Nov. 14, 1939. F. J. McCLUSKEY ET AL 2,179,749

ELECTRICAL SWITCH

Filed Sept. 28, 1933 2 Sheets-Sheet 1

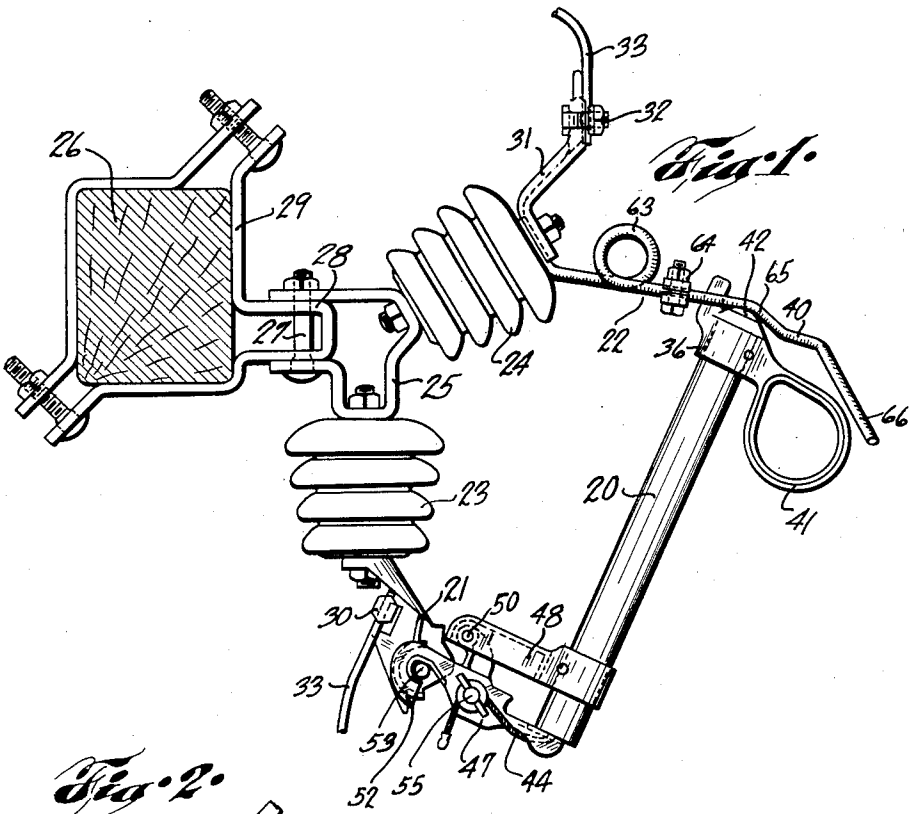
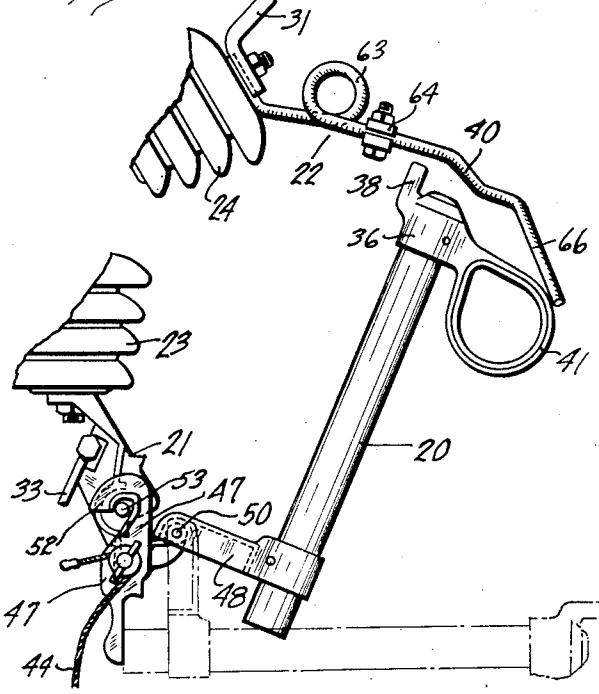


Fig. 1.

