Aug. 1, 1944. R. S. BENNETT ET AL 2,354,907

ELECTRIC SWITCH

Filed April 18, 1942

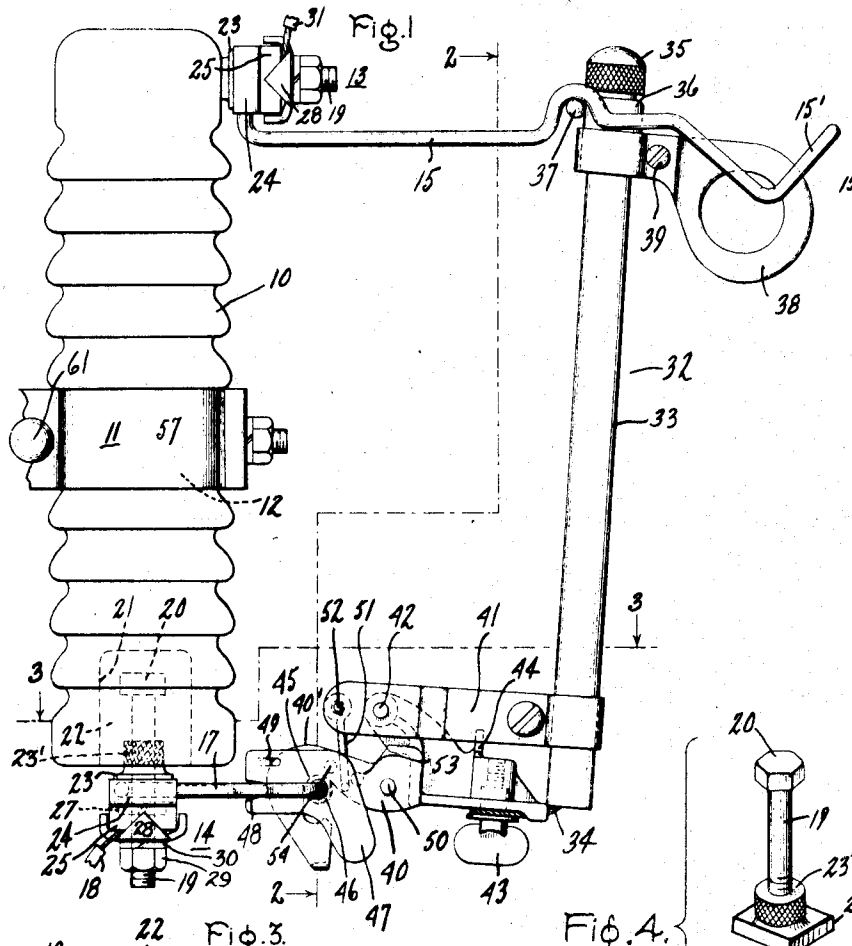

Fig. 1

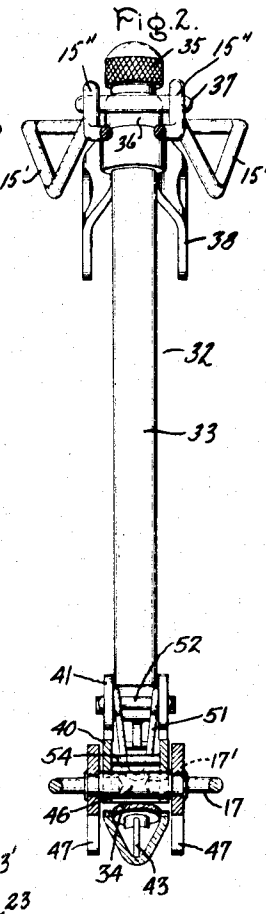

Fig. 2.

