fuse link 23, the head 25 of which rests upon the upper end of the element 13 and which is clamped in place by replacement of the cap 21.

The lower end of the tube 15 passes through

and is held to a lower conducting socket 24 from which the terminal 9 forms an extension. The lower end of the tube 15 is open to accommodate passage therefrom of the lower, flexible conducting wire 27 of the link 23. The upper end of the wire 27 is fastened to a fusible portion 29, and the upper end of said fusible portion 29 is in turn connected to a second conducting portion 31 which connects with said head 25.

The wires 5 and 9 may be soldered or sweated in their sockets, as shown in Fig. 2, or be riveted, as shown in Fig. 6.

The socket member 24 extends, as shown at numeral 33, to form a support for a pin 35. The pin 35 serves as a pivot for an arm 37 which has an opening 39 therein for accommodating passage therethrough of the conducting portion 27 of the link 23. The arm 37 may swing on the pin 35 from the position shown in Fig. 4 clockwise to that shown in Figs. 1 and 2, in which latter position said opening 39 is in substantial alignment or adjacent to the opening 19 through the tube 15.

The underside of the arm 37 is provided with a plurality of guiding lugs 41 for positioning the conductor 27 under and on the arm 37. The conductor is thus led around the rear end of the arm to a position over said extension 33. Here the conductor 27 is wrapped about a stud 43 which at its base is of a square cross section (Fig. 5) and at its top is of a round cross section and threaded (Fig. 2).

A thumb nut 45 is threaded to the upper threaded portion of the stud 43 and is provided with a round counterbore which clears the corners of the square base of said stud to form a skirt 47. This skirt is externally grooved as at 48. A washer 49 has ears 51 which are crimped into the groove 48. The washer 49 has a square opening 55 therein. The nut 45 and washer 49 are relatively rotatable but have no relative movement of translation. By this construction there is provided a rotatable nut 45 which is adapted to drive the washer 49 down on the end of the conductor 27 without rotation of the washer. The washer can slide on the square shank but cannot rotate, while the nut can both rotate and move endwise. There is relative rotary motion during adjustment between the ears 51 and the flange 53 but no relative longitudinal motion. Thus there is provided means whereby the ends of the component wires in the flexible wire 27 only compress upon making a juncture, rather than twist and fray.

A spring 57 is wound about the pin 35 and has one arm 59 reacting under the extension 33 and another arm 61 reacting over the lever 37, thus to push the lever downwardly.

To prepare the device for operation, the cap 21 is unscrewed and the link 23 threaded through the opening 17. The cap 21 is then reapplied and the head 25 of the link thus held in electrical contact with the socket 13. The upper conductor 31 extends into the tube 15, the latter surrounding the fusible portion 29. The lower, flexible conducting element 27 extends downward, from the lower open mouth of the tube 15, and is threaded through the opening 39, around the lever 37 and clamped by rotating the thumb screw 45. During this threading and clamping operation, the lever 37 is turned upwardly to the position shown in Figs. 1 and 2, thus tensioning the spring 57 and causing the lever 37 to tension the fuse link.

Upon blowing of the link 23, under heavy over-

load conditions, the gases formed by the fusion at the fusible portion 29 will more or less violently eject the conductor 27. The lever 37 will move counterclockwise until the rear set of lugs 41 strikes the back of the extension 33, thus limiting the counterclockwise motion of said lever 37 to the position shown in Fig. 4. Any tendency for the flexible conductor 27 to whip upwardly through an arc, is limited to the small dotted-line circle B shown around center Y, that is it cannot whip upwardly and into contact with the live member 5, or parts associated therewith along the arc A on center X.

The above construction is quite different from those heretofore employed, in which the means for whipping out the lower or flexible conducting element of the fuse have, in effect, had the conducting elements swing around a higher center somewhere near the center X (Fig. 4), thus also leaving a greater length of flexible whipping wire which could swing up on the higher center and reach the live portions of the circuit. In short, this invention provides a means for lowering the center of swing of the flexible, separated conducting portion of the link after blowing. It also reduces the length of the portion of 27 which swings. In Fig. 4, the radius of arc A is the old free length of swing on center X; and the radius of B is the new limited free length of swing on the lowered center Y.

