Dec. 30, 1947. B. R. HERMANN 2,433,666

ELECTRIC CIRCUIT INTERRUPTER

Filed April 15, 1944

Fig. 1.

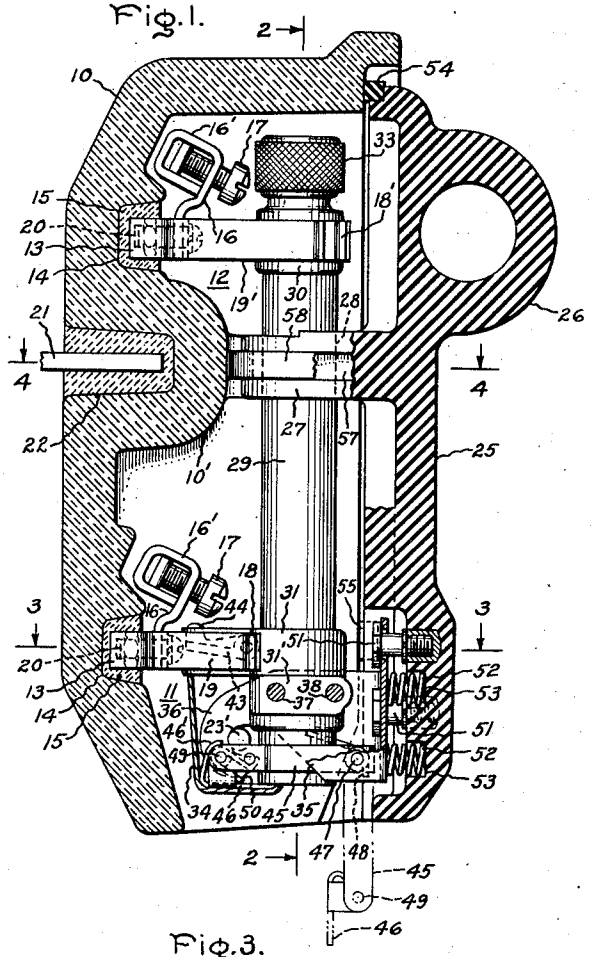


Fig. 2.

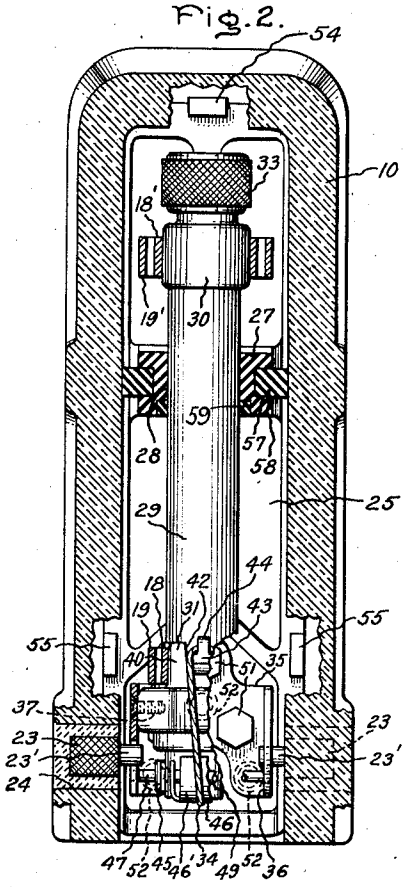


Fig. 3.

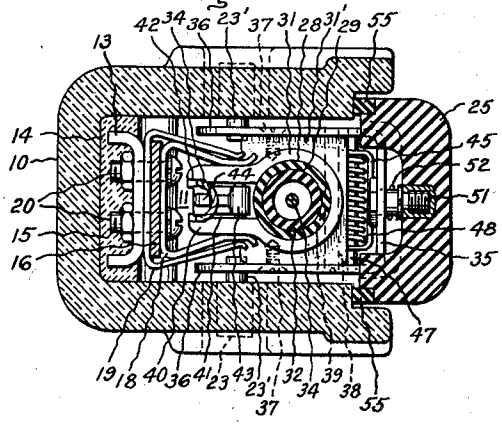
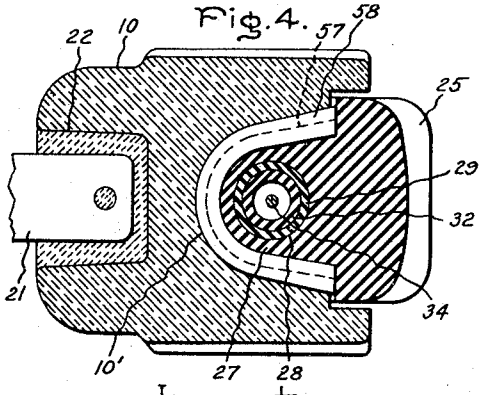


Fig. 4.



