May 20, 1958 R. H. EARLE 2,835,764

FUSE CONSTRUCTION

Filed April 1, 1957 2 Sheets-Sheet 1

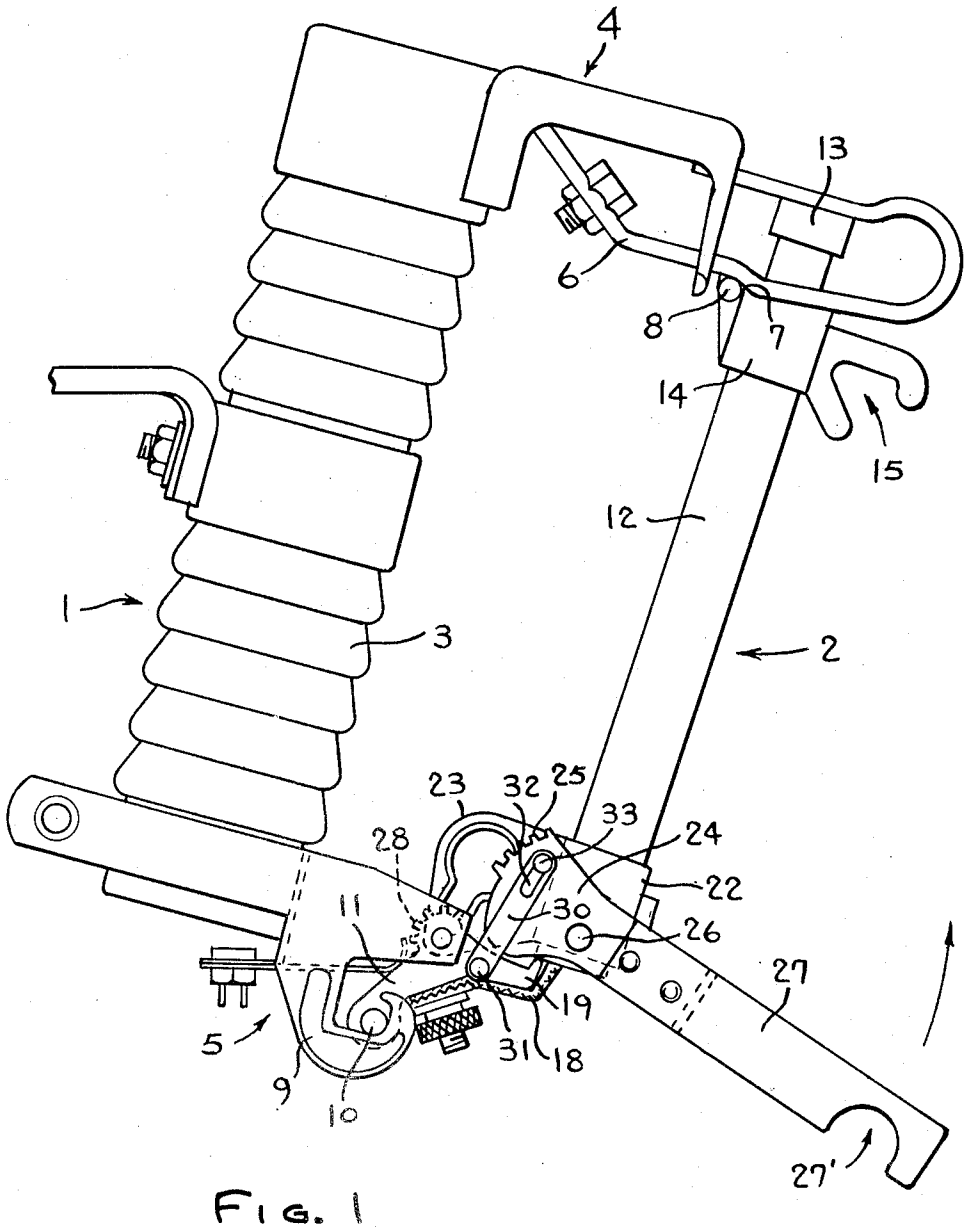


FIG. 1

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FUSE CONSTRUCTION

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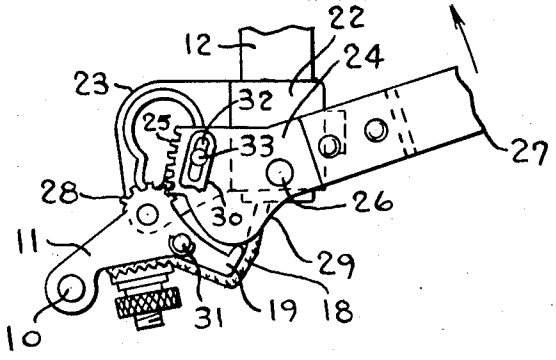