It is to be understood that if the overload is of the so-called dragging variety, then the explosive feature may not come into operation and the flexible link will merely be pulled downwardly by the arm 37, without any tendency in any event to again swing upwardly. However the free swinging radius is still limited which is advantageous. It will be seen from this that the invention is serviceable, both in cases where overloads provide the expulsion action and where they do not.

Another feature of the invention, when used under any conditions, is that the position of the arm 37 provides a visible indication as to whether or not the cutout has functioned, and saves time in the location of blown out fuses. For instance, in the case of Fig. 4, it is quite clear that the fuse has blown.

It is to be understood that although the invention is primarily useful for unenclosed fuses, it is also useful in connection with box type or enclosed fuses, because it prevents any excessive length of fuse link from whipping out and swinging from the open lower end of the box and into contact with outside wires or the like.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in carrying out the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

We claim:

1. A fuse comprising spaced contacts, a fuse link having a fusible portion and including a flexible portion electrically connected between said contacts and having a turned portion therebetween, and means pivoted to one of said contacts and having an opening through which said fuse link is passed at said turned portion and between its points of connection with said contacts,

said link being permanently attached to the fuse at a point below the fusible portion of the link.

2. A fuse comprising spaced contacts, a fuse link having a flexible portion held to said contacts and extending therebetween, an insulating tube between said contacts and surrounding a portion of said link, said link extending from the tube, means pivoted to one of said contacts and having an opening adapted to be positioned adjacent the tube outlet in one position of said pivoted means, the flexible portion of said link being threaded therethrough, means normally tensioning said pivoted means to withdraw a portion of the fuse link from the tube upon blowing of the fuse, and limiting stop means between said pivoted member and the contact to which it is pivoted, whereby upon withdrawal of said flexible portion, the center of whip of the same is moved away from the pivot contact.

3. A fuse comprising spaced upper and lower contacts, a fuse link having a flexible portion electrically connecting said contacts, an insulating tube joining said upper and lower contacts and surrounding a portion of said link and having an opening below the lower contact, said link extending from said lower opening, an arm pivoted to said lower contact and having an opening adapted to be swung adjacent to the lower opening in the tube, said link being threaded through said arm opening when connected to at least one of said contacts, spring reacting means between said arm and said lower contact adapted normally to tend to withdraw the fuse link from the tube, and stop means between said arm and said lower contact adapted upon blowing of the fuse to maintain the substantial center of whip of the flexible portion of the link to a point substantially below the lower contact.

4. A fuse comprising spaced upper and lower contacts, a fuse link having a flexible portion electrically connecting said contacts, an insulating tube joining said upper and lower contacts and surrounding a portion of said link and having an opening below the lower contact, said link extending from said lower opening, an arm pivoted to said lower contact and having an opening adapted to be swung adjacent to the lower opening in the tube, said link being threaded through said arm opening when connected to at least one

of said contacts, spring reacting means between said arm and said lower contact adapted normally to tend to withdraw the fuse link from the tube, stop means between said arm and said lower contact adapted upon blowing of the fuse to maintain the substantial center of whip of the flexible portion of the link to a point substantially below the lower contact, and means on the pivoted arm adapted to hold the flexible portion of the fuse link threaded under said arm when in connected position.

5. A fuse comprising spaced contacts, an expulsion fuse mechanism electrically connecting said contacts, and deformable extensions extending from said contacts for connection with portions of an electric circuit, said deformable extensions comprising cylindric conductors which are adapted to be bent and cut in the field but which are strong enough to support the fuse in the circuit, the spaced contacts, mechanism and extensions forming a rigid unit when mounted.

6. A fuse comprising spaced contacts, a fuse link held to said contacts and extending therebetween, said link having a flexible portion, an insulating tube between said contacts and surrounding a portion of said link, said link extending from the tube and being turned back externally, means pivoted to one of said contacts and having an opening adapted to be positioned adjacent the tube outlet in one position, said link passing through said opening adjacent the region where it is turned back, and means biasing said pivoted means to withdraw a portion of the fuse from the tube upon blowing of the fuse, said link being permanently attached to the contact which supports said pivoted means.

7. An expulsion-tube current interrupter comprising a tube of insulating material, a fuse link within the tube consisting of a small fusible portion and a larger flexible portion, an arm hingedly mounted near one open end of the tube with a swinging end movable from closed-circuit position at the tube to open-circuit position away from the tube, and a ring opening at the swing end of the arm to receive the flexible conductor.

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