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ELECTRIC CIRCUIT INTERRUPTER

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2 Claims. (Cl. 200—114)

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My invention relates to electric circuit interrupters, and more particularly to an expulsion type circuit interrupter such as a fuse cutout, for use in distribution circuits, having a much higher interrupting capacity than similar interrupting devices used heretofore.

Fuse cutouts of various forms have been extensively used for protecting and controlling electric distribution circuits. Devices of this sort generally have a housing provided with a front opening with a cover, or door hinged to the housing, for closing this front opening. Usually a pair of terminals, or contacts, are mounted within the housing and a fuse tube is mounted on the cover and provided with contacts to engage the contacts or terminals in the housing when the cover is closed. Such cutouts are also generally provided with means for indicating whether or not the circuit interrupting device has operated.

My invention is concerned with an electric circuit interrupting device, or cutout, having a considerably higher current interrupting capacity than similar devices used heretofore. In the prior art circuit interrupters of the expulsion type have been limited as to current interrupting ability, first by inability to prevent flashover between the externally mounted conductive parts of the expulsion tube, second by inability to withstand the recoil forces attendant upon the expulsion action and third by mechanical rupture strength of the fuse tube. It is an object of my invention to provide a device more nearly or only limited as to current interrupting ability by the mechanical strength of the fuse tube which can be constructed with great resistance to mechanical rupture.

It is another object of my invention to provide a new and improved circuit interrupting device with greatly increased interrupting capacity.

It is another object of my invention to provide a new and improved form of gas barrier for preventing arc over between conductive parts of a circuit interrupter incorporating a circuit interrupting element of the expulsion type.

It is another object of my invention to provide a new and improved resilient mounting arrangement for the covers or doors of fuse cutout housings so as to eliminate any danger of breakage thereof.

Further objects and advantages of my invention will become apparent as the following description proceeds and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of my invention reference may be had to the accompanying drawing in which Fig. 1 is a side elevation, partly in section, of an electric circuit interrupter of the fuse cutout type embodying my invention, Fig. 2 is a view taken on line 2—2 of Fig. 1, Fig. 3 is a view taken on line 3—3 of Fig. 1, and Fig. 4 is a view taken on line 4—4 of Fig. 1.

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Referring now to the drawing, 10 indicates a housing or casing of porcelain or similar weatherproof insulating material having an integrally formed electric creepage barrier 10' which separates two stationary terminal assemblies generally indicated at 11 and 12, respectively, mounted within housing 10. Lower terminal assembly 11 comprises a U-shaped terminal support 13 which is adapted to be cemented into a pocket 14 in the lower part of housing 10. This pocket is preferably filled with a cementing material 15 which is poured hot into the recess 14. Terminal assembly 11 further includes a terminal 16 comprising a looped portion 16' into which a conductor may be inserted and firmly clamped into electrical engagement with terminal 16 by means of one or more clamping screws 17. In addition, lower terminal assembly 11 includes a U-shaped contact clip 18 and a U-shaped spring backing means 19. The contact clip 18, the spring backing means 19, the terminal 16, and the U-shaped terminal support 13 comprising lower terminal assembly 11, are assembled as clearly shown in Fig. 3 and joined as a unitary assembly by means of suitable fastening means such as rivets, or as indicated in Fig. 3 by bolts 20. The various portions of lower terminal assembly 11 are assembled as a unit and then suitably cemented into recess 14, the cement 15 substantially enveloping U-shaped member 13.

Upper terminal assembly 12, except for the contact clip and spring backing means, is identical in every respect with lower terminal assembly 11 and the corresponding parts thereof are designated by the same reference numerals. The contact clip of upper terminal assembly 12 is designated by the reference numeral 18' and differs from lower terminal assembly 18 mainly in being somewhat longer, the purpose of which will become apparent as the following description proceeds. Similarly, the spring backing means of upper terminal assembly 12 designated as 19' is very similar to spring backing means 19 of lower terminal assembly 11 differing mainly in the length thereof. The terminals 16 of the upper and lower terminal assemblies may, if desired, be constructed in the manner of the terminal disclosed in my prior copending application, Serial No.