FIG. 4

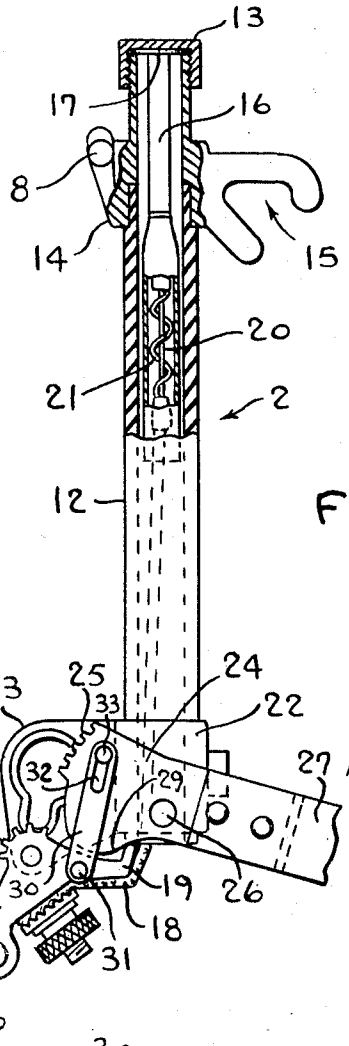


FIG. 2

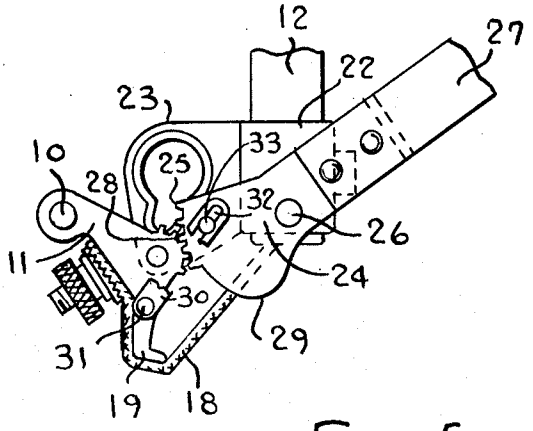


FIG. 5

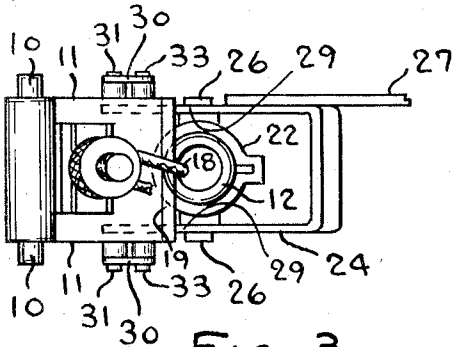


FIG. 3

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FUSE CONSTRUCTION

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Application April 1, 1957, Serial No. 649,770

6 Claims. (Cl. 200—114)

This invention relates to a circuit interrupter of the expulsion fuse type.

This invention is an improvement over that disclosed in the application of William E. Bracey, Serial No. 610,171, filed September 17, 1956, for expulsion fuse construction and assigned to the same assignee as the present invention.

In the development of this type of invention an expulsion fuse constructed was employed in which the fuse link could operate in the normal capacity on overload to extinguish the arc within the fuse tube by an expulsion action. The next step in the development of the general invention was to provide in addition to the normal action of the expulsion fuse construction, a further mode of operation whereby the fuse link could be manually broken or interrupted within the fuse tube, while carrying normal load current by manual manipulation of suitable parts of the device. Under these conditions the same type of expulsion action took place and the device cleared itself within the fuse tube in a sure and reliable manner. However, it was found that certain types of fuse links required an excessively long pull and, to meet this demand, fuse link rupturing manually operable means were added to the expulsion fuse tube construction whereby the stroke of the fuse link extracting lever was very much increased upon operation of a manually manipulable or operable lever. However, it was found that this change caused a lesser pull on the fuse link throughout the entire stroke than heretofore, because of the lengthened stroke of the fuse link extracting lever.