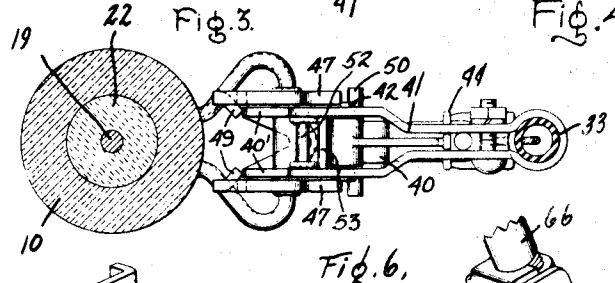

Fig. 3.

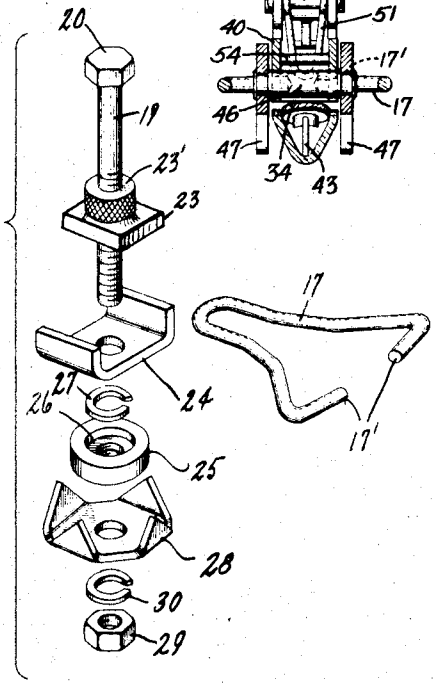

Fig. 4.

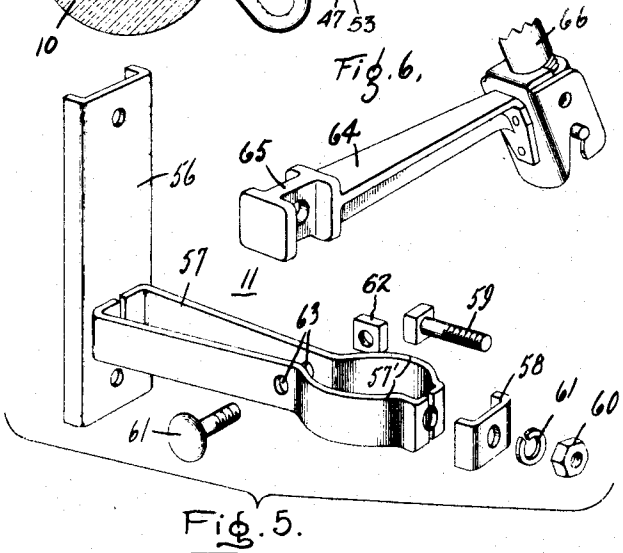

Fig. 5.

Fig. 6.

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UNITED STATES PATENT OFFICE

2,354,907

ELECTRIC SWITCH

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Application April 18, 1942, Serial No. 439,506

12 Claims. (Cl. 200—133)

Our invention relates to electric switches and more particularly to switches combined with fuses such as are disclosed in United States Letters Patents 1,973,265, 2,025,563, and 2,119,388, all assigned to the same assignee as the present application.

In the protection of overhead outdoor transmission lines, it has become common practice to combine a fuse with a line switch. For economy and safety, it is desirable to locate the switch and fuse combined with it near the top of the pole adjacent the transmission line. The opening and closing of the switch may be accomplished by a long switch stick with a hook adapted to engage the switch handle. However, examination of the fuse to determine whether or not it is operative and replacement of the fusible element is hazardous due to the close proximity of the live switch contact and the transmission line. Combined switches and fuses have been provided with an arrangement for automatically opening the switch when the fuse operates. In this manner, the operation of the fuse is clearly indicated without the necessity of a close examination. Usually the supporting means for the combined fuse and line switch provides a place where birds, for example, can alight and, since the supporting means is often grounded, it is desirable to provide an arrangement in which there is substantially no possibility of contact being made between the live parts of the combined fuse and switch and the supporting means as by a foreign object such as a bird.