Fig. 2.



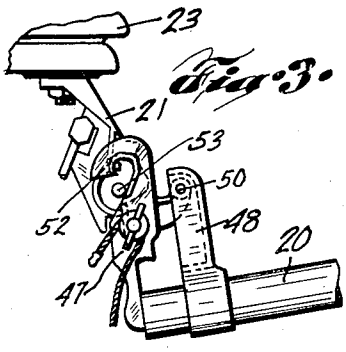


Fig. 3.

INVENTORS
FRANCIS J. McCLUSKEY
CHARLES ADIN FOX

BY

ATTORNEY.

Nov. 14, 1939. F. J. McCLUSKEY ET AL 2,179,749

ELECTRICAL SWITCH

Filed Sept. 28, 1933 2 Sheets-Sheet 2

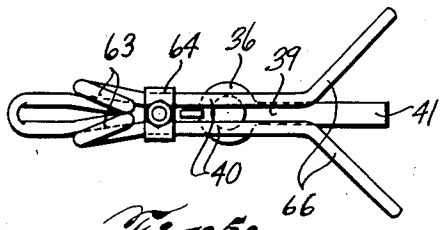


Fig. 5.

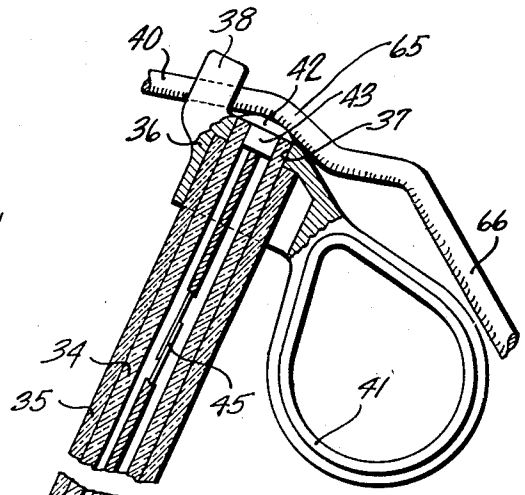
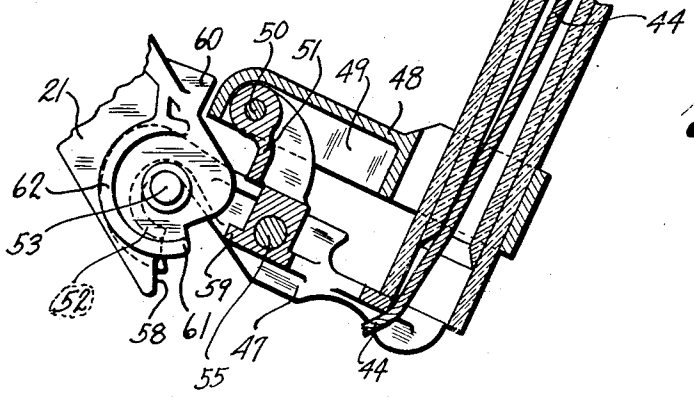


Fig. 4.



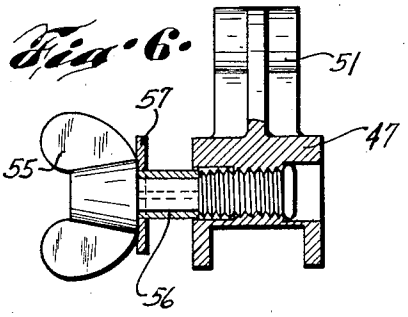


Fig. 6.

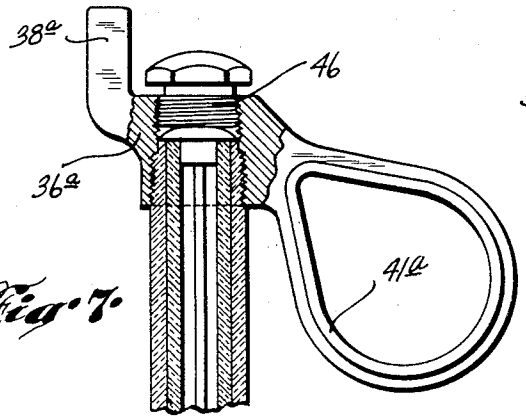


Fig. 7.