422,901, filed December 13, 1941, now Patent No. 2,393,163 issued January 15, 1946, and assigned to the same assignee as the present application.

To the back of housing or casing 10 there is secured a mounting bar 21 for attachment of the cutout to a suitable supporting structure (not shown). This mounting bar 21 is preferably cemented into an external recess 22 in the housing 10 in the same manner that the U-shaped terminal supports 13 are cemented into position.

In addition to terminal supports 13 and mounting bar 21, in the embodiment as shown, a pair of hinge supports 23 are cemented into recesses 24 in the lower portion of the housing 10, one on either side of the housing. These hinge supports 23, best shown in Fig. 2, comprise hinge pin portions 23' one extending into housing 10 from either side thereof in diametrically opposed relationship. The remaining portion of each hinge support 23 is preferably enlarged and knurled in order to insure firm support as by cementing within its associated recess 24.

In order to provide a closure for housing 10 I provide a cover or door 25, preferably made of a molded, insulating compound or the like, which includes an integral handle or eye 26 which may be either grasped manually or engaged by a suitable form of switch stick to open and close the cover 25 with respect to housing 10. The cover 25 is provided with a barrier 27 arranged in opposed relationship with respect to creepage barrier 10', as will be described in greater detail hereinafter. Barrier 27 has an opening 28 therein which only affords sufficient clearance to accommodate a tube 29 or similar housing for a suitable expulsion type circuit interrupting device. Barrier 27 and opening 28 cooperate with tube 29 to provide a relatively long, close fitting joint which to all intents and purposes is gas-tight, when subjected to suddenly increased pressure on one side of the barrier. A suitable sealing means may be employed if desired. I have chosen to illustrate the member 29 as a fuse tube which may be of conventional construction but preferably having greater strength against forces which would cause rupture. A pair of terminals or contacts 30 and 31 are mounted thereon one adjacent either end thereof. The upper terminal or contact 30 threadedly mounted on the upper end of expulsion tube 29 is adapted to be electrically engaged by the contact clips 18' of upper terminal assembly 12, while the lower contact 31 is adapted to be electrically engaged by the contact clips 18 of lower terminal assembly 11. The fuse tube 29 preferably includes at least a lining 32, see Figs. 3 and 4, of gas evolving insulating material such as horn fiber or the like, which emits large quantities of arc extinguishing gases when subjected to the heat of an electric arc. These gases are expelled from the open lower end of fuse tube 29.

Mounted within fuse tube 29 is the conventional so-called "universal" fuse link, of the button head type, which is held in position by cap 33 screwed to upper terminal 30. As will be understood by those skilled in the art, the fuse link mounted within fuse tube 29 includes a fusible element which may or may not be paralleled by a strain wire. The fusible element and parallel arranged strain wire, if one is provided, are usually connected to a flexible conductor adapted to extend out of the open lower end of fuse tube 29. In the drawings only the flexible conductor 34 of the fuse link is visible. In the event of an excess current condition, the fusible element of the fuse link ruptures and the arc drawn is extinguished on the expulsion principle to interrupt the circuit between terminals 16.

The lower contact 31 associated with fuse tube 29 comprises an enlarged rectangular portion 31' including an opening having sufficient clearance to accommodate fuse tube 29. A U-shaped hinge member 35, best shown in Fig. 3 and comprising hook-shaped ends 36 for engaging the hinge pins 23', is securely fastened as by screws 37 to the rectangular portion 31' of lower contact 31 of fuse tube 29. Fuse tube 29, which is inserted in an opening in lower contact 31, is fastened thereto by means of a pin 38 extending both through hinge member 35 and the rectangular portion 31' of lower contact 31. The exterior of fuse tube 29, as is best shown in Fig. 3, is provided with a slot or recess 39 so that pin 38 acts as a key to securely fasten lower contact 31 to fuse tube 29.

Lower contact 31 is also provided with a rearwardly extending rectangular portion 40 which is adapted to be electrically engaged by contact clips 18 of lower contact assembly 11. Because of this rearwardly extending portion contact clips 18 may be shorter than contact clips 18'. The rearwardly extending portion 40 also provides a means for electrically connecting the cable portion 34 of the fuse link extending from the lower open end of fuse tube 29 to contact 31 and includes a clamping or snubbing device very similar to the one disclosed and claimed in United States Letters Patent 2,267,393, Bennett, granted December 23, 1941, and assigned to the same assignee as the present application.