Accordingly, it is an object of our invention to provide a new and improved birdproof switch in which the possibility of a bird, for example, standing upon the supporting means of the switch and engaging live parts of the apparatus is relatively remote.

It is another object of our invention to provide a combined switch and fuse device having a new and improved arrangement of terminal contact connections.

Still another object of our invention is to provide a new and improved supporting hanger for an electric switch of the type disclosed in the above-mentioned patents.

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

For a better understanding of our invention, reference may be had to the accompanying drawing in which Fig. 1 is a side elevational view of our combined switch and fuse device, Fig. 2 is a view taken on line 2—2 of Fig. 1, Fig. 3 is a sectional view taken on line 3—3 of Fig. 1, Fig. 4 is an exploded view of the terminal assembly and supporting means therefor, Fig. 5 is an exploded view of the new and improved supporting strap or hanger construction, and Fig. 6 is a supporting arm for an auxiliary expulsion protector tube or surge arrester, such as is disclosed in the copending application of Sidney R. Smith, Jr., Serial No. 439,507, filed concurrently with the present application which is adapted to cooperate with the supporting strap or hanger construction of Fig. 5.

Referring now to the drawing, we have illustrated an insulator 10 which may be suitably supported from a pole carrying the transmission line, not shown, as by a supporting strap, mounting bracket or hanger construction generally indicated at 11, which is adapted to surround a central portion of reduced diameter 12 of the insulator 10. The details of the supporting strap or hanger construction, shown best in Fig. 5, will be set forth hereinafter in connection with the disclosures of Figs. 5 and 6.

It will be obvious from Fig. 1 that, if any live parts of the combined fuse and switch can be contacted by a bird, for example, sitting on supporting strap 11 which is usually grounded, a short circuit with its consequent damage and inconvenience might result. Accordingly, the upper and lower terminal contact assemblies, generally indicated at 13 and 14, respectively, are supported from insulator 10 in such a manner as to provide the greatest electrical clearance with respect to the supporting strap or hanger construction, generally indicated at 11, thereby providing a birdproof construction. The upper terminal assembly 13 includes a looped conducting rod or wire 15 of a particular configuration to act as a contact, a contact latch, and a contact guide as will become apparent from the following description. The terminal assembly 14, on the other hand, includes a looped conducting rod or wire 17 which supports the lower contact construction of the switch to be described in greater detail hereinafter. The means for supporting looped rods 15 and 17 from insulator 10 which form one feature of our invention are substantially identical and, consequently, only one of these means will be described and the corresponding parts of the other supporting means will be designated by the same reference numerals.

The simplified means of attaching looped conducting rod 17 to the lower end of insulator 10, which also provides simple means for attaching a lead-in wire or conductor 18 thereto, comprises a member having an irregularly shaped portion and an outwardly extending threaded portion such, for example, as a standard bolt 19 threaded at one end and having a hexagonal head 20 at the other end. This bolt 19 is adapted to be anchored in a recess 21 in the end of insulator 10 as by any suitable means, such as

cement 22, indicated in Fig. 3. With this arrangement, the head 20 of bolt 19 serves to prevent any motion tending to pull the terminal assembly 14 away from insulator 10. A rectangular member such as a special square nut 23, (see Fig. 4) is provided for bolt 19 having an extending portion 23' which is preferably knurled. The knurled extending portion 23' is partially embedded in the cement 22 as indicated in Fig. 1, thereby preventing any rotation of the terminal assembly 14. Bolt 19 and nut 23 might comprise a single member having a rectangular portion, an irregularly shaped portion and an outwardly extending threaded portion. Square nut 23 acts as a guide for U-shaped washer 24 which extends down over the square sides. In the case of lower terminal contact assembly 14, the looped end of conducting rod 17 is clamped between square nut 23 and U-shaped washer 24 by means of a round or annular nut 25 of conducting material including a recess 26 therein for accommodating lockwasher 27 which, being preferably constructed of steel, affords a relatively poor conductor. By providing the recessed construction of round nut 25, a good current-conducting path is afforded and the lock washer 27 of poor conducting material is bypassed. The nut 25 is preferably constructed in the annular form shown so that it cannot be readily loosened when connecting or disconnecting the lead wire or conductor 18 and also so that it cannot readily be tampered with. With the arrangement just described, the looped end of conducting rod 17 is tightly clamped between U-shaped washer 24 and square nut 23 with the lock washer 27 in recess 26 being sufficiently compressed to provide the necessary locking action without interfering with the current conduction from nut 25 to rod 17.