INVENTORS
FRANCIS J. McCLUSKEY
CHARLES ADIN FOX

BY

ATTORNEY.

Patented Nov. 14, 1939

2,179,749

UNITED STATES PATENT OFFICE

2,179,749

ELECTRICAL SWITCH

Francis J. McCluskey and Charles Adin Fox, St. Louis, Mo., assignors to James R. Kearney Corporation, St. Louis, Mo., a corporation of Missouri

Application September 28, 1933, Serial No. 691,280

14 Claims. (Cl. 200—114)

This invention relates to electrical switches, and more particularly to high tension fused disconnect switches.

An object of the present invention is to provide a device of the character described embodying a pivotally mounted fuse cartridge of expulsion type for completing a circuit between spaced terminal members, and improved means for causing the cartridge to swing automatically to open position responsive to fuse rupture.

Another object of this invention is to provide a switch of the character described embodying improved and simplified means for producing high contact pressures between the fuse cartridge and stationary terminal members.

Yet another object of this invention is to provide, in a switch of the character described, a pivotally and removably mounted fuse cartridge, one end of which is open to the atmosphere, the other end being closed by cap or head portion formed on the fuse link, such cap or head portion providing a contact surface adapted for direct, high pressure engagement by one of the stationary terminal members.

A further object of this invention is to provide an improved hinging mechanism for the fuse cartridge which cooperates with a resilient relatively stationary terminal member for producing tension in the fuse link when the fuse cartridge is disposed in closed position, the hinging mechanism functioning, when the fuse link becomes ruptured, to cause the severed link portions to be drawn apart very rapidly, whereby to assist in effecting a rapid extinguishment of the resultant arc.

Yet a further object lies in the provision of an improved binding post for the fuse link which is especially designed to prevent inadvertant rupturing of the link at the time of its installation in the cartridge.

Further objects are to incorporate the aforementioned features in a switch of extremely simple and practical design.

Other objects and advantages will appear from the following description and accompanying drawings.

In the drawings, Fig. 1 is a side elevation of a switch embodying the features of the invention; Fig. 2 is a fragmentary side elevation of the device of Fig. 1, the full line illustration of the cartridge showing the position of that member relative to the terminals immediately following fuse rupture, and before the cartridge has dropped to full open position, and the broken line illustration of the fuse cartridge in Fig. 2 showing that member in full, switch open position; Fig. 3 is a fragmentary side elevation of the lower terminal end cartridge assembly, the cartridge hinge member being shown lifted from the trunnions on the lower terminal to illustrate the manner in which the cartridge is applied to, and removed from the lower terminal; Fig. 4 is a sectional elevational view of the cartridge and associated parts, together with fragmentary portions of the upper and lower switch terminal members; Fig. 5 is a top plan view of the upper switch terminal member and cartridge; Fig. 6 is a sectional view taken transversely through the cartridge hinge member and illustrating a presently preferred construction of the fuse link binding post, and Fig. 7 is a sectional view, illustrating an alternate or modified construction of the upper cartridge terminal member.

Referring now by characters of reference to the drawings, reference numeral **20** designates a tubular fuse housing, or fuse cartridge which is removably and pivotally associated with the lower of a pair of relatively vertically spaced terminal members **21** and **22**, the upper terminal member **22** being adapted to engage the free end of the fuse cartridge when the latter is disposed in switch closed position as appears in Fig. 1. The terminal members, by preference, are mounted on individual insulators **23** and **24**, carried by an angulate strap **25** which is secured for angular adjustment, relative to a cross-arm support **26**, by means of a bolt **27** which extends vertically through horizontal portions of the strap **25**, and through a horizontal extension **26** formed on one section of a two piece cross-arm hanger bracket, designated generally at **29**. Line connection with the lower terminal **21** is effected by means of a connector **30**, and with the upper terminal **22** by means of a vertically extending arm **31** and connector **32**. The connectors **30** and **32** are preferably of split-bolt type and are shown as engaging line sections, designated **33**.