This rearwardly extending portion 40 includes a trough or recess 41 which at the extreme rear of portion 40 is generally V-shaped, as indicated at 42, the apex of which is open toward the bottom. Pivotally mounted within recess 41 is an operating tongue 43. In securing fuse link cable 34 to the clamping device just described, the cable 34 is looped around the tongue 43 and behind the upwardly extending portion 44 thereof, as best shown in Fig. 3, with the ends of the loop extending out of the open apex of the V-shaped portion 42 of extension 40. The loop of the cable is then drawn as tight as possible around tongue 43. The tension applied to the cable 34 by the fuse link pull-out means to be described hereinafter pulls tongue 43 down into recess 41 so as tightly to clamp the loop of the cable between the edges of the tongue and the V-shaped portion 42 of recess 41. The greater the tension on the fuse link the more tightly is the cable 34 clamped in the clamping means described above. With this clamping device it is possible to secure the cable 34 to lower contact 31 very quickly and easily without the aid of any tools.

In order to provide prompt fuse link terminal separation upon rupture of fusible elements, particularly in that range of fault currents where there is not sufficient expulsion action caused by the arc in fuse tube 29, I have provided an articulated fuse link pull-out means which takes up a very small amount of space and yet which provides for a wide separation between the fuse link terminals. This articulated fuse link pull-out means, which is essentially the same as that disclosed and claimed in my prior copending application referred to above, comprises a pair of rigid members or arms 45 and 46, most clearly shown in phantom in the extended position (Fig. 1). Arm 45 is preferably constructed as a U-shaped member with the base of the U pivotally mounted to U-shaped hinge member 35, as indicated at 47. A suitable coiled spring 48 associated with pivotal

support 47 is provided to bias arm 45 in a counter-clockwise direction, as viewed in Fig. 1, so as to tend to assume the phantom position shown. Arm 46 is pivotally mounted as indicated at 49 to the free end of arm 45 and a suitable spring 50, see Fig. 1, biases arm 46 in a clockwise direction with reference to Fig. 1 so as to assume the phantom position indicated in Fig. 1. If desired, the free end of arm 46 may be provided with a forked or recessed end to accommodate conductor 34.

When the fuse device of Fig. 1 is loaded, arm 46 is rotated in a counter-clockwise direction with reference to arm 45 in the manner of a jack knife moved to the closed position and arm 45 is rotated in a clockwise direction about pivot 47 with reference to Fig. 1. The springs 48 and 50 therefore apply tension to the fuse link cable 34 to operate the clamping means described above. Upon rupture of the fusible element the articulated fuse link pull-out means is released to pull the lower portion of the fuse link from the end of the fuse tube 29 with high speed. This pull-out means assumes the position indicated by dotted lines in Fig. 1 upon rupture of the fusible element and consequently also functions as a suitable indicating means to indicate the condition of the cutout. It should be noted that the arm 46 includes a curved portion 46' which substantially protects the spring 50 from the hot gases expelled from the fuse tube 29 during the arc extinguishing operation.

I have found that when fuse cutouts are used to interrupt relatively high currents, the recoil force incident to fuse interruption becomes so great as to cause breakage of the doors or covers 25 which are generally constructed of relatively brittle material as compared to the mechanical strength that can be provided in other parts of the cutout such as tube 29. Heretofore, such cover members have generally been rigidly fastened to the fuse tube or hinge support. The recoil forces due to expulsion action drive the fuse tube 29 upwardly with respect to the hinge pin 23. Since the axis of the fuse tube is not in line with the hinge pins 23' the fuse tube tends to bow which in turn would put a transverse or bowing stress on the cover 25, which being relatively brittle might be broken if means for relieving the stress were not provided. In accordance with my invention, I permit the relatively strong fuse tube 29 to receive the recoil shocks directly from the hinge supports and fasten the door to the hinge supports by means which will relieve the door from the bowing stress. Accordingly, I have illustrated the U-shaped member 35 as being fastened to the lower portion of door or cover 25 by means of screws 51. I also provide a plurality of coiled springs 52 mounted in recesses 53 in cover 25 for engaging the base of the U-shaped member 35. These springs, three being shown in the drawings arranged like the legs of a tripod with their axes perpendicular to the inner face of cover 25, are maintained in compression by bolts 51 and provide a resilient connection between the door or cover 25 and fuse tube 29 permitting the tube 29 to bow without bowing the door 25.