The conductor or lead-in wire 18 is readily attached to the free end of bolt 19 by being clamped between round nut 25 and multipronged washer 28 which is shaped so as readily to admit the insertion of lead-in wire 18. Suitable means including nut 29 and lock washer 30 are provided to fasten lead wire 18 and it will be observed that lead wire 18 may be connected or disconnected without in any way affecting or disturbing looped conducting rod 17.

As was mentioned above, the upper terminal assembly 13 for supporting looped conducting rod 15 is identical with lower terminal assembly 14 and also provides the same means for fastening a suitable lead-in conductor 31 thereto without disturbing the support of conducting rod 15.

In order electrically to interconnect terminal assemblies 13 and 14, we provide a switch 32 including a fuse holder 33 within which is mounted the conventional fuse link, only the flexible cable portion 34 of which is shown in Figs. 1 and 2. The upper end of the fuse holder 33 is closed by a contact cap 35, which is threadedly mounted on a conducting upper contact member 36 having welded thereto a short conducting bar 37. The closed end of looped conducting rod 15 is flared out as indicated at 15' to act as a contact guide for the upper fuse or switch contact 36 and a bent portion on each side of the loop acting as a contact latch 15'' is provided suitably to engage the extending portions of rod 37 on either side of upper contact 36 to latch the switch in the closed position. Looped conducting rod 15 is of springy construction so as to tend to push downwardly on switch 32, thereby providing a good contact and also maintaining contact latch 15'' in the latching position as long as the lower end of the switch is held in a fixed position, thereby preventing rotation of switch 32 to the open position. A suitable operating handle 38 is secured to fuse holder 33 adjacent contact 36 as by means of screw 39.

Switch 32 is pivotally mounted to the lower terminal assembly 14 by means of a toggle comprising toggle lever 40 and fuse holder support 41 pivotally connected at 42. Fuse holder support 41 surrounds the lower end of fuse holder 33. The flexible cable portion 34 of the fuse link extending from the lower end of the fuse holder 33 is adapted to be connected to toggle lever 40 as by means of thumbscrew 43. When the fuse link is intact, the toggle comprising the lever 40 and fuse holder support 41 is held in the position shown in Fig. 1 by the flexible cable portion 34 of the fuse link, being tightly drawn and held by thumbscrew 43. In this position, toggle lever 40 has a projection 44 thereof engaging fuse holder support 41 to limit the relative movement therebetween.

In order pivotally to support switch 32 from terminal assembly 14, toggle lever 40 is provided with a hook-shaped portion 45 which is adapted to engage a sleeve 46 into which the ends 17' of looped conducting rod 17 are adapted to be inserted. These ends 17' are turned inwardly to readily engage sleeve 46, thereby forming a pivot for switch 32. In order to prevent lateral movement of toggle lever 40 pivotally mounted to sleeve 46, we provide side plates 47 which are secured to sleeve 46. To prevent rotation thereof, side plates 47 have notched out portions 48 to engage conducting rod 17. Also side plates 47 are provided with lanced out portions 49, which act as backstops for toggle lever 40 which is shaped as a cam at 40' to cooperate with these stops and prevent separation of the pivoted members comprising sleeve 46 and the hooked portion 45 of toggle 40 when the fuse is in the closed position. While the fuse link is intact, the switch 32 may be manually opened or closed in the usual manner by a switch stick provided with a hook adapted to engage operating handle 38. The opening movement of switch 32 is limited by the engagement of projections 50 extending from the sides of toggle lever 40 with side or hinge plates 47.