The fuse cartridge **20** is of so-called expulsion type and comprises an open-ended tube of insulating material. The tube is preferably of composite construction, embodying an inner tubular portion of horn fibre, and an outer tubular jacketing portion of Bakelite, or other insulating material having equivalent weather resisting properties. It has been found advantageous to employ horn fibre in the construction of the cartridge because of the fact that such material has a beneficial deionizing effect on the arc which occurs when the fuse link ruptures, aiding materially in causing the arc to become

quickly extinguished. In Fig. 4 the inner horn fibre, and the outer Bakelite tubes are designated **34** and **35** respectively. As appears in Fig. 4 the inner horn fibre tube 34 extends short of the outer tube **35**, at the lower end of the cartridge, and is preferably bevelled as shown. The enlarged mouth resulting from this provision occasions a reduction in the pressure at which the fuse vapors are discharged from the cartridge, and also facilitates the pulling of the lower fuse link section from the tube. A further advantage results from the aforementioned cartridge construction, in that there is less likelihood of moisture penetrating the junction of the tubes and causing warping or separation thereof. At the upper end of the cartridge the inner tube 34 projects beyond the outer tube 35, thereby forming a step or shoulder by which a terminal member or cap **36** is positioned on the cartridge. The member **36** is secured to the cartridge by suitable means, such as rivets or pins, and is provided with a bore 37 which snugly receives that portion of the inner tube which projects beyond the outer tube. It will appear that this construction precludes any possibility of the cap **36** being blown off of the cartridge by the fuse gases, and further, such gases are prevented from escaping from between the junction of the cap member and tube. Projecting longitudinally beyond the end wall of the cap **36** is a guide finger **38** which is adapted to move into the passage 39 (Fig. 5), formed between laterally spaced, resilient arm portions **40** of the upper terminal member **22**, during switch closing movement of the cartridge. Projecting laterally at one side of the cap **36** is a puller ring 41 which serves as a manipulating member for the cartridge.

In the embodiment of the invention illustrated in Fig. 4, the upper end of the cartridge is adapted to be closed or capped solely by means of a head element carried by, and forming a part of the fuse link. Such head portion comprises, in the present example, an externally convex disc **42** having an axially projecting plug **43** which provides a closure for the upper end of the cartridge. The portion **42**, when properly seated over the end of the member **36**, provides a contact surface for direct engagement by the resilient arm portions **40** of the upper terminal **22**. Due to its convexity, the disc will center itself relative to the resilient contact arms **40**, and the spring pressure will be distributed equally on opposite sides of the fuse head. It will appear that the spring contact arms bear upon the fuse head, to effect high pressure, low resistance contact with that element, and produce a substantially gas tight closure for the cartridge tube. The pressure on the end of the tube tends to move the cartridge axially downwardly, which, as will hereinafter appear, results in a tensioning of the fuse link, and also operates to produce high pressure, low resistance contact between the lower switch terminal member 21 and its companion cartridge terminal member.

The fuse link, designated generally 44, is provided with a fusible section, indicated at 45, of reduced current carrying capacity, and extends from the plug portion 43 of the contact head through the cartridge tube and out of the mouth thereof for connection with a cartridge terminal member in a manner to be hereinafter explained.

In the alternate or modified construction illustrated in Fig. 7, a fube closure means in addition to such means afforded by the fuse head is provided. The terminal member or cap 36ª extends a substantial distance beyond the end of the cartridge tube and is provided with an internally threaded bore for the reception of a plug **46** which engages, and clamps the fuse head against the end of the tube. A guide finger **38ª** and a puller ring **41ª** are formed on the terminal **36ª** for purposes previously explained. The plug **46** has a rounded head portion for engagement by the spring terminal arms **40** in the same manner as the fuse head is engaged in the construction illustrated in Fig. 4. It will appear that the provision of a terminal assembly on the cartridge such as shown in Fig. 7 renders the switch suitable for use with any fuse link of so-called button head type, of which there are many now available to the trade.