This invention, as stated, is an improvement over the preceding invention last noted hereinabove. In the present construction a primary object of the invention is to divide the stroke of the fuse link extracting lever and the manually manipulable lever into two portions, the first portion being obtained without sacrificing the intensity or force of the pull exerted on the fuse link, and the second portion of the stroke being provided so as to have a very long stroke of the fuse link extracting lever which necessarily lessened the pull on the fuse link throughout this second portion of the stroke. The above noted arrangement produced a very desirable result indeed and could be satisfactorily used with common types of fuse links which require a very long pull such as those which had a strain wire that took the normal strain of the fuse link and a fusible section which had to be greatly elongated before it ruptured. With this invention the strain wire is first broken as a heavy pull is placed thereon, and following this, a lighter pull is placed on the fusible section, this lighter pull, however, being accompanied by a very much elongated stroke of the fuse link extracting lever.

An embodiment of the invention is shown in the accompanying drawings in which:

Figure 1 is a side elevation of the apparatus.

Figure 2 is a view of the fuse tube assembly with parts broken away and parts in section.

Figure 3 is a bottom view of the structure shown in Figure 2.

Figures 4 and 5 are views showing the manually operable lever and associated parts in successive positions during the manual rupturing of the fuse link.

Referring to the drawings it will be seen that the fuse tube construction comprises a support assembly indicated generally by the reference character 1, and an expulsion fuse tube assembly indicated generally by the reference character 2. The support assembly comprises an elongated insulator 3 provided with upper and lower stationary contacts indicated generally by the reference characters 4 and 5, respectively. The upper stationary contact 4 comprises a spring member 6 provided with a shouldered portion 7 behind which projecting pins 8 of the upper contact 14 of the fuse tube are positioned to yieldingly lock the upper end of the fuse tube in position, the fuse tube being pivotally supported from the hooklike members 9 of the lower stationary supporting contact 5. The fuse tube has trunnions or pins 10 on a fuse link extracting lever 11, and the pins or trunnions 10 are removably received in the hooklike members 9.

The fuse tube 12 is a dropout expulsion type fuse tube and is closed at its upper end by means of the screw cap 13 and is open at its lower end as shown in the prior construction. As in the prior construction, the upper movable contact 14 of the fuse tube assembly 2 has a ferrule secured to the upper end of the fuse tube 12. This ferrule is provided with a downwardly and outwardly opening eyelet 15 adapted to receive a switch stick so that the fuse tube may be rocked into service position about the pivoted lower end.

The fuse tube houses a fuse link indicated by the reference character 16 and this link is provided with a disc-like upper portion 17 which is clamped in position by the screw cap 13 as shown in Figure 2 and described in the prior application. The fuse link leader 18 extends from the open lower end of the fuse tube 12 and over the outer end or lip 19 of the fuse link extracting lever 11 as shown most clearly in Figure 2.

Between the upper portion of the fuse link and the lower portion thereof a strain wire 20 is positioned and an elongated fusible member 21 is loosely coiled about the strain wire and joins the upper and lower portions of the fuse link as shown in Figure 2.

Under normal conditions when an overload occurs the strain wire 20 is ruptured and the parts of the fuse link separate due to the pull of the fuse link extracting lever 11 which is actuated by the weight of the fuse tube 12 and associated parts and by the downward pressure exerted by the spring portion 6 of the upper contact. The fusible section 21 immediately melts on overload after the strain wire is melted and rupture occurs between the two sections of the fuse link, the resulting arc being extinguished by expulsion action within the fuse tube 12.

The lower contact of the fuse tube includes the lower ferrule or member 22 secured to the lower portion of the fuse tube 12 and provided with a rearwardly extending arm 23 suitably apertured to receive the hooklike end of the switch stick so that the fuse tube may be positioned in the lower contact supporting prongs or hooklike members 9 in the usual manner.