In order that the fuse link and fuse holder 33 may be replaced, it is desirable that ready removal of switch 32 from supporting insulator 10 may be accomplished as by means of a switch stick and, to this end, lever 40 is removably hooked to sleeve 46. However, the expulsion of gases from the lower end of fuse holder 33 upon blowing of the fuse link causes a recoil action which might permit unhooking of the hooked portion 45 of toggle lever 40 from sleeve 46 while switch 32 is rotating to the open position which would result in switch 32 falling to the ground. To prevent such unhooking, we provide a latch 51 pivotally connected at 52 to fuse holder support 41. Suitable guides 53 and 54 are provided on toggle lever 40 between which the latch 51 is adapted to pass. During the opening movement of switch 32 upon blowing of the fuse link, the relative movement of toggle lever 40 and fuse holder support 41 will cause latch 51 to move between guides 53 and 54 in a downward direction as viewed from Fig. 1 so as to close the open portion of the hook 45 and thus prevent removal of toggle member 40 from sleeve 46. This latch feature and the lower switch support is not our invention but is disclosed and claimed in the above-mentioned Pat-

ent 1,973,265. Normally, when the switch is in the fully open position and the recoil forces are no longer acting on fuse holder 33, the relative positions of toggle lever 40 and latch 41 are the same as shown in Fig. 1, whereby the switch 32 may readily be lifted from terminal assembly 14, by means of a switch stick which engages operating handle 38, for replacement of the blown fuse link in fuse holder 33.

Upon operation of the fuse, the lower end of the fuse link including flexible cable portion 34 is expelled by the gas pressure generated by the arcing in fuse holder 33 and the support for toggle lever 40 is removed causing it to rotate about sleeve 46 acting as a pivot. However, the other lever of the toggle, namely, fuse holder support 41, does not immediately follow rotation of toggle lever 40 due to the reaction produced by the rapid expulsion of the arc gases from the lower end of fuse holder 33. Shortly after the movement of toggle lever 40, however, fuse holder 33 begins longitudinal movement produced by the spring action of upper looped conducting rod 15 pushing downwardly on rod 37. The longitudinal movement of fuse holder 33 is, of course, still opposed by the reaction of the gases being expelled from the lower end of fuse holder 33, but this reaction diminishes rapidly as the arc is extinguished and the expulsion of gases ceases. Shortly thereafter, the contact latch portions 15'' of conducting rod 15 release rod 37 and switch 32 rotates about pivot 42 until engagement with toggle 40 results to limit the opening movement.

The conducting strap or hanger construction indicated at 11 is best shown in Fig. 5 and comprises a support 56 having welded thereto two identical arms 57 having cooperating portions 57' for engaging with the reduced central portion 12 of insulator 10. The support portion 56 is adapted to be bolted or clamped to a suitable pole or crossarm in an obvious manner. The ends of arms 57 are shaped in such a manner as to engage with U-shaped clamping member 58. U-shaped clamp 58 prevents spreading of the ends of arms 57 and is held in engagement therewith by means of bolt 59, nut 60, and lockwasher 61. Clamping action to hold insulator 10 firmly in supporting strap 11 is accomplished by means of bolt 61 and nut 62 adapted to be inserted in opening 63 in arms 57.