At its lower end the cartridge tube is provided with means for effecting its pivotal and detachable connection with the lower switch terminal 21. Such means include a hinge member or lever 47 which is pivotally connected to the outer end of a bracket member **48**, the latter member being rigidly secured to, and projecting at a right angle from the cartridge tube. In the presently preferred construction of the lower cartridge terminal assembly, the bracket **48**, which is preferably spaced a short distance from the lower end of the tube, is provided with a downwardly opening recess or pocket **49** (Fig. 4), which forms a housing for the pivot pin **50**. The hinge member **47** is formed, intermediate of its ends, with a laterally projecting arm portion **51** which extends into the pocket **49** and pivotally engages the pin **50**. Thus the bearing portions of members **47** and **48** are protected from ice and snow which otherwise would tend to hamper the operation of the switch.

As best appears in Fig. 4, one end of member **47** is adapted to abut the end face of the cartridge tube. The opposite end of member **47** is bifurcated and terminates in downwardly opening hook-like portions **52** which engages trunnions **53** formed on the lower terminal member 21. Under normal operating conditions, opening and closing of the switch is effected by swinging the cartridge about the axis of trunnions **53**, there being no movement of the hinge member **47** relative to the cartridge tube. The latter movement, under normal conditions of operation, is prevented by the fuse link, which, as best appears in Fig. 1, passes over the end, then the side of hinge member **47**, to engage a binding post projecting from the side of such member. The binding post comprises a wing screw **55** having associated means which prevent the screw from acting in the manner of a capstan or winch to produce undue tension, or possible rupturing of the fuse link, as that element is being secured to the hinge member. Thus, as appears in Fig. 6, the wing screw **55** is provided with a sleeve **56**, terminating, adjacent the screw head, in an annular flange or washer 57. That portion of the screw shank upon which the sleeve 56 is disposed is preferably devoid of threading and reduced in diameter to substantially the root diameter of the threads. Hence any substantial longitudinal displacement of the sleeve on the wing screw is prevented and the flange or washer portion 57 is always maintained adjacent the screw head, which expedient facilitates the operation of securing a fuse link to the hinge member.

The cartridge is prevented from swinging downwardly beyond a horizontal position by a stop shoulder 58, formed on the terminal 21, which is disposed in the path of movement of a

web portion 59 (Fig. 4) on the hinge member 47. Upward swinging movement of the cartridge is limited by a projection 60 on the terminal 21. For purposes of preventing casual or unintended detachment of the fuse cartridge, a step portion 61 is provided on the terminal 21. When the cartridge is disposed in full switch open, or horizontal position, as shown by broken lines in Fig. 2, the step portion 61 overlies the web 59 and prevents vertical displacement of the hinge member 47, which is necessary to effect disconnection of the same from the trunnions 53. In order to remove the cartridge, the hinge member 47 is swung through a small angle to bring the web 59 beyond the edge of step 61, which permits such member to be lifted sufficiently (Fig. 3), to enable its disengagement from the trunnions. For purposes of preventing lateral shifting and rocking movement of the hinge member, which movement might result in the disengagement of either hook portion 52 from its associated trunnion, each side of the terminal 21 is provided with an arcuate flange or web 62, the outer margins of which contact the inner side faces of the hook portions and thereby maintain the hinge member in proper alignment with the terminal.

The upper terminal 22 is preferably formed of heavy wire having the requisite properties of strength, good conductivity, and resiliency, and embodies the laterally spaced arm portions 40, each of which is preferably provided with a torsion loop 63 for increasing its resiliency. A clamp assembly, indicated at 64, secures the arm portions 40 together, preventing them from spreading, one relative to the other. A slight bend in the arm portions, appearing at 65, aids in holding the cartridge in switch closed position. The arms 40 terminate in relatively divergent end portions 66, preferably of downward trend, to provide arc extinguishing horns, and to aid in guiding the cartridge into proper switch closed position. It will appear that the upper resilient terminal member makes high pressure, hence low resistance contact with the fuse head, or, in the case of the construction illustrated in Fig. 7, with the contact plug 46. The equal of the force imparted by the spring terminal to the upper cartridge contact surface is present at the contact surfaces of the hinge and lower terminal members.