In order to further cushion door or cover 25 which by action of the recoil forces tends to be slammed closed, I provide resilient inserts 54 and 55, best shown in Figs. 1, 2 and 3. These resilient inserts, which may be sponge rubber or the like, are suitably cemented to the edge of the cover within suitable recesses formed therein. The resilient member 54 is fastened to the upper edge of cover 25, while two resilient members 55

are provided on either side of cover 25 near the lower portion thereof. These resilient members 54 and 55 cushion the door or cover 25 with respect to housing 10. I have found that with the above arrangement breakage of door or cover member 25 on cutouts used for interrupting high currents is substantially eliminated.

In accordance with my invention I provide a substantially gas-tight barrier between upper and lower terminal assemblies 12 and 11, respectively, to prevent hot gases expelled from the circuit interrupting device from bridging these terminal assemblies and causing failure of the circuit interrupting device. The use of barriers or dams for this purpose has been employed heretofore as disclosed and claimed in United States Letters Patent, Newton et al. 1,694,979, granted December 11, 1928, and assigned to the same assignee as the present application. However, such prior use has depended entirely upon the formation of a circuitous or restricted path to prevent the hot ionized gases from bridging the contacts. My experiments proved conclusively that such circuitous or restricted paths are not sufficient to prevent the gases from bridging the contacts when very large currents are interrupted such as are permitted with the high rupture strength it is practical to build into a well constructed tube 29. Therefore in order to approach even a fair percentage of the interrupting ability of such a fuse tube I have found it necessary to provide a sealing means such as a gas-tight barrier between the upper and lower terminal assemblies 12 and 11 respectively, thereby dividing the housing into a plurality of chambers between which gas cannot be interchanged upon the application of a suddenly applied pressure. In addition, I have found it necessary to construct the sealing means so as to prevent any electromagnetic radiations, such as ultra violet light, from the arc gases or other short wave length emissions from the arc from rendering conducting the air path between the upper and lower terminal assemblies 12 and 11 respectively, and thereby causing a flashover external to the tube 29 with the attendant destruction of the circuit interrupting device. To this end the barrier 27 formed integrally with door 25, is provided with a circumferential groove 57 within which is placed a resilient sealing member 58. This sealing member may comprise sponge rubber or the like and may be of the same material as resilient members 54 and 55, described above. Resilient member 58 is suitably fastened as by cementing or the like in recess 57 so that when door or cover 25 is closed resilient sealing member 58 is in sealing engagement with creepage barrier 10' as best shown in Fig. 4, to effectively isolate the upper and lower terminal assemblies by a gas tight and "light tight" barrier and thereby effectively prevent arc-over between conductive parts of the circuit interrupting device. A resilient sealing member 59 which may be made of the same material as resilient members 54, 55 and 57 may be provided as shown in Fig. 2 to insure light tightness between barrier 27 and fuse tube 29. By the expression "light tight" as used in this specification and claims is meant that the barrier prevents the transmission of short wave length emissions or electromagnetic radiations whether in the visible spectrum or not.

From the above description it will be obvious that the spring-backed contact clips 18' effectively latch the fuse tube and consequently cover 25 in the closed position, as well as electrically

connect upper terminal 16 with upper contact 30. Door or cover 25 may be rotated about hinge pins 23' and when the cover is sufficiently opened it may be completely removed from housing 10 to facilitate replacement of the fuse link associated therewith.

The operation of the circuit interrupting device of my invention will be obvious in view of the detailed description included above.

While I have shown and described what I at present consider the preferred embodiment of my invention, it will be understood by those skilled in the art that various changes and modifications may be made without departing from my invention and I, therefore, aim in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

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

1. A circuit interrupting device having a housing, a pair of terminal assemblies located in spaced relationship in said housing and each provided with means for receiving a contact of a circuit interrupting device, a tubular casing, means for pivotally mounting said casing in said housing, and a door for closing an open side of said housing, means for preventing shocks incident to operation of said circuit interrupting device from being transmitted from said tubular casing to said door comprising resilient means including a spring interposed between said door and said means for pivotally mounting said casing in said housing, said spring being arranged to have its axis substantially perpendicular to said door.

2. A circuit interrupting device having a housing, a pair of terminal assemblies located in spaced relationship in said housing and each provided with means for receiving a contact of a circuit interrupting device, a tubular casing, means for pivotally mounting said casing in said housing, and a door for closing an open side of said housing, means for preventing shocks incident to operation of said circuit interrupting device from being transmitted from said tubular casing to said door comprising a first resilient means interposed between said door and said means for pivotally mounting said casing in said housing, and a second resilient means for cushioning said door in its engagement with said housing.

BENJAMIN R. HERMANN.

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