As is disclosed in the copending application of Sidney R. Smith, Jr., referred to above, auxiliary expulsion protector tubes or surge arresters are often utilized with switching devices similar to the one described heretofore in order to give protection against lightning surges and the like, which arrangement provides an arc gap between one of the terminal assemblies, such as terminal assembly 13, and ground. Since supporting strap or hanger construction 11 is usually grounded as at bolt 61 for example the hanger construction 11 illustrated in Fig. 5 is readily adaptable to being used with such an expulsion protector device and, accordingly, in Fig. 6, we have shown a conducting support 64 having a double U-shaped end 65 which is adapted to serve in exactly the same manner as U-shaped washer 58. At the same time, an expulsion protector tube, only a portion of which is shown at 66, is adapted to be supported so as to provide a spark gap between supporting strap 11 and terminal assembly 13. With the new and improved hanger construction of our invention, the switching device is readily adapted for use with or without such an auxiliary spark gap for lightning protection of the expulsion protected tube type. It will be observed also that with the double U-shaped end the surge arrester may be supported either to the right or the left of insulator 10.

While we have shown and described our invention in considerable detail, we do not wish to be limited to the exact arrangement shown but seek to cover in the appended claims all those modifications which fall within the true spirit and scope of our invention.

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

1. In an electric switch, an insulator, a stationary switch contact consisting of a rod supporting a contact surface near one end, a standard bolt having the head thereof anchored in a recess at one end of said insulator, a square nut for said bolt having an extending portion thereof anchored in said recess, means including a U-shaped member cooperating with said square nut for securing the other end of said rod to said insulator so as to prevent rotation thereof, and means for securing a conductor to the free end of said bolt without releasing said rod during the operation of securing a conductor to said bolt.

2. In an electric switch, an insulator, a stationary switch contact consisting of a rod forming a contact surface near one end, a standard bolt having the head thereof cemented in a recess at one end of said insulator, a square nut for said bolt having a knurled end embedded in the cement in said recess, means including a U-shaped member cooperating with said square nut for securing the other end of said rod to said insulator so as to prevent rotation thereof, and means for securing a conductor to the free end of said bolt without releasing said rod during the operation of securing a conductor to said bolt.

3. In an electric switch, an insulator, a terminal assembly associated with each end of said insulator, and a switch member electrically interconnecting said terminal assemblies; each terminal assembly comprising a standard bolt having the head thereof cemented in a recess in an end of said insulator; a square nut including an extending portion, said extending portion being embedded in the cement in said recess, a rodlike member, means including a U-shaped member cooperating with said square nut for firmly fastening one end of said rodlike member to prevent rotation thereof, the other end of said rodlike member supporting a contact surface, and means for securing a conductor to the end of said bolt independently of said last-mentioned means.

4. In an electric switch, an insulator, a stationary switch contact consisting of a rod supporting a contact surface near one end, a standard bolt having the head thereof cemented in a recess at one end of said insulator, a square nut for said bolt having an extension embedded in the cement in said recess, a U-shaped member interengaging with said square nut for holding the other end of said rod against rotation, a nut having a recess therein for accommodating a lock washer of relatively poor conducting material for clamping said rod between said square nut and U-shaped member, and means for securing a conductor to the free end of said bolt by clamping it against said nut having a recess therein, whereby a very efficient electrical connection between said rod and said conductor is provided by effectively eliminating said lock washer from the electrical circuit.

5. In an electric switch, an insulator, a stationary switch contact consisting of a rod supporting

a contact surface near one end, a standard bolt having the head thereof cemented in a recess at one end of said insulator, a square nut for said bolt having an extension embedded in the cement in said recess, a U-shaped member interengaging with said square nut for holding the other end of said rod against rotation, a circular nut having a recess therein for accommodating a lock washer of relatively poor conducting material for clamping said rod between said square nut and U-shaped member, and means including a multipronged washer for securing a conductor to the free end of said bolt by clamping it against said circular nut, whereby a very efficient electrical connection between said rod and said conductor is provided by effectively eliminating said lock washer from the electrical circuit.