When the cartridge is disposed in switch closed position, the fuse link is held under constant tension, this by reason of the tendency of hinge member 47 to turn about the pivot pin 50 resulting from forces set up by the upper resilient terminal. A distinct advantage is obtained by arranging the hinge member so that its fuse engaging end is movable in an arc substantially tangential to the axis of the fuse link, such arrangement, when the link becomes ruptured, enabling the fuse section attached to the hinge member to be pulled from the cartridge with a minimum of interference therefrom.

The operation of the switch, upon the occurrence of an overload or short circuit, is believed to be obvious from the foregoing, but for purposes of completeness may be described as follows: When the fuse link becomes rupture, as by reason of abnormal current passing therethrough, the hinge member, freed at its outer or link engaging end and acting under the forces imparted thereto, turns rapidly about the two axes defined by the trunnions 53 and the pivot pin 50. Movement of the hinge member about the trunnions is accompanied by an endwise lowering of the cartridge tube, (Fig. 2), which, when clear of the upper terminal member, swings under gravity action to full open position. It will appear that the hinge member, considered as a lever, has a high velocity ratio and that its outer or link engaging end moves very rapidly. Accordingly the ruptured ends of the fuse link become quickly separated, resulting in practically instantaneous extinguishment of the arc created therebetween.

As certain changes may be made in the device herein illustrated and described without departing from the spirit and full intended scope of the invention, it is understood that the present description shall be construed in an exemplary and not a limiting sense, except as the invention is defined by the appended claims.

We claim:

1. A fuse switch embodying spaced, relative stationary terminal members and a demountable fuse cartridge adapted for pivoted movement to open and close a circuit between said terminal members, said fuse cartridge comprising an open-ended tube of insulating material, and a fuse link having a closure cap disposed at one end of said tube, said closure cap having a contact surface adapted for direct bearing engagement by one of said terminal members.

2. In a fuse switch, a tubular fuse cartridge, a fuse link extending through said cartridge, said fuse link having a contact cap closing one end of said cartridge, and a resilient terminal member adapted for direct bearing engagement with said cap.

3. In a fuse switch, a terminal member, a fuse cartridge pivotally mounted on said terminal member, a fuse link extending through said cartridge, a contact cap integral with said fuse link, closing the free end of said cartridge, and a second, resilient terminal member adapted to bear upon said contact cap in a direction axially of the cartridge.

4. In a fuse switch, a pivotally mounted fuse cartridge, a fuse link in said cartridge, said link terminating at one end in an externally convex contact plate seated over the free end of said cartridge, and a terminal member including spaced, substantially parallel, resilient arm portions adapted to bear directly upon the outer surface of said contact plate.

5. A device of the class described, including a tubular fuse cartridge having a laterally projecting bracket near one of its ends, a lever fulcrumed on said bracket, a fuse link extending through said fuse cartridge, terminating at one end in a contact cap, the opposite end of said fuse link being connected to said lever, a pair of relatively spaced, fixed terminal members, engaging, respectively, said lever member and said fuse link contact cap.

6. In a device of the class described, a stationary terminal member, a tubular fuse housing having a rigid, laterally projecting arm near one of its ends, a hinge member pivotally connected to said arm adapted for pivotal, detachable engagement with said terminal member, said hinge member having a fuse engaging portion movable substantially tangentially to the axis of said housing; a fuse link having a contact disc overlying one end of the housing, said link extending through the housing and engaging said hinge member, and a resilient member constituting a second terminal, said second terminal being

adapted to bear upon said fuse contact disc in a direction axially of said housing.

