Dec. 27, 1966 T. E. CURTIS 3,294,939

COMBINATION EXPENDABLE CAP HOLDER AND FUSE LINK RETAINER FOR ELECTRICAL DISTRIBUTION CUTOUT

Filed July 15, 1965

Fig. 1.

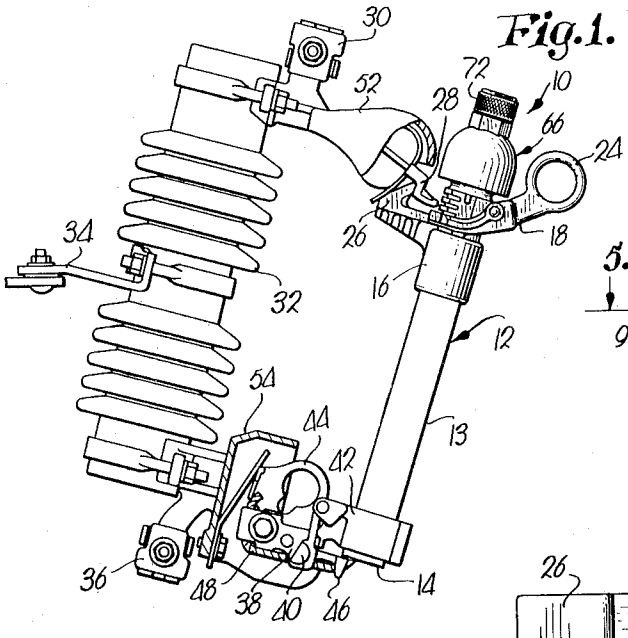
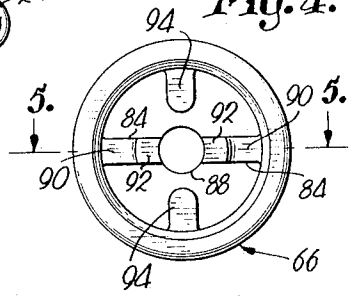


Fig. 4.



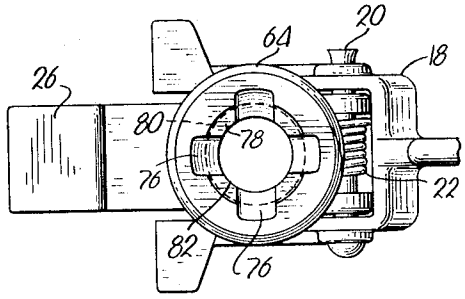


Fig. 3.

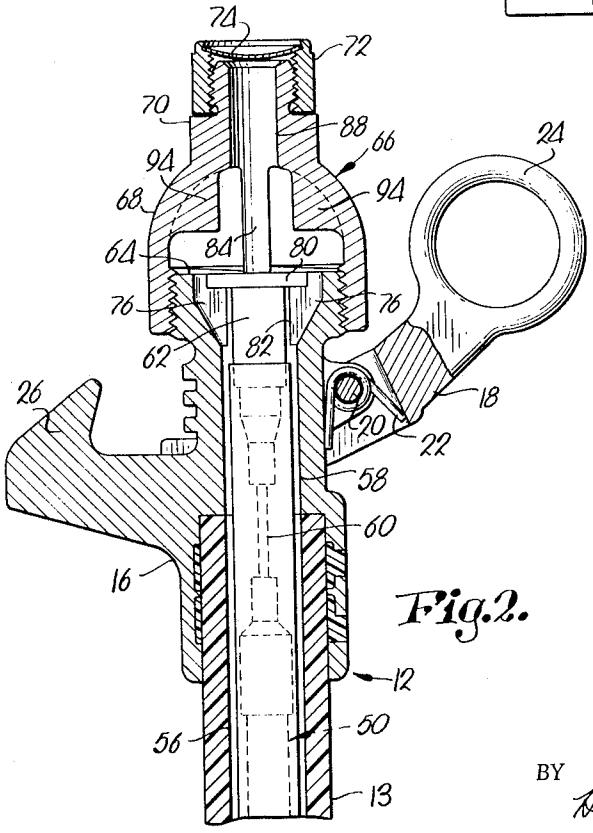
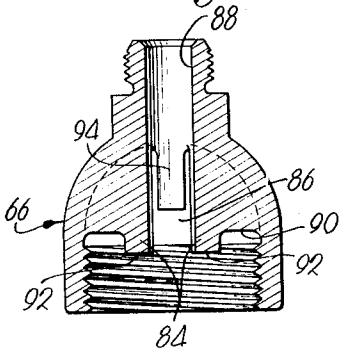