The fuse link extracting lever 11 is pivoted on the extension 23 of the ferrule 22 of the fuse tube assembly 2. A manually manipulable member is provided, and is indicated by the reference character 24. It has a pair of spaced segmental gears indicated at 25 and straddles the ferrule 22 and is pivoted thereon as indicated at 26. It is provided with an arm 27 which projects outwardly, as shown in Figure 1, and which is provided with a notch 27' to receive the hooklike portion of the switch stick so that it may be pushed upwardly by the switch stick and to cause an upward rocking of the manually manipulable member 24 through the successive positions shown in

Figures 1, 2, 4 and 5. If desired, the arm 27 may project in the opposite direction from that shown, so that it requires a downward pull.

It is to be noted that the fuse link extracting lever 11 is provided with segmental gears 28, see Figures 1, 2, 4 and 5, which mesh with the segmental gears 25.

The manually operable member 24, which is pivoted at 26 on the ferrule 22, is provided with a cam portion, indicated at 29, against which the upturned portion or lip 19 of the fuse link extracting lever 11 bears. A pair of small links 30 loosely connect the fuse link extracting lever 11 and the manually manipulable member 24. It is to be noted that these links 30 are pivoted on the fuse link extracting lever 11, as indicated at 31, and are provided with elongated slots 32 which slidably receive the pins 33 carried by the manually operable member 24. These links do not transmit motion from the manually manipulable member or lever 24 to the fuse link extracting lever 11 but merely serve to tie them together loosely without having any other function than this.

The operation of the apparatus is as follows:

Under normal conditions an overload ruptures the fuse link in the usual manner and an expulsion action takes place in the fuse tube and clears the line. However, when it is desired to interrupt the circuit while the device is carrying load current it is done manually by pushing upwardly on the lever or extension 27 of the manually manipulable member 24 and thereby rocking it in a counterclockwise direction as viewed in Figures 1, 2, 4 and 5. The first portion of the stroke results in moving the fuse link extracting lever 11 through the action of the cam 29 and the lip 19 of the fuse link extracting lever 11. At this time the greatest mechanical advantage is obtained and consequently the greatest pull is exerted on the fuse link thereby rupturing the strain wire at the initial portion of the stroke. Continued upward motion of the arm 27 of the manually manipulable member 24 results in the engagement of the segmental gears 25 and 28. This is accompanied by a rapid or extensive rocking motion of the fuse link extracting lever 11 which causes it to quickly move from the position shown in Figure 4 through the position shown in Figure 5 to thereby greatly and rapidly extend the fusible portion of the fuse link. However, at this time only a light pull is required to rupture the fuse link but a long pull is required and is obtained by this construction. The fuse link therefore although requiring a long stroke is easily ruptured within the fuse tube and an expulsion action takes place and the line is cleared.

It will be seen that this invention provides a novel form of expulsion fuse construction in which normal action on overload is obtained and in which also the fuse link can be ruptured within the fuse tube by manually manipulable means which require only a slight effort on the part of the user. Particular attention is called to the fact that this invention provides the greatest mechanical advantage at the initial portion of the operation of the apparatus when it is manually operated, and results in the greatest pull on the fuse link at this portion of the stroke. As the stroke progresses, a lesser pull is exerted but a longer pull is obtained, thereby insuring rupture of the fuse link within the fuse tube even when a fuse link requiring a long pull is used.

Although this invention has been described in considerable detail it is to be understood that such description is intended as illustrative rather than limiting as the invention may be variously embodied and is to be interpreted as claimed.

I claim:

1. A drop out expulsion fuse tube construction comprising a support assembly having upper and lower stationary contacts; a fuse tube assembly comprising a fuse tube closed at its upper end and open at its lower end and having upper and lower movable contacts normally engaging said upper and lower stationary contacts, a fuse link extracting member pivoted at a fixed point on the lower portion of said fuse tube assembly and having a rearwardly located trunnions pivotally supported from said support assembly, a fuse link within said fuse tube and extending outward from the lower open end thereof and electrically connecting said upper and lower movable contacts, an operating arm pivoted at a fixed point on said fuse tube assembly and having cam means engaging said fuse link extracting member for moving said fuse link extracting member through a predetermined distance upon motion of said operating arm, gear means initially having two disconnected gears one of which is carried by said fuse link extracting member and the other of which is carried by said operating arm, said two members of said gear means coming into mesh upon further motion of said operating arm after said cam portion has finished its motion in operating said fuse link extracting member, whereby an initially heavy pull is imparted to said fuse link and is followed by an extended and lesser pull.