7. In a switch of the class described, a pivotally mounted fuse cartridge terminating at its free end in a rounded contact surface, and a terminal member embodying laterally spaced, resilient arms, said arms being substantially parallel for a portion of their lengths and having relatively divergent end portions, said arms being adapted to bear upon said rounded contact surface and exert a force thereon in a direction endwise of said cartridge.

8. In a device of the class described, a fuse cartridge, a hinge member pivotally carried by the fuse cartridge and means for securing a fuse link to said hinge member, said means comprising a bolt movable into and out of a threaded bore in the hinge member, a sleeve on said bolt held against endwise movement relative thereto, and a washer fixedly secured to said sleeve.

9. In a device of the class described, a fuse cartridge comprising an inner, horn fibre tube, and an outer tube of insulating material closely jacketing said inner tube, said tubes being relatively disposed so that one end of the inner tube extends beyond the corresponding end of the outer tube, and the opposite end of said outer tube extends beyond the corresponding end of the inner tube, and a terminal member capping the end of said outer tube, the projecting portion of said inner tube extending through said terminal member.

10. An electrical switch including a hollow member, a lever pivotally associated with said hollow member, said lever having a portion which underlies and abuts against an end face of the hollow member so as to aid in the support of said hollow member and which is adapted for movement with respect to said end face of said hollow member, and a fuse link extended through said hollow member in normally fixed relation therewith and having a part thereof in engaging relation with respect to said underlying portion of said lever to prevent movement of said lever with respect to said hollow member when the fuse link is intact and operable to release said lever for movement relative to the hollow member when the fuse link is ruptured.

11. An electrical switch including a hollow member, a lever pivotally associated with said hollow member, said lever having a portion which underlies and abuts against an end face of the hollow member so as to aid in the support of said hollow member and which is adapted for movement with respect to said end face of said hollow member, a fuse link extended through said hollow member in normally fixed relation therewith and having a part thereof in partially embracing relation with respect to said underlying portion of said lever to prevent movement of said lever with respect to said hollow member when the fuse link is intact and operable to release said lever for movement relative to the hollow member when the fuse link is ruptured, and means for securing said fuse link to said lever.

12. An electrical switch including a hollow member, a lever pivotally associated with said hollow member, said lever having a portion which underlies and abuts against an end face of the hollow member so as to aid in the support of said hollow member and which is adapted for movement with respect to said end face of said hollow member, a fuse link extended through said hollow member in normally fixed relation therewith and having a part thereof in partially transverse embracing relation with respect to said underlying portion of said lever to prevent movement of said lever with respect to said hollow member when the fuse link is intact and operable to release said lever for movement relative to the hollow member when the fuse link is ruptured, and means for securing said fuse link to said lever.

13. An electrical switch including a hollow member, a lever pivotally associated with said hollow member, said lever having a portion which underlies and abuts against an end face of the hollow member so as to aid in the support of said hollow member and which is adapted for movement with respect to said end face of said hollow member, a fuse link extended through said hollow member in normally fixed relation therewith and having a part thereof in partially transverse embracing relation with respect to said underlying portion of said lever to prevent movement of said lever with respect to said hollow member when the fuse link is intact and operable to release said lever for movement relative to the hollow member when the fuse link is ruptured, means for securing said fuse link to said lever, and spaced terminals to one of which said lever is pivotally attached.

14. An electrical switch including a hollow member, a lever pivotally associated with said hollow member, said lever having a portion which underlies and abuts against an end face of the hollow member so as to aid in the support of said hollow member and which is adapted for movement with respect to said end face of said hollow member, a fuse link extended through said hollow member in normally fixed relation therewith and having a part thereof in partially transverse embracing relation with respect to said underlying portion of said lever to prevent movement of said lever with respect to said hollow member when the fuse link is intact and operable to release said lever for movement relative to the hollow member when the fuse link is ruptured, means for securing said fuse link to said lever, and spaced terminals, one of which provides pivotal support for said lever and the other of which is resilient and engages an end portion of said hollow member in a manner to exert force longitudinally of the axis of said hollow member.

FRANCIS J. McCLUSKEY.
CHARLES ADIN FOX.