Fig. 2.

Fig. 5.



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COMBINATION EXPENDABLE CAP HOLDER AND FUSE LINK RETAINER FOR ELECTRICAL DISTRIBUTION CUTOUT

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This invention relates to improvements in electrical distribution cutouts and, more specifically, to structure for permitting the venting of gases produced during cutout interruption while simultaneously preventing ejection of the head of the current interrupting fuse link.

Distribution cutouts of the expendable cap type have gained wide acceptance in the art as a protective device for power distribution systems. The expendable cap is threaded on the end of a fuse holder containing a fuse link which melts at a predetermined overload current rating. Cutout interruption generates hot, high velocity gases which rupture the cap to permit venting of the gases at both ends of the fuse holder. Caps are obainable in various ratings corresponding to the fuse link ratings.

In smaller cutouts, i.e., 100 ampere continuous rating or less, the fuse holder is commonly constructed to permit the ejection of the head of the fuse link upon rupture of the cap by the expanding gases. This is acceptable since the head is of small enough mass that it becomes partially volatilized by the extreme heat of interruption and thus presents a minimum hazard to surrounding property or personnel.

Cutouts of higher ratings, however, utilize fuse links having substantially heavier heads. For example, the buttonhead of a typical 100 ampere fuse link weighs 0.35 ounce, while the head of a typical 200 ampere fuse link weighs 1.80 ounces. Due to the substantially larger mass, the 200 ampere fuse link head does not completely volatilize upon cutout interruption and thus becomes a dangerous, high velocity projectile if permitted to eject from the fuse holder.

It is, therefore, the primary object of this invention to provide means for trapping the head of a relatively high rating fuse link in the fuse holder of a distribution cutout upon interruption thereof while simultaneously permitting escape of the hot gases which would otherwise destroy the fuse holder and its associated components if not permitted to vent to atmosphere.

Another object of the instant invention is to provide a fuse link head retainer in the form of an adaptor which may be utilized in a conventional cutout fuse holder without modification of the fuse holder structure.

Still another object of the invention is to provide such a retainer which mounts the expendable cap on the upper end of the fuse holder and provides a means of adapting caps normally utilized with lower rating fuse links for use with links of higher rating.

A further, specific object of this invention is to provide a retainer for the buttonhead of a 200 ampere fuse link in the form of a hold-down cap mounted on the upper end of the fuse holder which, in turn, mounts a 100 ampere expendable cap to thereby, in addition to the advantages discussed above, eliminate the need to supply line service trucks with conventional 200 ampere expendable caps in addition to 100 ampere caps.

Other objects will become apparent as the detailed description proceeds.

In the drawing:

FIGURE 1 is an elevational view showing a distribution cutout embodying the features of the instant invention mounted in its associated support assembly;

FIG. 2 is a detailed view in longitudinal cross section of the upper portion of the fuse holder;

FIG. 3 is an end view of the fuse holder showing the upper end thereof with the retainer of the instant invention removed;

FIG. 4 is a detailed, bottom view of the retainer; and

FIG. 5 is a sectional view taken along line 5—5 of FIG. 4.