2. A drop out expulsion fuse construction comprising a support assembly having upper and lower stationary contacts; a fuse tube assembly comprising a fuse tube closed at its upper end and open at its lower end and having upper and lower movable contacts normally engaging said upper and lower stationary contacts, a fuse link within said fuse tube electrically connecting the upper and lower contacts of said fuse tube and extending outwardly from the lower open end of said fuse tube, a fuse link extracting member pivotally supported from said fuse tube assembly and having rearwardly located trunnions pivotally supported from said support assembly, operating means including an operating arm pivoted at a fixed point on said fuse tube assembly and having cam means for moving said fuse link extracting member with a large force for the initial portion of the motion of said operating arm and having gear means including normally disengaged gears, one of said gears being secured to said fuse link extracting member and the other of said gears being secured to said operating arm, said gears being arranged to come into mesh upon continued motion of said operating arm after said fuse link extracting member has been moved by said cam means.

3. A drop out expulsion fuse construction comprising a support assembly having upper and lower stationary contacts; a fuse tube assembly comprising a fuse tube closed at its upper end and open at its lower end and having upper and lower movable contacts normally engaging said upper and lower stationary contacts, a fuse link within said fuse tube electrically connecting the upper and lower movable contacts and extending outwardly from the lower open end of said fuse tube, a fuse link extracting member pivoted at a fixed point on the lower portion of said fuse tube assembly and having rearwardly located trunnions pivotally supported from said support assembly, said fuse link extracting member being controlled by said fuse link and normally holding said fuse tube assembly in service position, an operating member including an operating arm, said operating member being pivoted on said fuse tube assembly, said operating member having cam means normally engaging said fuse link extracting member for the initial portion of the motion of said operating arm and having a pair of gears arranged to come into mesh upon continued motion of said operating arm to give a further stroke to said fuse link extracting member after said cam means has become ineffective.

4. An expulsion fuse construction comprising a supporting member, an expulsion fuse tube carried by said supporting member and having upper and lower contacts, a fuse link electrically connecting the upper and lower contacts and located within said fuse tube, a fuse link extracting member pivoted at a fixed point on said fuse tube, an operating member provided with an operating arm and pivotally supported upon the lower portion

of said fuse tube assembly, said operating member having a cam portion normally engaging said fuse link extracting member for moving said fuse link extracting member through the initial portion of the fuse link extracting stroke and having gears carried by said fuse link extracting member and said operating member and being normally disengaged and coming into mesh when said cam means has become ineffective to move said fuse link extracting member, whereby motion of said operating member will cause initial motion of said fuse link extracting member by said cam means to be supplemented by further motion due to the interengagement of said gears.

5. A fuse construction comprising a support assembly having upper and lower stationary contacts, a fuse tube assembly comprising a fuse tube having upper and lower movable contacts normally engaging the upper and lower stationary contacts, a fuse link within said fuse tube electrically connecting the upper and lower movable contacts and extending outwardly from one end of the fuse tube, a fuse link extracting member pivoted at a fixed point on the lower portion of said fuse tube assembly, said fuse link extracting member being controlled by said fuse link and normally holding said fuse tube in service position, an operating member including an operating arm, said operating member being pivoted on said fuse tube assembly and having motion transmitting means coacting with said fuse link extracting member for the initial portion of the motion of said operating member, said operating member and said fuse link extracting member having a pair of gears arranged to come into mesh upon continued motion of said operating arm to give a further stroke to said fuse link extracting member after said motion transmitting means has become ineffective to rupture said fuse link.

6. A fuse construction comprising a support assembly having upper and lower stationary contacts, a fuse tube assembly comprising a fuse tube having upper and lower movable contacts normally engaging said upper and lower stationary contacts, a fuse link within said fuse tube electrically connecting the upper and lower movable contacts and extending outwardly from one end of said fuse tube, a fuse link extracting lever pivoted at a fixed point on the lower portion of said fuse tube, said fuse link extracting lever being controlled by said fuse link, and an operating member including an operating arm, said operating member being pivoted on said fuse tube assembly, said operating member having cam means normally engaging said fuse link extracting lever for the initial portion of the motion of said operating arm, a pair of gears one of which is operatively associated with said fuse link extracting lever and the other of which is operatively associated with said operating member, said gears being arranged to come into mesh to give a further stroke to said fuse link extracting lever after said cam means has become ineffective.

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