6. In an electric switch, an insulator, a stationary switch contact consisting of a rod supporting a contact surface near one end, a member including a rectangular portion, an irregularly shaped portion and a threaded portion, means for anchoring said irregularly shaped portion of said member in a recess at one end of said insulator so that said threaded portion extends outwardly from said insulator and said rectangular portion is anchored against rotation, means including a U-shaped member cooperating with said rectangular portion of said member for securing the other end of said rod to said insulator so as to prevent rotation thereof, and means for securing a conductor to said threaded portion of said member without releasing said rod during the operation of securing a conductor to said member.

7. In an electric switch, an insulator, a terminal assembly associated with each end of said insulator, and a switch member electrically connecting said terminal assemblies; each terminal assembly comprising a member including a rectangular portion, an irregularly shaped portion, and a threaded portion, means for anchoring said irregularly shaped portion of said member in a recess at one end of said insulator so that said threaded portion extends outwardly from said insulator and said rectangular portion is anchored against rotation, a rodlike member, means including a U-shaped member cooperating with said rectangular portion of said member for firmly fastening one end of said rodlike member to prevent rotation thereof, the other end of said rodlike member supporting a contact surface, and means for securing a conductor to said threaded portion of said member independently of said last-mentioned means.

8. In an electric switch, an insulator, a stationary switch contact consisting of a rod supporting a contact surface near one end, a member including a rectangular portion, an irregularly shaped portion, and a threaded portion, having the irregularly shaped portion cemented in a recess at one end of said insulator so that said threaded portion extends outwardly from said insulator, said rectangular portion being partially embedded in the cemented recess so as to be anchored against rotation, a U-shaped member interengaging with said rectangular portion of said first-mentioned member for holding the other end of said rod against rotation, a nut having a recess therein for accommodating a lockwasher of relatively poor conducting material for engaging said threaded portion to clamp said rod between said rectangular portion of said first-mentioned member and said U-shaped member, and means for securing a conductor to the threaded portion of said first-mentioned member by clamping it against said nut having a recess therein, whereby a very efficient electrical connection between said rod and said conductor is provided by effectively eliminating said lockwasher from the electrical circuit.

9. In an electric switch, an insulator, a rod having a contact guide, a contact surface, and a latch adjacent one end thereof, a member including a rectangular portion, an irregularly shaped portion and a threaded portion, means for anchoring said irregularly shaped portion of said member in a recess at one end of said insulator so that said threaded portion extends outwardly from said insulator and said rectangular portion is anchored against rotation, means including a U-shaped member cooperating with said rectangular portion of said member for securing the other end of said rod to said insulator so as to prevent rotation thereof, and means for securing a conductor to said threaded portion of said member without releasing said rod during the operation of securing a conductor to said member.

10. The combination with an electric switching device having an insulating support and a pair of spaced terminal contacts, means for supporting an electric switching element from said support and electrically connected between said contacts, a mounting bracket for said support comprising a split member for encircling said support, a U-shaped clamp adapted to interfit with the split end of said member, and means for fastening said clamp to said member of said mounting bracket to hold firmly said insulating support on said mounting bracket.

11. The combination with an electric switching device having an insulating support and a pair of spaced terminal contacts, means for supporting an electrical switching element from said support and electrically connected between said contacts, a mounting bracket for said support comprising a pair of substantially identical cooperating members each having a curved portion for encircling a portion of reduced cross section of said insulating support, a U-shaped clamp adapted to embrace the corresponding ends of said cooperating members within the confines of the U so as to prevent spreading of said cooperating members, and means for fastening said U-shaped clamp to said cooperating members to hold firmly said insulating support on said mounting bracket.

12. The combination with an electric switching device having an insulating support and a pair of spaced terminal contacts, means for supporting an electric switching element from said support and electrically connected between said contacts, a mounting bracket for said support comprising a split member for encircling said support, a supporting arm having a U-shaped end adapted to interfit with the split end of said member, and means for fastening said U-shaped end of said supporting arm to said member of said mounting bracket to hold firmly said insulating support on said mounting bracket.

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