The numeral 10 broadly denotes a distribution cutout comprising a fuse holder 12 including a hollow, insulated tube 13 having an open, lower end 14. The upper portion of the fuse holder 12 is provided with a terminal 16 which carries a forked operating arm 18 mounted thereon by a pin 20. Arm 18 is biased by a spring 22 toward the position illustrated, movement of the arm in a clockwise direction being effected by a lineman utilizing a switch stick hooked through operating ring 24.

Terminal 16 has a projecting hook 26 which engages a catch 28 extending from a line connector 30 mounted on the upper end of a support insulator 32. The mid-portion of the insulator is secured to a supporting tower or pole (not shown) by a bracket 34. The lower end of insulater 32 carries a line connector 36 provided with a pair of laterally extending, stationary bearing elements 38 which receive opposed gudgeons 40 forming a part of a support assembly 42 secured to the lower end of fuse holder 12.

Assembly 42 includes a rotary contact member 44 and a spring-loaded link ejector 46, the latter being spring-loaded and shown in engagement with the lead or pigtail 48 of a fuse link 50 (FIG. 2). Sleet hoods 52 and 54 serve to protect the electrical contact surfaces of the latch 26, 28 and contact member 44.

A full description and illustration of the construction and operation of cutout 10 appears in Bridges et al., U.S. Letters Patent No. 3,026,391, granted March 20, 1962, and entitled "Fuse Cutout Operating Tool," said patent being incorporated herein by reference as may be necessary for a complete understanding of the operation of distribution cutouts of this type. Therefore, the remainder of this specification will be directed primarily to the improvements of the instant invention over cutouts of the general type shown and described in the aforesaid patent.

Fuse tube 13 has a central bore 56 registering at its upper end with a bore 58 in terminal 16. Fuse link 50 is received within bores 56 and 58 and includes a current responsive element 60 terminating at its upper end in a buttonhead 62. Head 62 is seated in the upper end 64 of fuse holder 12 defined by the upper extremity of terminal 16. A retainer 66 is threaded onto end 64 and has a dome-shaped body 68 integral with an upper, hexagonal extension 70 adapted to receive a wrench or other tightening tool. An expendable cap 72 is threaded on extension 70 and is provided with a pressure-responsive, frangible disc 74.

It should be understood at this juncture that the frangible disc 74 must be communicated with bore 56 of fuse tube 13 to render the disc responsive to the gas generated within the tube should element 60 be subjected to current of a sufficient magnitude to melt the element and thus break the fuse link. Cap 72 serves to protect the fuse holder from the effects of weather but, when cutout interruption occurs, disc 74 must rupture or venting of the gas would occur only at the lower end 14 of the fuse tube. Manifestly, venting at only one end would produce an upwardly directed force component which could be of sufficient magnitude to tear the cutout loose from its mountings and thus, of course, provide a very dangerous condition. Therefore, venting at both the upper and the lower ends of the fuse holder is essential if the prevention

of a resultant force due to the expanding gases is to be realized.

Accordingly, bore 56 of tube 13 is communicated with retainer 66 by the bore 58 in terminal 16 and four inclined, upwardly diverging grooves or vents 76 which terminate at the uppermost end surface of the fuse holder defined by end 64 thereof. A recessed, radially inwardly extending ledge 78 is located between adjacent grooves 76, the four ledges 78 serving as a seat for the flanged extremity 80 of buttonhead 62. The inner edges of ledges 78 define a central aperture 82 which receives the cylindrical, main body portion of head 62, it being apparent that the head is thus held against movement downwardly through tube 13. A downward bias is placed on fuse link 50 by the ejector 46 which applies spring pressure to the fuse link lead 48 (FIG. 1).

Retainer 66 is provided with a pair of opposed shoulders 84 projecting toward head 62. Shoulders 84 define an opening 86 therebetween centrally of the dome-shaped body 68, opening 86 registering with a bore 88 in extension 70. Each of the shoulders 84 has a relieved portion 90 which prevents substantial interference of the shoulder with the passage of gas through vents 76.

From the foregoing it may be seen that gas discharged through each of th events 76 reaches the frangible disc 74 of cap 72 via a passage through the clearance opening defined by the overlying relieved portion 90, opening 86 and bore 88, or alternatively, directly through opening 86 and bore 88 to disc 74, depending on the position of shoulders 84. FIGURES 4 and 5 clearly show that shoulders 84 are relatively thin in cross section and have a width somewhat less than the width of each of the grooves or vents 76. The final position of shoulders 84 upon engagement of faces 92 with head flange 80 will depend upon manufacturing tolerances in the forming of head flange 80 and variations in the mating male and female threads of the retainer and the fuse holder. Thus, the exact path of the discharging gases through the retainer is governed somewhat by the ultimate position of the shoulders with respect to the vents 76.

Retainer 66 is also provided with a pair of integral, opposed, laterally extending ribs 94 in substantially spaced relationship to one another and faces 92. Ribs 94 are angularly spaced 90° from the opposed shoulders 84; thus, the ribs do not interfere with the passage of gas to the frangible disc 74 but serve to distribute the hot gases throughout the internal chamber of body 68 as well as reduce heat erosion of the internal surfaces of the retainer.

In operation, fuse holder 12 is installed in the conventional manner through the use of a lineman's stick, as fully described in the aforesaid Patent No. 3,026,391. Thus, a complete description of the installation procedure and operation of the cutout when an overload condition occurs will not be set forth in this specification, it being sufficient to note that gudgeons 40 are seated in bearing elements 38 with the end of lead 48 secured to contact member 44 and with the spring-loaded ejector 46 in engagement with the lead, whereupon the hook 26 is placed in engagement with catch 28 to mount the fuse holder on its support structure. When the cutout interrupts, hook 26 disengages from catch 28 since the fuse link is broken, resulting in the release of the spring pressure of ejector 46 which lowers the fuse holder to a position where hook 26 clears the catch, permitting rotation of the fuse holder about the axes of gudgeons 40 until it hangs freely from the bearing elements 38. This positively breaks the circuit through the fuse holder to prevent the possibility of restriking internally of the holder.

When current through the current-responsive element 60 of fuse link 50 exceeds the rated value of the link, the current-responsive element volatilizes, the fuse link is severed, and an electric arc is established. Tremendous pressure is generated within the bore of the fuse holder which is proportional to the square of the fault current. Rapid expansion of these gases occurs throughout tube 13 resulting in venting at the lower end 14 thereof and pressurization of the upper portion of the tube and retainer 66. The frangible disc 74 of the expendable cap is selected to rupture at a preselected pressure to prevent destruction of the fuse holder, the gases thus also being vented to atmosphere at the upper extremity of the fuse holder via vents 76 and the passage through retainer 66 set forth in detail hereinabove.

If it is assumed that retainer 66 were not utilized but, instead, that an expendable cap of a size sufficient to receive the male threads surrounding the upper end 64 of the fuse holder were employed, then it is evident that rupture of the cap diaphragm would free head 62 for ejection from the upper end of the fuse holder. (Lead 48, of course, is ejected through the lower end 14 of tube 13 by the action of the spring-loaded ejector 46.) As discussed at the outset of this specification, particularly when fuse links having a 200 ampere rating or higher are utilized, the mass of head 62 is sufficiently great to form a dangerous, high velocity projectile if permitted to eject from the fuse holder.

It will be appreciated, therefore, that the head-engaging faces 92 of shoulders 84 forcibly retain the fuse link head in the seat formed by the four ledges 78 during the venting of the gases to atmosphere after rupture of disc 74. Faces 92 are dimensioned such that they do not extend over the edge of head flange 80 and thereby present no obstruction to the passage of gases from vents 76. The relieved portions 90 of the shoulders may be in direct overlying relationship to two of the vents 76, but the clearance provided prevents substantial obstruction of gas flow.

The provision of means for maintaining the fuse link head in the fuse holder while simultaneously providing a clear passage for the hot gases is important to the practical utilization of the instant invention since the gases produced upon cutout interruption have sufficient heat and pressure to severely erode retainer 66 if substantial back pressure is allowed to build up within the retainer. Thus, the provision of a substantially unobstructed passage for the gases is of importance if the retainer is to have sufficient strength to be reusable after it is subjected to a cutout interruption.

Another advantage of the instant invention is that it increases the maximum interrupting current capacity of the fuse holder as compared with prior art schemes for maintaining the head in the holder while permitting the gas to escape therefrom, such as, for example, vented fuse holders which retain the head in the holder by providing a force component transverse to the tube axis which is produced by the escaping gases. Additionally, the instant invention adapts 100 ampere expendable caps for use with 200 ampere fuse holders and fuse links, as may be appreciated in FIG. 2 by a comparison of the diameter of cap 72 with the diameter of the end 64 of the fuse holder.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In a distribution cutout for use with a fuse link having a current responsive element terminating in a head:

an elongated, link-receiving fuse holder having an open end provided with structure for seating said head therewithin,

said structure having a head-receiving aperture therein and means defining a plurality of gas vents spaced around said aperture;

a retainer on said end provided with a pair of spaced-apart shoulders projecting toward said aperture for engaging said head to hold the latter seated in said structure; and

a pressure responsive, frangible cap mounted on said retainer remote from said end,

said shoulders defining an opening therebetween registering with said cap and having relieved portions clearing said vents, whereby to provide a substantially

unobstructed passage communicating the vents with the cap,

said retainer being provided with spaced, laterally extending ribs aligned with said opening and spaced from said vents, whereby to reduce heat erosion of the retainer.

2. In a distribution cutout:

a fuse link having a current responsive element terminating in a head;

an elongated fuse holder receiving said link and having an open end provided with structure seating said head therewithin; and

a hollow retainer body on said end having shoulder means in the interior thereof projecting toward said head and engaging the latter to maintain the head seated in the structure,

said body being provided with a gas outlet and a frangible pressure responsive relief member normally closing said outlet,

said structure having means defining a gas vent through said end communicating said holder with said interior,

said shoulder means being configured to permit substantially unrestricted flow of gas through said body from said vent to said outlet, whereby gas generated during cutout interruption effects rupture of said member while the head is held against the force of the escaping gas to prevent ejection thereof.

3. The invention of claim 2,

said outlet being spaced from said vent,

said shoulder means including a pair of spaced shoulders defining a passage therebetween communicating with the outlet.

4. The invention of claim 3,

said holder and said body having mating, interengaged threads permitting relative rotation of the holder and body to bring said shoulders into tight engagement with the head,

said shoulders having relieved portions clearing said

vent, whereby to preclude blocking of the vent by either of the shoulders regardless of the relative positions of the holder and the body when said tight engagement is effected.

5. In a distribution cutout:

a fuse link having a current responsive element terminating in a head;

an elongated fuse holder receiving said link and having an open end provided with structure defining an aperture extending longitudinally of the holder and receiving said head,

said structure having means seating the head within said end and defining a plurality of gas vents spaced around said aperture outwardly of said head; and

a hollow retainer body on said end having spaced shoulders in the interior thereof projecting toward said head and engaging the latter to maintain the head seated in the structure,

said body being provided with a gas outlet and a frangible pressure responsive relief member normally closing said outlet,

said shoulders having relieved portions clearing said vents to thereby permit substantially unrestricted flow of gas through said body from said vents to said outlet, whereby gas generated during cutout interruption effects rupture of said member while the head is held against the force of the escaping gas to prevent ejection thereof.

References Cited by the Examiner

UNITED STATES PATENTS

1,407,706	2/1922	Smith et al.	200—132
1,502,883	7/1924	Sandin	200—132
1,550,504	8/1925	Condit	200—132
2,135,164	11/1938	Brock	200—127
2,583,440	1/1952	Oxley et al.	200—120 X

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